The Livestock Institute (IDELE) and INRAe (UMR SAS) contributions to the CCCfarming project

- Annexes -

Project: Climate Care Cattle Farming Systems - CCCfarming

Authors: Xavier Vergé[1], Caroline Evrat-Georgel[1] and Paul Robin[2]

Affiliations: [1] Institut de l'Élevage (IDELE), France
[2] INRAE (UMR SAS)

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1. WP1.1 Farm selection

The following document (Fig.1) developed under the WP1.1 has been translated in French and sent to a large panel of French farms to identify those which will be visited for this project.

The next one (Fig.2) is a flyer specifically done for the french farmers which has also been sent to the same farm panel.

CLIMATE CARE CATTLE FARMING

Le projet européen CCCfarming vise à développer des systèmes d'élevage bovin respectueux du climat, qui réduisent les émissions de gaz à effet de serre et l'ammoniac tout en préservant les perspectives socio-économiques des entreprises agricoles. Les mots clefs sont l'efficacité de la production et la protection du climat.

www.CCCfarming.eu

Demande de participation à ce projet de développement d'un système agricole innovant

Cher agriculteur / ferme familiale ,

Au centre de ce projet de trois ans se trouvent des systèmes novateurs de logement, de traitement du fumier et d'utilisation des terres pour réduire les émissions, comme l'utilisation de litière compostée, de systèmes de séparation fèces/urine, de sols artificiels, toilettes pour vaches, de drones ainsi que la fertilisation de précision des cultures. Des pratiques prometteuses d'alimentation, de reproduction et d'atténuation des pâturages sont examinées pour contribuer à l'approche des systèmes intégrés.

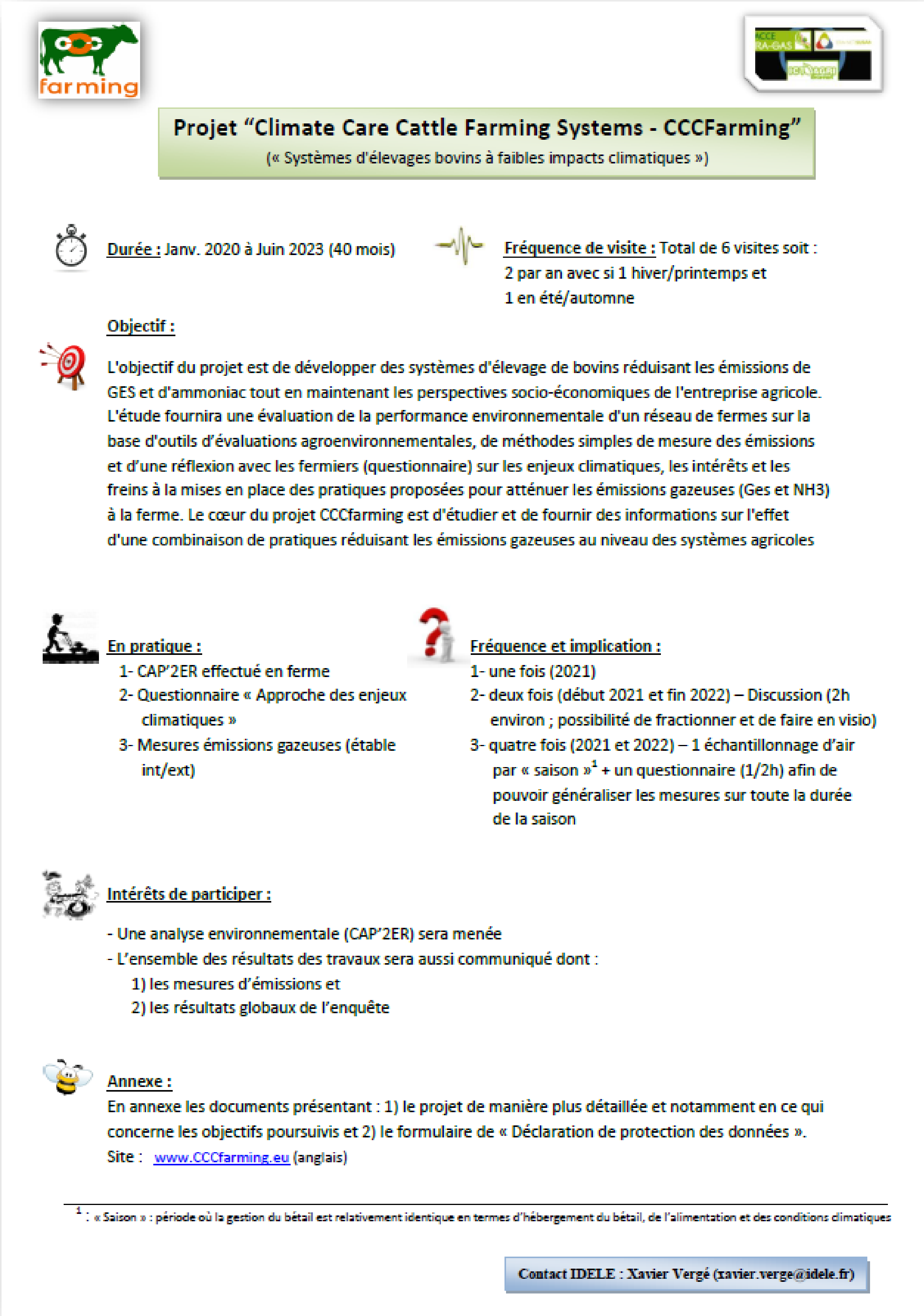
Notre étude fournira une évaluation des performances environnementales d'un réseau de 60 fermes dans huit pays de l'UE sur la base d'outils de calcul azote-phosphore-carbone (NPC) et d'un moyen simple de mesurer les émissions au niveau des fermes. L'interaction entre chercheurs et agriculteurs vise à améliorer les performances et l'impact.

Pour cela, il vous est alors demandé de permettre aux chercheurs de collecter des données générales sur votre ferme et votre troupeau de vaches et d'effectuer plusieurs mesures. Votre ferme sera visitée six fois. Le chercheur réalisera un entretien avec vous / votre famille (sur la base d'un questionnaire). Avec votre collaboration, les données seront collectées pour alimenter les outils NPC (bilan Azote, Phosphore et Carbone) et les émissions seront mesurées dans l'étable (4 fois). Toutes les données seront rendues anonymes (nous ne communiquons que les moyennes d'un groupe d'exploitations). Nous sommes soucieux qu'une bonne coopération avec les chercheurs soit établie.

Vos avantages ? Nous vous tiendrons informés des progrès de la recherche et des données ci-dessus, comme les apports et les pertes de NPC et les niveaux d'émission. Vous êtes invités à participer à des réunions avec des experts dans le domaine de l'élevage de bétail respectueux du climat et à discuter des innovations. Un plan d'exploitation sera élaboré avec vous afin de réduire les émissions et les pertes de NPC dans votre exploitation. Vous faites partie du réseau international. Vous recevrez également, bien entendu, les résultats globaux des études.

Vue d'ensemble : voir page suivante

Figure 1 : Climate Care Cattle Farming (CCCFarming) project – General presentation



Projet "Climate Care Cattle Farming Systems - CCCFarming"

(« Systèmes d'élevages bovins à faibles impacts climatiques »)

Durée : Janv. 2020 à Juin 2023 (40 mois)

Fréquence de visite : Total de 6 visites soit : 2 par an avec si 1 hiver/printemps et 1 en été/automne

Objectif :

L'objectif du projet est de développer des systèmes d'élevage de bovins réduisant les émissions de GES et d'ammoniac tout en maintenant les perspectives socio-économiques de l'entreprise agricole. L'étude fournira une évaluation de la performance environnementale d'un réseau de fermes sur la base d'outils d'évaluations agroenvironnementales, de méthodes simples de mesure des émissions et d'une réflexion avec les fermiers (questionnaire) sur les enjeux climatiques, les intérêts et les freins à la mises en place des pratiques proposées pour atténuer les émissions gazeuses (Ges et NH3) à la ferme. Le cœur du projet CCCfarming est d'étudier et de fournir des informations sur l'effet d'une combinaison de pratiques réduisant les émissions gazeuses au niveau des systèmes agricoles

En pratique :

1- CAP'2ER effectué en ferme
2- Questionnaire « Approche des enjeux climatiques »
3- Mesures émissions gazeuses (étable int/ext)

Fréquence et implication :

1- une fois (2021)
2- deux fois (début 2021 et fin 2022) – Discussion (2h environ ; possibilité de fractionner et de faire en visio)
3- quatre fois (2021 et 2022) – 1 échantillonnage d'air par « saison »[1] + un questionnaire (1/2h) afin de pouvoir généraliser les mesures sur toute la durée de la saison

Intérêts de participer :

- Une analyse environnementale (CAP'2ER) sera menée
- L'ensemble des résultats des travaux sera aussi communiqué dont :
  1) les mesures d'émissions et
  2) les résultats globaux de l'enquête

Annexe :

En annexe les documents présentant : 1) le projet de manière plus détaillée et notamment en ce qui concerne les objectifs poursuivis et 2) le formulaire de « Déclaration de protection des données ».
Site : www.CCCfarming.eu (anglais)

[1] : « Saison » : période où la gestion du bétail est relativement identique en termes d'hébergement du bétail, de l'alimentation et des conditions climatiques

Contact IDELE : Xavier Vergé (xavier.verge@idele.fr)

Figure 2 : Climate Care Cattle Farming (CCCFarming) project – French Flyer

2. WP1.1 Farm Factsheets

FR1

This expérimental farm is located in The Pays de la Loire County, between Rennes and Nantes. It is characterized by dry conditions (700 mm of rain per year) and loamy soils. Estabished in 1973, this dairy farm is speciliazed in the field of milking. It also carries out studies on fodder productions and on environmental impact assessments. At the end of 2018 the "Agri Méthane Derval" biogas unit has been launched. The farm is also focused on the control of the energy consumption of the milking unit.

Landscape :	Lowland
Soil type :	Loamy soils
Farming system :	Conventional
Total lands :	
- Arable lands :	105 ha : 55 ha of temporary grasslands (5 – 7 T DM/ha) , 35 ha of maize silage (10 T DM/ha), 15 ha of wheat (85 q/ha)
- Permanent grassland :	No
- Other land types :	No
Dairy cow housing :	Cubicles with scrapped alley ways producing slurry (liquid manure)
Bedding material :	(straw, mainly on alley ways, 1 kg/cow/day)
Floor in walking alley :	Grooved concrete
Dairy herd :	85 dairy cows + 75 heifers
Breed :	Holstein
Herd production level :	8 600 l/cow/year
Milking system :	Robot
Feeding system :	Trough feeding
Dairy herd grazing :	Yes (150 days / dairy cow)
Manure type :	Solid manure (from heifers building) and slurry (exported to the biogas unit)
Manure storage :	Open liquid manure tank
Other farming animals :	No

Highlights

- Speciliazed in the field of milking
- Studies on fodder production
- Methanization unit and energy consumption

Figure 3 : Farm factsheet - FR1

FR2

This experimental farm is located in Normandy on a loamy sandy clay soil. Established in 1972, the farm carries out studies on pasture management and grass productions. The dairy herd is 100% composed by the Normande breed. Studies are oriented on mixed crop livestock farming systems, agroecology and energy productions and savings : heat recovery under the bedding straw area and solar panels.

Landscape :	Lowland
Soil type :	mostly loamy sandy clay soil
Farming system :	Conventional
Total lands :	
- Arable lands :	41 ha : 17 ha of maize silage (12 T DM/ha), 24 ha of temporary grasslands (7 – 9 T DM/ha)
- Permanent grassland :	55 ha
- Other land types :	No
Dairy cow housing :	Straw yard for bedding + alley ways on slatted floor
Bedding material :	Straw
Floor in walking alley :	Slatted floor
Dairy herd :	90 dairy cows + 75 heifers
Breed :	Normande
Herd production level :	6 800 l/cow/year
Milking system :	Milking parlour (2x5posts)
Feeding system :	Trough feeding
Dairy herd grazing :	Yes (208 days for dairy cows)
Manure type :	Solid manure and slurry
Manure storage :	For slurry : Indoor covered tank (under slatted floor) + outdoor open tank For solid manure : storage in the field
Other farming animals :	Fattening bovine (males from dairy herd)

Highlights

- Agroecological system
- 100% Normande breed
- Studies on pasture management and grass productions
- Energy production (heat recovery / solar panels)
- Bovine meat production

Figure 4 : Farm factsheet – FR2

FR3

This farm is located on a loamy clay soil in the black mountain of West of Brittany. The experimental farm is managed by the "Chambre d'Agriculture" of Britany since 1971. Studies are carried out on milking, sustainable production systems and fodder production. Since 2018, the objective of the farm is to quantify the extent to which implementation of best practices will lower the carbon footprint of a maize and grass system.

Landscape :	Lowland
Soil type :	mostly loamy clay soil
Farming system :	Conventional
Total lands :	
- Arable lands :	110 ha : 60 ha of temporary grasslands (7 T DM/ha), 32 ha of maize silage (14 T DM/ha), 8 ha of wheat (75 q /ha), 10 ha of rapeseed and other crops and forages
- Permanent grassland :	21 ha
Dairy cow housing :	Cubicles with scrapped alley ways producing slurry (liquid manure)
Bedding material :	Sand Dust
Floor in walking alley :	Grooved concrete
Dairy herd :	130 dairy cows + 95 heifers
Breed :	Holstein
Herd production level :	7 770 l/cow/year
Milking system :	Milking parlour
Feeding system :	TMR
Dairy herd grazing :	Yes (140 days for dairy cows)
Manure type :	Slurry and solid maure (from heifers)
Manure storage :	Liquid manure tank
Other farming animals :	No

Highlights

- Studies in low carbon footprint system (and low environmental impact)
- Fodder and grasslands production
- Feed efficiency

Figure 5 : Farm factsheet – FR3

FR4

This farm created in 1974 is located on a sandy clay soil in the Pays de la Loire County, near from Angers. The farm carries out studies on animal feeding and fodder crops adapted to water shortages but also on animal welfare and production costs.

Landscape :	Lowland
Soil type :	mostly sandy soil
Farming system :	Conventional
Total lands :	
- Arable lands :	144 ha : 50 ha of irrigated sillage maize (15-16 T DM/ha) – 50 ha of grain maize (90 q / ha), 12 ha of triticale (55 q / ha), 29 ha of temporary grasslands and 3 ha of sorghum.
- Permanent grassland :	44 ha
- Other land types :	No
Dairy cow housing :	Cubicles
Bedding material :	Straw
Floor in walking alley :	Grooved concrete
Dairy herd :	137 dairy cows + 124 heifers
Breed :	Holstein
Herd production level :	9 400 l/cow/year
Milking system :	Rotary Milking parlour (28 places)
Feeding system :	TMR and individual feeding system (84 weighing troughs)
Dairy herd grazing :	No for dairy cows (only heifers on permanent grasslands)
Manure type :	Solid manure and slurry
Manure storage :	Open liquid manure tank Stockpile for solid manure
Other farming animals :	swine (Sows)

Highlights

- Speciliazed in the field of animal feeding
- All the animals are genotyped
- Weighing troughs allow to know precisely the consumption of each of the 84 cows on trial
- Studies on fodder production adapted to water shortages

Figure 6 : Farm factsheet – FR4

FR5

The farm is located on a sandy clay soil. Established for more than twenty years, the production is now diversified with dairy processing, vegetable production, drying of firewood and energy production by photovoltaic panels and bioreactor. The digestate is 1- applied to the fields and avoid mineral fertilizers and 2- is dried with the heat coming from cogeneration and this solid fraction replaces part of the straw (100t/year) used in straw areas. Heat from cogeneration is also used to obtain better (drier) forages and therefore replaces 40t/year of soybeans. The farm produces locally about 95% of all feed for the herd. It recently received the High Environmental Value certification ("farms limiting inputs and with concern for biodiversity"- June 2020). The bedding has recently been partly (25%) replaced by water circulation mattresses (Aquaclim®) and the exercise areas have been covered with the Magellan® rubber mats with liquid manure drainage. Cleaning by hydrocurage has been abandoned in favor of a manure scraper.

Landscape:	Lowland
Soil type:	Mainly clay and sandy soils
Culture system:	Conventional
Total land:	
Arable land:	150 ha of Corn, 20 ha of Alfalfa
Permanent meadows:	30 ha of meadow
Other types of land:	50 ha vegetables
Dairy cow housing:	Cubicles
Litter:	Straw flour and Aquaclim® mattress
Exercise area:	Grooved Concrete and Magellan® flooring
Dairy herd:	203
Breed:	Holstein
Herd production:	10,500 kg / cow / year
Milking system:	robot
Feeding system:	robot
Grazing dairy herd:	No
Manure type:	Liquid manure
Manure storage:	Open liquid manure tank and Bioreactors
Other farm animals:	No

Highlights

- Innovative sleeping system and exercise area
- Energy production by bioreactor and photovoltaic panels
- Heat from cogeneration used to dry forages and digestate which replaces part of the straw bedding
- Digestate applied replaces all mineral fertilizer
- High Environmental Value Certification (HVE)

Figure 7 : Farm factsheet – FR5

FR6

The farm is located on a sandy clay soil. The dairy cow building has recently been completely redone to accommodate a larger herd and for the sake of animal welfare. The animal's sleeping area and exercise area are made up of innovative systems: sleeping area with water circulation mattress (Aquaclim®) with animal heat recovery and exercise area with rubber mat (Magellan®) with drainage of the purine. Frequent scrapings to maintain dry soil. A bioreactor is under construction. In the long term, it should supply all of the methane needs of the nearby town (around 7,300 inhabitants).

Landscape:	Lowland
Soil type:	Mainly clay and sandy soils
Culture system:	Conventional
Total land:	210 ha
Arable land:	120 ha corn, 120 ha of corn, 40 ha of wheat
Permanent meadows:	- -
Other types of land:	50 ha temporary meadow (RayGrass) + white and purple clover
Dairy cow housing:	Cubicles
Litter:	Aquaclim® mattress, a little straw
Exercise area:	Magellan® mat
Dairy herd:	180
Breed:	Holstein
Herd production:	8,500 kg / cow / year
Milking system:	ROTO fulllwood pack 32 places with milk meter
Feeding system:	green feed + full ration (grass and corn silage + rapeseed cake + corn flour)
Grazing dairy herd:	No
Manure type:	Liquid manure
Manure storage:	Open liquid manure tank (Bioreactors under construction)
Other farm animals:	No

Highlights

- Innovative sleeping system and exercise area

- Frequent scraping - Recovery of animal heat

- Bioreactors with direct distribution of biogas under construction

- Certified non GMO milk production


Figure 8 : Farm factsheet – FR6

FR7

The farm is on sandy clay soil. It is located in the outbuildings of a medieval castle. All the crops are used to feed the herd and the dairy farm has been in organic production since 1997. The farm receives visitors and tourists and is part of the "Gîtes de France" association. It owns the label "Tourism and Handicap".

Landscape: Lowland
Soil type: Mainly loamy soils
Culture system: Organic
Total land: 159 ha
Arable land: 159 ha
Permanent meadows: 0
Other types of land: 93 ha
Dairy cow housing: Cubicles
Litter: Composted bedding area (Miscanthus)
Exercise area: Grooved Concrete
Dairy herd: 108
Breed: Holstein
Herd production: 7,965 kg / cow / year
Milking system: parlor x16
Feeding system: silage defacer bucket
Grazing dairy herd: Yes
Manure type: Composted Manure
Manure storage: Open slurry pit
Other farm animals: Only cattle (calves, heifers, dairy cows). We sell the males at 12 days

Highlights

- Composted bedding pack barn (Miscanthus)
- Organic production since 1997
- Registered with "Gîtes de France"

Figure 9 : Farm factsheet – FR7

FR8

The farm is located in the Madon valley (river) on a clay-limestone soil. The farm was built in 1969 with dairy and pig breeding. In 1996 the pig farming was stopped. The dairy cow building was renovated in 2015 and the roof redone in 2020. This building has straw bedding stalls, a grooved concrete floor and a milking robot. Animal wastes are scraped with the straw and collected in a nearby stockpile.

Landscape:	Lowland
Soil type:	Mainly clay-limestone soil
Culture system:	Conventional
Total land:	140 ha
Arable land:	30 ha maize, 35 ha wheat and 10 winter barley
Permanent meadows:	40 ha
Other types of land:	15 ha temporary meadow (alfalfa, RGA clover) and 9 ha Natura 2000 meadow
Dairy cow housing:	Cubicles
Litter:	Sraw
Exercise area:	grooved concrete
Dairy herd:	75
Breed:	Holstein
Herd production:	10 600 kg / cow / year
Milking system:	Robot
Feeding system:	Maize silage + clover/alfalfa/ryegrass mixture + corn feed + nitrogen corrector
Grazing dairy herd:	Yes (7 months)
Manure type:	Liquid manure mixed with straw
Manure storage:	Stockpile (concrete floor and 2 walls)
Other farm animals:	Beef cattle (30 Redyblack) – Poultry

Highlights

- Dairy cow building renovated in 2015 and 2020
- Bedding straw cubicles and grooved concrete corridor
- Slurry and straw scraped and stored in a nearby stockpile
- Beef cattle Redyblack breed
- Natura 2000 meadow

Figure 10 : Farm factsheet – FR8

3. WP1.6 Questionnaire on the country policies and supply chains

Greenhouse gas and NH_3 policy and supply chain environment and common practices

What are the main government-driven regulations and support schemes which support/force farmers to implement GHG and NH_3 mitigation practices and which are the exact practices they promote?

The CAP 2023-2027.

Concerning the environmental domain, the main change introduced by this new CAP policy is the eco-scheme.

In France, and based on the NSP (National Strategic Plan), farmers have three possibilities to access to the eco-scheme:

1. cultural practices,
2. certifications,
3. agri-environmental infrastructure.

Two level of payments can be claimed by farmers based on their involvement:

- basic = 54€/ha
- high =76€/ha.

For the 1st path, the access to the eco-scheme is based on promoting crop diversification, legumes in rotations and limiting the permanent grasslands to arable land conversion. For path 2, in addition to Organic Farming, the HVE (High Environmental Value) certification will allow access to the higher level of payment. The HVE was created in 2010 following the Grenelles I and II laws.

National Low Carbon Strategy 2 (2018)

The Green Deal and the “Farm to Fork” European strategy aim to make the European Union the first carbon neutral zone by 2050. In France the National Low Carbon Strategy 2 (Stratégie Nationale Bas Carbone 2 – SNBC-2) has been developed. For agriculture this means decreasing by 46% all GHG emissions by 2050.

What are the main voluntary (dairy/agricultural driven) schemes which support farmers to implement GHG and NH_3 mitigation practices and which are the exact practices they promote?

National Adaptation Plan to Climate Change 2 (Plan National d'Adaptation aux Changements Climatiques-2 – PNACC2, 2018)

Developed to increase knowledge, for policy adaptations, to inform people on CC issues, to facilitate interactions between production activities and to help implementing mitigation pratices.
20 Action Sheets for agriculture, biodiversity, forestry, energy, transportation, etc. have been proposed.

Plan for Competitiveness and Adaptability of Agricultural Farms (PCAEA)

The objective is to support farm investments to improve competitiveness and mitigate environmental impacts such as GHG and ammonia emissions. Subsidies can be used for:

1. building improvement,
2. investing in agro-environmental equipment and
3. energy saving and greenhouse gas and NH_3 mitigation

What are the main supply chain (processors, supermarkets) driven regulations which support/force farmers to implement GHG and NH_3 mitigation practices and which are the exact practices they promote?

EGalim law

The law aimed at protecting farmers' remuneration. It has been developed for having a better distribution of value throughout the agri-food chain.

This law introduces regulatory and transparency mechanisms and the development of a specific indicator labeling agricultural products named “Rémunéra-Score” (pay-score). This new indicator will be used for a test period of 5 years starting at the beginning of 2022.

Describe how GHG and NH_3 reduction practices are promoted through the extension service or any other channels

1- In France several **Institutes** are working on developing and promoting agricultural practices mitigating gas emissions (GHG and NH3). They are gathered under the **ACTA association** (Association de Coordination Technique Agricole - Agricultural Technical Institutes).
"*It coordinates the network of technical agricultural institutes and contributes to strengthening their influence through collective actions*". ACTA federates a network of specialised Technical Agricultural Institutes (ITA) and applied research structures.

2- **IDELE** is one of these ITA and is specialised in ruminant livestock. The swine sector and the cropping systems are represented by the IFIP (swine) and ITAVI (crop).

3- The **"French Chambers of Agriculture" (CA)** – They have been in 1924 and they represent the French farmers and the rural world. The objectives are to offer advisory services and to test and promote new products and practices. They also make the link between agriculture and policy makers. (https://chambres-agriculture.fr/fileadmin/user_upload/National/FAL_commun/publications/National/plaquette_french-chambers-agriculture-english.pdf)

4- **Universities** and **Ingineering schools** have specific programs and courses dealing with environmental concerns and, among which, climate change issues.

5- Specialised **journals** are also an important way to develop understanding and knowledges on the agricultural environmental issues.

6- **Internet** also opens to other source of knowledge.

Are there any GHG and NH_3 reduction practices which are already commonly practiced in the country?

Feed and crop production

- High digestable diet
- More hours on pasture
- Self-produced protein feed

Buildings

- Increasing the scrapping frequency
- Solid/liquid manure separation
- Innovative floors and bedding

Storages

- Covering manure storage
- Composting manure
- Covering liquid manure tanks with passive methane production
- Anaerobic digester

Field / Manure spreading

- Use of covercrops
- Reduced tillage and restored pastures
- Manure application techniques: slurry applied close to ground or buried

Others

- Burning methane
- Solar panels

Social analysis based on farm data collection

Work Package WP.1.6

Discussion Points

The French Situation

Author : Caroline Evrat-Georgel

Policy and agricultural background

Some questions you might consider here:

- What are the main differences between countries in policies, initiatives?
- How “strict” these requirements in your country, how much effort it is for farmers to comply?
- How these differences link to the practices farmers said they were doing in your country?

Also look at Table 15 and Table 14 in the report, which are Q27, Q30-33, Q51-52

Overall, the respondents are of the same opinion: they are aware of their responsibility in protecting the environment and are ready to commit to improving their practices, but on condition that they maintain their income and a collective commitment. Indeed, they recognize that the effects of climate change are visible, but consider that the link between agriculture and environment is overestimated by the public. For 6/8 producers, sustainable agricultural practices can create business opportunities.

All producers surveyed have heard of greenhouse gases (GHGs) or carbon footprints, and all believe that agriculture contributes significantly (4) or slightly (4) to GHG emissions. 6/8 producers have already had the GHG footprint (or carbon footprint) assessed on their farm. The most used method is CAP2ER (5), an older method (1) and one not known to the producer (1).

All producers have heard of ammonia emissions, and they all believe that agriculture contributes to NH3 emissions, either a little (2) or a lot (6).

Farmers’ information sources, contracts

In the report: Tables 7-9, Figure 1; Q26, Q65, Q7

Some questions you might consider here:

- How much information on GHG and NH3 might be reaching farmers in your country?
- Scientific information is often mentioned – do we think it is common amongst general farmers to access scientific information?
- How did the farmers react to the knowledge questions? [please, not that the results on this on the slides from October are incorrect, I made a mistake in the calculations]
- What do you think, would it be important for farmers to understand the emission processes, or would it be enough if they got clear instructions on what to do and how on their farms? How much educated the future farmer should be on NH_3 and GHG (and biodiversity, etc)? In other words: should the farmer be making the decisions, or expert advisors/computer tools?
- How common is it for other farmers to have contractual obligations for sustainability practices in your country?
- Any thoughts on the most trusted information sources?

Before making a change on their farm, half of the respondents rely on 3 or more sources of advice; the advice they take into account the most are: various advisors (6) (advisory structures, including milk control, or research), managers or accountants/ lawyers (5), employees or parents (2), farmers' groups (2), cooperative or commercial advice (2), veterinarian (1) and specialized press (1).

Advice that producers consider most before making a change on the farm to reduce GHG or NH_3 emissions: half of the respondents rely on 3 or 4 sources of advice, the other half rely on only 1 to 2 sources; the advice they consider most are: miscellaneous advisors (8) (advisory structures, including milk control, or research), managers or accountants/ lawyers (6), employees or relatives (1), farmer groups (1), and cooperative or commercial advice (1).

5/8 have contractual obligations to evaluate or implement sustainable practices on their farms: organic specifications (2), other specifications (protected designation of origin, non-GMO, charter of good breeding practices, sustainable agriculture: 5), high environmental value (2).

They all receive CAP subsidies, 5/8 receive the green payment in addition, and 3/8 receive a complementary payment (organic, agri-environmental measures).

The overall profile of the sample is experienced, with respondents who have been farmers on average for 20 years (4) or more (2). Only 2/8 are young producers (2 and 7 years).

They are open-minded in nature, with 7/8 producers having an average of 20 exchanges per year (and up to 1/week) with professionals to receive advice on the management of their operations. All of them rely on various advisors (advisory or research structures), 5/7 on milk control, veterinarians and accountants/managers, 3/7 are part of farmers' groups, and 3/7 also take into account the advice of their cooperative or various commercials.

They are all involved in multiple research projects concerning the environment or sustainability. This finding is not surprising since our sample is particular: 4 farms out of the 8 that agreed to participate in the study are experimental farms, and the others are particularly innovative with farmers with an entrepreneurial profile. Only the one who does not rely on professional advice to manage his farm does not participate in research projects, except for this study.

3/8 producers have half of the events in which they participate related to environmental improvement or sustainable agriculture. Conversely, the same proportion of producers do not participate or participate very little in events on this theme, the remaining 2 producers being intermediate. The first vector are technical days and open houses (4), fairs (3) and farmers' groups (3), then managers/union. Moreover, 5/8 producers are members of a union, cooperative or association: dairy (4), coop/OP (3), nature conservation association (2), political unions (2), GDS (1).

Changes on farms (in general)

In the report: Tables 11-13; Q21-25, Q34-48
Some questions you might consider here:

- The farms in some countries reported many types of changes, others just a few. Any thoughts on that?
- Grassland management is mentioned by many, but fertilisation by only a few farmers.

7/8 producers think that external factors could change over the next 5 years and affect the way they manage their operations:
- societal changes (3): explosion of data use, demand for organic and green products
- the economic context (3): loss of markets/partners, ensuring the recovery of the farm, measures imposed by the dairy
- climate change (3)

- changes in the CAP (1)
3 of them already have ideas to adapt to these changes: improving protein autonomy (2), adapting grassland mixtures (1), producing quality and sustainable products (1), creating renewable energy to supply a data center that will open nearby (the heat produced by the data center would be used for drying) (1), investing in a sorter for a sales crop (honey locust) (1), installing miscanthus (greater absorbency) (1).

Overall, the majority of producers are willing to make changes on their farm to meet the requirements of GHG reduction. The first levers would be those related to public policies (increased regulatory pressure, education on sustainable practices) or markets (dairies). The second levers would be economic (increased subsidies) or social (increased local community pressure). Indeed, 3/8 producers believe that local community pressure is even more focused on the use of pesticides.

We observe known practices, still practiced or with a desire to do so, by the majority of producers:
- increasing the efficiency of fertilization (8) and soil OM (8)
- increase the longevity of the stock (7)
- plant clover for grazing (7)
- increase milk production per cow (6). The 2 producers against prefer to maintain the production as it is but save on forages
- increase forage production per ha (5). The producers against prefer to increase the quality of forages

Known practices that the majority of producers do not wish to implement or no longer wish to implement:
- Capture methane from the slurry pit and burn or purify it (5)
- Acidify manure (5)
- Add feed additives to the ration (5)
- Feeding low crude protein feeds (5)

More controversial practices according to producers, with a balanced proportion between supporters, nonfans or those who are not familiar with the practice:
- Separating manure and slurry (3), (3) and (2)
- Provide higher MB content feed (3), (4) and (1)
- Cool manure pit or dilute manure, (3) and (5)
- Compost manure or have a methanizer (4), (4)

Changes on farms (GHG, NH_3)

In the report: Tables 17-21; Q50, Q53-60, Figures 2-5

Some questions you might consider here:

- DE, NL, SC seem to be the most "active" in reducing emissions
- GHG changes implemented: any observations? Areas or practices missing completely? (preparing silage in bales, more grass in the diet, compost bedded barns, home-grown feed, some NH3 measures)
- NH3 changes implemented: any observations? Areas or practices missing completely? (slurry probiotics, N fixing bacteria into manure, compost bedded barns, Freewalk housing)
- GHG reasons: why C sequestration is so high in NL?

- NH3 reasons: why regulations are not mentioned in IT and LT (and NL)?

6/8 producers have already made at least 2 changes on their farm to reduce GHG or increase carbon sequestration on their farm. The levers are, from most used to least used:
- Animal feed (4), including the use of rapeseed instead of soybeans (2)
- The method of spreading and/or burying liquid manure (2)
- The practice of no-till (2)
- Increasing the proportion of grassland (2) and maintaining hedges (2)
- Optimization of energy consumption (1)
- Methanization (1)
- Reduction of the age at calving (1)

3/8 producers considered changes on their farm to reduce GHGs or increase carbon sequestration on their farm, but ultimately abandoned them. Levers considered include:
- Crops (2), including the introduction of alfalfa (1) and rotation management (1)
- Methanization (1)

One producer said, "I could talk about hedges, but that's fantasy! I'm for HVE, maintaining biodiversity...but it tells a nice story!"

7/8 producers plan to make changes in the next 5 years to reduce GHGs or increase carbon sequestration on their farm. One producer does not have a specific practice in mind, stating "I'm still in the process of making changes, but I don't know what they are yet". They remain open, but consider that they are at the end of what they could already do (they have reached the limit of what they can do in terms of soil management and feeding, with many difficulties with green feeding). The practices considered are:
- The practice of no-till or reduced tillage (2)
- Increasing the proportion of hedges (2)
- Animal feeding (1), especially maximizing feed efficiency
- The method of spreading (1), in particular following certain trials
- Optimization of energy consumption (1)
- Methanization (1)
- Fattening of cull cows (1)

7/8 producers have already made at least 2 changes on their farm to reduce NH3 emissions on their farm. These are:
- The method of spreading and/or burying liquid manure (5)
- Manure management (4)
- Methanization (1)
- Ventilation of buildings (1)

5/8 producers plan to make changes in the next 5 years to reduce NH3 emissions on their farm. Of those who are not considering changes in the next 5 years, one has just started a new project, the changes are already done, and another is waiting for the results of ongoing experiments.

The changes envisaged are:
- Manure and slurry management (3)
- Building layout (cubicles) (1)

Social analysis based on farm data collection

Work Package WP.1.6

Report on the French Situation

Author : Caroline Evrat-Georgel

PROFIL DES PRODUCTEURS ENQUETES

Panel : l'échantillon est constitué de 2 femmes et 6 hommes. La moitié à entre 46 et 55 ans, 1 entre 56 et 65 ans, 2 entre 36 et 45 ans, et 1 a moins de 35 ans.

Formation : 6/8 producteurs ont suivi une formation agricole. Ils sont majoritairement diplômés, avec 4 à un niveau BTS, 3 à un niveau Bac + 5, et 1 en BEP.

Un seul producteur a déjà identifié son successeur (fils), 5 ne sont pas sûrs, et 2 ne savent pas. 4/8 producteurs ont accepté d'indiquer leur revenu agricole, qui est de 50 à 90 k€ par an. 3/8 producteurs ont 10 à 50% (30% en moyenne) de leur revenu agricole qui provient d'activité de diversification agricole. 4/8 producteurs ont 5 à 50% (30% en moyenne) de leur revenu familial qui provient d'activités non agricoles.

Tous les producteurs font appel à des entrepreneurs sur l'exploitation : Cuma, ETA travaux agricoles (semis, récolte), soins animaux (vétérinaires), inséminateurs, contrôle laitier. Chez certains en plus : travaux épandage, rénovations diverses.

5/8 ont des obligations contractuelles d'évaluation ou de mise en œuvre de pratiques durables sur leur exploitation : cahier des charges Bio (2), autres cahiers des charges (AOP, non OGM, CBPE, agriculture raisonné : 5), HVE (2).

Ils touchent tous les aides de la PAC, 5/8 le paiement vert en plus, et 3/8 un paiement complémentaire (Bio, MAE).

Le profil global de l'échantillon est expérimenté, avec des répondants agriculteurs en moyenne depuis 20 ans (4) ou plus (2). Seulement 2/8 sont de jeunes producteurs (2 et 7 ans).

Ils sont de nature ouverte avec 7/8 producteurs qui ont en moyenne 20 échanges par an (et jusqu'à 1/semaine) avec des professionnels pour recevoir des conseils sur la gestion de leur exploitation. Tous s'appuient sur des conseillers divers (structures de conseil ou de recherche), 5/7 sur le contrôle laitier, les vétérinaires et les comptables/gestionnaires, 3/7 font partie de groupe d'agriculteurs, et 3/7 tiennent également compte des conseils de leur coopérative ou de commerciaux divers.

Ils participent tous à des projets de recherche multiples concernant l'environnement ou la durabilité. Ce constat n'est pas surprenant puisque notre échantillon est particulier : 4 exploitations sur les 8 qui ont accepté de participer à l'étude sont des fermes expérimentales, et les autres sont particulièrement innovantes avec des éleveurs au profil d'entrepreneurs. Seul celui qui ne s'appuie pas sur les conseils de professionnels pour gérer son exploitation, ne participe également pas à des projets de recherche, excepté cette étude ☺.

3/8 producteurs ont la moitié des évènements auxquels ils participent qui concernent l'amélioration de l'environnement ou l'agriculture durable. A l'inverse, la même proportion de producteur ne participe pas ou très peu à des évènements sur cette thématique, les 2 producteurs restant étant intermédiaires. Le premier vecteur sont les journées techniques et portes ouvertes (4), les salons (3) et groupes d'agriculteurs (3), puis les gestionnaires/syndicat. D'ailleurs, 5/8 producteurs sont membres d'un syndicat, coopérative ou association : laiterie (4), coop/OP (3), association de défense de la nature (2), syndicats politiques (2), GDS (1), …

6/8 exploitations ont été impactées par la crise du COVID-19 : 2 sur les aspects sociaux, 2 sur les aspects économiques, 1 sur la gestion de la main d'œuvre, et pour une ça a donné lieu à une expérimentation spécifique.

CHANGEMENTS INTERVENUS SUR LA FERME

1. Changements les plus importants effectués au cours des 5 dernières années

Q.20 à Q.26

Principaux changements effectués	Raisons de ces changements
Méthanisation > a changé la façon de travailler (perte de 1,5 ETP), la gestion des effluents	Méthanisation (ferme + 5 autres agris) : - Dynamique de groupe > projet motivant - Volonté de gagner plus d'argent car prend en charge tout l'épandage des effluents organiques (gain = 7000 € / an) - Personnel : départ en retraite et rationnalisation des effectifs
Agrandissement (2017) : reprise de 40 ha **Restructuration du parcellaire**	Être représentatif de la ferme moyenne normande en termes de surface et capacité de production
Agrandissement : reprise de 30 ha, **Travaux sur les chemins** **Rénovation du système de traitement des eaux** blanches : lagunage avec plantes aquatiques pour épuration naturelle **Rénovation de la zone d'épandage**	- Prévision d'accueillir un centre de formation agricole mais projet avorté (pour l'acquisition des terres) - Obsolescence des installations et remise aux normes (pour les travaux)
Changement de direction (2019) Restructuration de la station (2020/21) > 1,8 millions d'investissement) : Nouvelle salle de traite Augmentation troupeau de 120 à 150 VL **Création bâtiment bioclimatique** Génisse post sevrage à partir de 3 mois Achat auges peseuses pour équipement expé	- Vétusté de l'outil - Attractivité du métier - Adapter les capacités expérimentales au numérique (gagner précision, fiabilité) - Répondre aux nouveaux enjeux
Méthanisation (10 ans) **Photovoltaïque** Séchage fourrages protéiques BEA : matelas à eau, tapis Robotisation alimentation Caméras sur animaux Changement tracteurs et analyse des datas	- Déficience de main d'œuvre : besoin de gagner du temps et en efficacité - Approche de savoir combien ça rapporte : préfèrent investir pour être sûrs de l'efficacité que ça représente - Motivations : être plus résilients, plus attentif aux attentes sociétales, et garder le plaisir de travailler - Situés sur est morbihan, commune touristique : composer avec changement de CSP car acteurs du territoire, messages forts ***« Notre adn est fait de projets pour sortir de notre zone de confort »***
Nouveau bâtiment Méthanisation (mise en service fin 2021)	- Economique : sinon ils auraient arrêté la production laitière - Pérenniser le système à transmettre à leurs enfants. ***« On est fatigués de produire du lait à si peu cher, c'est moins qu'un litre d'eau ! »***
Installation fratrie (2019) **Agrandissement** : 117 à 159 ha Construction nouveau bâtiment Réalisation 3ème gîte	- Economique : installation avec besoin d'1 revenu de plus > besoin agrandissement, bâtiment trop petit, plus aux normes et dans le village - Objectif technique : ne plus avoir de logettes (aire paillée maintenant pour le BEA et pénibilité du travail pour eux) - Surface : être autonome en fourrage. Fait dès l'installation pour optimiser.
Arrivée du **troupeau allaitant** Atelier poulet de chair et pondeuses Arrêt du colza et du verger de mirabelle	- Allaitantes : demande de la chambre pour conduire les essais - Aviculture : besoin avec formation dispensée et vente directe (débouché) - Verger : pas assez rentable - Colza : achat de paille, préférence pour mettre plus de céréales à paille et trop d'énergie à mettre sur la culture du colza pour un gain mitigé

7/8 producteurs pensent que des facteurs externes pourraient changer au cours des 5 prochaines années et affecter la façon dont ils gèrent leur exploitation :

- les évolutions sociétales (3) : explosion de l'utilisation des data, demande en produits bio et issues d'une production « green »

- le contexte économique (3) : perte de marchés/partenaire, assurer la reprise de la ferme, mesures imposées par la laiterie

- le changement climatique (3)

- les évolutions de la PAC (1)

3 d'entre eux ont déjà des idées pour s'adapter à ces évolutions : améliorer l'autonomie protéique (2), adapter les mélanges prairiaux (1), produire des produits de qualité et durables (1), créer de l'énergie renouvelable pour alimenter un data center qui va ouvrir à proximité (la chaleur produite par le data center serait valorisée dans le séchage) (1), investir dans un trieur pour culture de vente (févérole) (1), mise en place de miscanthus (pouvoir absorbant plus important) (1).

Avant d'effectuer un changement sur leur exploitation, la moitié des enquêtés s'appuient sur 3 ou plus sources de conseil ; les avis dont ils tiennent le plus compte sont : les conseillers divers (6) (structures de conseil, dont contrôle laitier, ou de recherche), les gestionnaires ou comptables/juristes (5), les salariés ou parents (2), les groupes d'agriculteurs (2), les conseils de coopératives ou commerciaux (2), le vétérinaire (1) et la presse spécialisée (1).

2. Perception des producteurs sur le lien entre agriculture et environnement

Q.27

Globalement les enquêtés sont du même avis : ils ont conscience de leur responsabilité dans la protection de l'environnement, sont prêt à s'engager pour améliorer leurs pratiques, mais sous condition du maintien de leurs revenus et d'un engagement collectif. En effet, ils reconnaissent que les effets du changement climatiques sont visibles, mais considèrent que le lien entre agriculture et environnement est surestimés par le public.

Pour 6/8 producteurs, les pratiques agricoles durables peuvent créer des opportunités commerciales. Pour la plupart, ils sont souvent parmi les premiers à essayer les nouvelles technologies (5), ou sont prêt à essayer (2). Seul un producteur préfère attendre et voir (1).

Les agriculteurs ont l'obligation de contribuer à la protection de l'environnement dans la mesure du possible.	2	2	1	1	1	2	2	2
Je suis prêt à prendre des mesures de protection de l'environnement dans mon exploitation, même si cela se fait au détriment des revenus.	4	3	3	4	5	5	3	4
Les effets négatifs de l'agriculture sur l'environnement sont souvent surestimés par le public.	3	1	2	1	1	1	4	2
Un agriculteur ne peut rien faire individuellement pour réduire les émissions de gaz à effet de serre	5	5	4	5	5	4	4	5
Les effets du changement climatique sont déjà perceptibles	1	2	1	3	-	1	1	2
Les pratiques agricoles durables peuvent créer des opportunités commerciales	1	2	2	3	1	1	2	3

1 : tout à fait d'accord ; 5 : pas du tout d'accord

3. Importance des activités sur la viabilité financière à long terme de l'exploitation

Q.29

Ceux qui accordent beaucoup d'importance aux nouvelles technologies le sont notamment car *« on ne trouve plus de salariés en élevage ».*

6/8 producteurs citent d'autres activités importantes sur la viabilité financière de l'exploitation, notamment :

- le bien être des éleveurs, dont la pénibilité du travail, la santé des éleveurs, la charge de travail et l'agribashing (5)

- la gestion/stratégie de l'entreprise, dont la gestion du travail (2) : augmentation de la taille des exploitations/litrage, surcharge qui peut pénaliser la ferme *« de là, découle tous les problèmes à suivre… »*

- le manque de cercles d'échanges avec des personnes aussi innovante qu'eux (1) : manque de prise de hauteur de la plupart des producteurs car ils ont trop de travail

Alimentation des animaux	2	2	1	1	1	1	1	1
Elevage des animaux	2	2	1	1	1	1	2	2
Santé animale	3	2	1	1	1	1	2	3
Logement des animaux et stockage du fumier	3	3	1	1	1	2	3	2
Fertilisation des sols via l'application de fumier et lisier	2	3	2	1	1	3	1	1
Irrigation et/ou drainage	4	4	6	1	1	2	2	2
Gestion prairies et pâturage (ex : régénération des prairies, planning de pâturage...)	4	2	1	3	1	4	3	2
Autres aspects de la gestion des cultures (ex : rotations, couverts, variétés, intercultures…)	2	2	1	1	1	2	3	1
Gestion de la ferme (contrats et ressources humaines)	3	2	1	1	1	6	3	3
Machinisme et carburant	3	3	2	1	1	3	3	1
Technologie et automatisation	4	3	3	1	1	3	3	2
Autres (ex : qualification des employés, santé des éleveurs…)	2	2	1	6	1	6	1	1

1 : absolument important ; 5 : pas du tout important ; 6 : non applicable

MESURES D'ATTENUATION DES GAZ A EFFET DE SERRE

Q.30 à 33

Tous les producteurs enquêtés ont déjà entendu parler des gaz à effet de serre (GES) ou de l'empreinte carbone, et tous pensent que l'agriculture continue aux émissions de GES de façon importante (4) ou légère (4).

6/8 producteurs ont déjà fait évaluer l'empreinte des GES (ou empreinte carbone) sur leur exploitation. La méthode la plus employée est le CAP2ER (5), une méthode plus ancienne (1) et une non connue par le producteur (1).

1. Probabilité d'effectuer des changements au cours des 5 prochaines années en raison des circonstances suivantes

Q.34

Globalement, la majorité des producteurs est disposée à effectuer des changements sur son exploitation afin de répondre aux exigences liées à la réduction des GES. Les premiers leviers seraient ceux liés aux politiques publiques (pression réglementaire accrue, éducation aux pratiques durables) ou aux marchés (laiteries). Les seconds leviers seraient économiques (subventions accrues) ou sociaux (pression accrue communauté locale). En effet, 3/8 producteurs estiment que la pression de la communauté locale est encore davantage axée sur l'utilisation des pesticides.

Attentes accrues du grand public en matière de réduction des émissions de gaz à effet de serre de l'exploitation	3	3	1	3	2	3	2	1
Exigences accrues des acheteurs (laiterie, coopérative) en matière de réduction des émissions de gaz à effet de serre de l'exploitation	2	1	2	3	1	1	2	2
Disponibilité accrue de subventions pour réduire les émissions de gaz à effet de serre de l'exploitation	1	2	2	3	1	3	1	3
Pression accrue de la communauté locale sur la réduction des émissions de gaz à effet de serre de l'exploitation	3	2	2	3	1	3	2	2
Augmentation des exigences réglementaires pour réduire les émissions de gaz à effet de serre de l'exploitation	2	2	1	2	2	2	2	1
Augmentation des programmes éducatifs sur les pratiques agricoles durables	3	2	2	2	2	2	2	1

1 : très probable ; 3 : pas du tout probable

2. Changements les plus importants déjà effectués pour réduire les GES ou augmenter la séquestration du carbone

Q.35 à Q.38

6/8 producteurs ont déjà effectués au moins 2 changements sur leur exploitation pour réduire les GES ou augmenter la séquestration du carbone sur leur exploitation. Les leviers sont, du plus utilisé au moins utilisé :

- L'alimentation des animaux (4), notamment l'utilisation de colza au lieu du soja (2)
- Le mode d'épandage et/ou l'enfouissement des déjections liquides (2)
- La pratique du sans labour (2)
- L'augmentation de la part de prairies (2) et l'entretien des haies (2)
- L'optimisation de la consommation d'énergie '1)
- La méthanisation (1)
- La baisse de l'âge au vêlage (1)

<table>
<tr><th colspan="2">Pratiques</th><th>Raisons pour lesquelles la pratique a été adoptée</th></tr>
<tr><td rowspan="4">Alimentation</td><td>passage au colza au lieu du soja</td><td>circuit court du colza comparé à celui du soja</td></tr>
<tr><td>utilisation tourteau colza</td><td>raison économique et pratique</td></tr>
<tr><td>utilisation de DAC pour mesurer les émanations de méthane par les vaches selon leur alimentation</td><td>essais pour estimer l'impact d'une pratique sur les gaz à effet de serre</td></tr>
<tr><td>efficacité alimentaire</td><td></td></tr>
<tr><td rowspan="2">Epandage</td><td>changement mode épandage des déjections (buse palette passé en pendillard et enfouisseur en 2021)</td><td>limiter les émissions</td></tr>
<tr><td>enfouissement des épandages liquides</td><td>pour éviter les différentes pertes lorsqu'on épand au pendillard</td></tr>
<tr><td rowspan="2">Labour</td><td>réduction du labour (passage d'un labour systématique et 1 labour / tous les 2 ans) - SL total exige un matériel spécifique</td><td>environnement et économique (carburant qui a flambé il y a quelques années)</td></tr>
<tr><td>non labour depuis presque 20 ans</td><td>efficience main d'œuvre, conso carburant, temps passé à l'hectare, préservation biodiversité</td></tr>
<tr><td rowspan="2">Prairies</td><td>maintien prairies permanentes</td><td></td></tr>
<tr><td>mise en place de prairies temporaires à base de légumineuses</td><td>pour augmenter la valeur protéique de la ration de base</td></tr>
<tr><td rowspan="2">Haies</td><td>plantation de haies</td><td></td></tr>
<tr><td>plan de gestion des haies durables</td><td>pour augmenter la séquestration</td></tr>
<tr><td>Conso énergie</td><td>réduction de la consommation énergétique autour du bloc traite (disposition du tank, utilisation calories du lait pour générer de l'eau chaude…)</td><td>économique et expérimentale (envie de bien faire)</td></tr>
<tr><td>Méthanisation</td><td>méthanisation</td><td>diversification de revenus, améliorer efficacité fertilisation lisier et fumier (coef efficacité N : 60 à 70% contre 30% avant) > entre 1 à 1,5 point d'augmentation de matière organique dans le sol</td></tr>
<tr><td>Âge au vêlage</td><td>diminution âge vêlage</td><td>âge vêlage : raison économique, lien avec les contraintes expé (besoin de vêlage groupé)</td></tr>
</table>

3. Changements envisagés pour réduire les GES ou augmenter la séquestration du carbone, mais finalement abandonnés

Q.39 à 44

3/8 producteurs ont envisagés des changements sur leur exploitation pour réduire les GES ou augmenter la séquestration du carbone sur leur exploitation, mais les ont finalement abandonnés. Les leviers envisagés concernent :

- Les cultures (2), notamment l'introduction de luzerne (1) et la gestion de la rotation (1)
- La méthanisation (1)

Un producteur nous exprime *« je pourrais parler des haies, mais c'est du fantasme ! Je suis pour HVE, le maintien de la biodiversité…mais çà raconte une belle histoire ! »*

Pratique	Raisons pour lesquelles les producteurs ont décidé d'abandonner cette pratique	Raisons qui leur feraient adopter cette pratique
introduction de luzerne (10 ans d'expé)	doit se récolter en plusieurs fois, donc ingérable avec des salariés et trop de temps de travail	terres sableuses
rotation de cultures	aide de l'état plus importante qu'aujourd'hui donc ne couvre pas le coût de main d'œuvre supplémentaire (faudrait 1000 €/ha au lieu de 100)	nouvelles cultures ou nouvelles filières
méthanisation	trop cher, et pas adapté à la ferme et ne savent pas comment le digesta va nourrir le sol	-

4. Changements envisagés de faire au cours des 5 prochaines années pour réduire les GES ou augmenter la séquestration du carbone

Q.45 à 48

7/8 producteurs envisagent de faire au cours des 5 prochaines années des changements pour réduire les GES ou augmenter la séquestration du carbone sur leur exploitation. Un producteur n'a pas de pratique spécifique en tête, il déclare *« je suis toujours dans cette logique de changement, mais je ne sais pas encore lesquels ».* Ils restent ouverts, mais considèrent être au bout de ce qu'ils pouvaient déjà faire (arrivés à la limite sur la gestion du sol et l'alimentation, avec notamment beaucoup de difficultés avec l'affouragement en vert). Les pratiques envisagées sont :

- La pratique du sans labour ou d'une réduction du travail du sol (2)
- L'augmentation de la part de haies (2)
- L'alimentation des animaux (1), notamment maximiser l'efficacité alimentaire
- Le mode d'épandage (1), notamment suite à certains essais
- L'optimisation de la consommation d'énergie (1)
- La méthanisation (1)
- L'engraissement des vaches de réforme (1)

Pratiques		**Raisons pour lesquelles la pratique est envisagée**
Labour	réduire encore plus le labour	économique (coûts de fonctionnement et carburant : labour = 25 L fioul / ha alors que outil de désherbage = 7 L / ha) et pas de soucis technique apparu en plus sans glyphosate (salissement des parcelles)
	technique simplifiée pour les sols (arrêt du labour sur 95% des terres, sauf si retournement des prairies ou parcelle trop sale car ne souhaite pas utiliser de glyphosate)	Simplification du travail et réduction carburant
Haies	implantation de haies	tous les avantages que les haies apportent (pas trop cher à implanter et entretenir et favorise la biodiversité, les attentes sociétales, paysage, brise vent, insolation des génisses)
	plantation de haies, recours à la plaquette bois pour pailler les vaches	haie : car présence d'une plante invasive dans un fossé et se développe moins vite quand ombre ; bois : limiter les achats extérieurs
Alimentation	travailler sur valeur alimentaire des fourrages pour diminuer les concentrés (baisses au 1000 L mais pas gros impact au niveau exploitation)	réduire les concentrés
Epandage	attends de voir ce que vont donner les essais en cours avec le CNRS (volatilité de l'azote en lien avec le type et la période d'épandage des lisiers et fumiers)	serait équivalent au niveau économique (car bénéfice à un autre endroit) et gain environnemental
Conso énergie	aménagement d'un plan d'eau (infrastructures agroécologiques)	diminuer les frais de méca et entretien, et image de l'agrciulture, fin pédagogiques quand accueil étudiants
Méthanisation	méthanisation	pérenniser l'exploitation
Engraissement réformes	engraissement des vaches de réforme	animaux improductifs générateurs de GES donc faire partir les animaux improductifs le plus vite

PRATIQUES AGRICOLES

1. Activités importantes à modifier pour réduire les GES de l'exploitation

Q.49

Les 3/8 producteurs qui accordent peu d'importance à l'alimentation des animaux mettent en garde sur le fait *« de ne pas aller au détriment de la performance laitière ».*

Concernant la gestion de la ferme, un producteur précise que ce n'est pas évident quand beaucoup d'intervenants travaillent sur une même exploitation, car tout le monde n'a pas le même référentiel de travail par rapport à sa gestion environnementale.

2/8 producteurs citent d'autres activités importantes à modifier pour réduire les GES, notamment :

- La conviction de chacun
- Le Plan Climat Air Energie Territorial (PCAET)
- Les attentes sociétales

Alimentation des animaux	1	2	1	2	3	3	3	2
Elevage des animaux	3	2	1	2	1	2	2	3
Santé animale	3	4	3	3	1	4	4	4
Logement des animaux et stockage du fumier	2	2	1	3	1	1	1	2
Fertilisation des sols via l'application de fumier et lisier	1	2	2	2	1	1	2	1
Irrigation et/ou drainage	4	3	6	4	1	2	3	4
Gestion prairies et pâturage (ex : régénération des prairies, planning de pâturage...)	3	2	2	3	1	2	2	2
Autres aspects de la gestion des cultures (ex : rotations, couverts, variétés, intercultures…)	2	2	2	2	1	2	2	1
Gestion de la ferme (contrats et ressources humaines)	5	4	2	5	1	6	5	4
Machinisme et carburant	2	2	1	3	1	2	1	1
Technologie et automatisation	2	4	3	3	1	2	2	1
Autres (ex : qualification des employés, santé des éleveurs…)	6	6	3	6	1	6	5	6

1 : absolument important ; 5 : pas du tout important ; 6 : non applicable

2. Pratiques mises en œuvre par les producteurs sur leur exploitation

Q.50

On observe des pratiques connues, toujours pratiquées ou avec un souhait de le faire, par la majorité des producteurs :

- augmenter l'efficacité de la fertilisation (8) et la MO du sol (8)
- augmenter la longévité du stock (7)
- implanter du trèfle pour le pâturage (7)
- augmenter la production de lait par vache (6). Les 2 producteurs contre préfèrent maintenir la production telle qu'elle est mais économiser sur les fourrages
- augmenter la production de fourrage par ha (5). Les producteurs contre préfèrent plutôt augmenter la qualité des fourrages

Des pratiques connues, que la majorité des producteurs ne souhaite pas ou plus mettre en œuvre :

- Capter le méthane de la fosse à lisier et le brûler ou le purifier (5)
- Acidifier le fumier (5)
- Ajouter des additifs alimentaires à la ration (5)
- Fournir des aliments à faible teneur en protéines brutes (5)

Des pratiques plus controversées selon les producteurs, avec une proportion équilibrée entre les partisans, les non adeptes ou ceux qui ne connaissent pas cette pratique :

- Séparer fumier et lisier (3), (3) et (2)
- Fournir des aliments à teneur plus élevée en MG (3), (4) et (1)
- Refroidir la fosse à lisier ou diluer le fumier, (3) et (5)
- Composter le fumier ou avoir un méthaniseur (4), (4)

Augmenter la production de lait par vache	5	2	2	2	3	4	2	2
Augmenter la longévité du stock	3	2	2	3	2	4	3	2
Implanter un mélange de trèfle pour le pâturage	2	2	2	2	2	2	2	3
Augmenter l'efficacité de la fertilisation	2	2	2	2	2	2	2	2
Séparer le fumier et le lisier (séparateur de phase)	1	5	2	1	4	2	2	4
Augmenter la production de fourrage par Ha	4	2	4	5	3	2	2	2
Fournir des aliments à faible teneur en protéines brutes	5	5	4	1	1	2	4	4
Fournir des aliments à teneur plus élevée en matières grasses (pour baisser les émissions de GES en bâtiment)	5	1	2	5	3	5	3	5
Ajouter des additifs alimentaires à la ration (pour diminuer fermentation entérique avec produits)	5	3	1	3	4	5	5	4
Refroidir la fosse à lisier	1	1	1	1	1	5	5	5
Acidifier le fumier (limite la volatilisation de l'ammoniac)	5	5	1	1	1	5	5	5
Diluer le fumier	1	1	1	1	5	5	1	5
Composter le fumier	5	2	2	5	5	5	2	3
Augmenter la matière organique du sol	2	2	2	3	2	2	2	2
Pratiquer la digestion anaérobie du fumier (=méthanisation)	2	5	5	1	2	3	5	5
Capter le méthane de la fosse à lisier et le brûler ou le purifier (sans digestion anaérobie) (avec bâche sur fosse et torchères)	5	1	5	1	5	3	5	5

1 : n'a pas entendu parler de cette pratique ; 2 : utilise cette pratique ; 3 : prévois d'utiliser cette pratique d'ici 5 ans ; 4 : a utilisé cette pratique mais ne souhaite plus ; 5 : n'a pas utilisé cette pratique et ne prévois pas de l'utiliser d'ici 5 ans.

MESURES D'ATTENUATION DES EMISSIONS D'AMMONIAC - NH3

1. Changements les plus importants déjà effectués pour réduire les émissions d'ammoniac (NH3)

Q.52 à Q.56

Tous les producteurs ont déjà entendu parler des émissions d'ammoniac, et ils pensent tous que l'agriculture contribue aux émissions de NH3, peu (2) ou beaucoup (6). 7/8 producteurs ont déjà effectués au moins 2 changements sur leur exploitation pour réduire les émissions de NH3 sur leur exploitation. Il s'agit de :

- Le mode d'épandage et/ou l'enfouissement des déjections liquides (5)
- La gestion des fumiers et lisier (4)

- La méthanisation (1)
- La ventilation des bâtiments (1)

Changements effectués sur l'exploitation pour réduire les émissions de NH3		Raisons pour lesquelles la pratique a été adoptée
Epandage	épandage (délai d'enfouissement minimum + pendillard uniquement et plus de buse palette)	faire en sorte d'utiliser au max ce qu'on apporte au sol (ne pas perte le NH3 en volatilisation pour qu'il soit utilisé par le sol et les plantes) : économique et environnemental, et obligations réglementaires
	changement du mode d'épandage du lisier	réduire émissions d'ammoniac, qui contribue au GES
	enfouissement du lisier	limiter les pertes et gagner des points d'ammoniac
	utilisation de pendillard pour épandage	limiter la volatilité de l'ammoniac
	enfouissement de l'engrais au moment du semis de maïs	limiter les pertes et gagner des points d'ammoniac
Gestion fumier et lisier	ajout de produits dans la fosse à lisier	essais expérimentaux
	système de raclage : hydrocureur passé en cureur à corde	gagner du temps, efficience main d'œuvre
	génisse sur aire paillée, les passer en logettes avec raclage avec robot racleur	potentiel métahnogène
	tapis magelhan pour séparer l'urine des féces + raclage lisiers toutes les 2 heures	construction d'un bâtiment neuf : pour le confort et bien-être des animaux
Méthanisation	stockage (méthaniseur)	économique et dynamique de groupe avec projet innovant
Ventilation	ventilation du nouveau bâtiment	BEA animal

2. Changements les plus importants envisagés de faire au cours des 5 prochaines années pour réduire les émissions de NH3

Q.57 à Q.60

5/8 producteurs envisagent de faire au cours des 5 prochaines années des changements pour réduire les émissions de NH3 sur leur exploitation. Parmi ceux qui n'envisage pas de changements d'ici 5 ans, l'un vient de juste de lancer son nouveau projet, les changements sont déjà fait ☺, et un autre est en en attente des résultats des expérimentations en cours.

Les changements envisagés sont :

- La gestion du fumier et lisier (3)
- L'aménagement du bâtiment (logettes) (1)

Pratiques		Raisons pour lesquelles la pratique est envisagée
Gestion fumier et lisier	projet bâtiment : fosse à lisier qui va être réalisée et sera couverte si possible (budget)	pour réduire les émissions d'ammoniac
	Les changements seront réfléchis lors de la construction du nouveau bâtiment : jouer sur le fumier et le lisier, mais ne sait pas encore ce qui serait envisagé)	ancien bâtiment non adapté pour les essais
	recours à la mécanisation	capacité de la fosse insuffisante
Logettes	changement de logement vers logettes	

SOUTIEN A L'ACTION ENVIRONNEMENTALE

1. Type de soutien pour accompagner les producteurs à réduire les émissions de GES et/ou de NH3

Q.61 à 63

Si la réglementation ou les marchés imposait de réduire les émissions de GES et/ou de NH3 sur leur exploitation, les producteurs auraient besoin en priorité pour remplir cet objectif de :

- conseils techniques (5)
- soutien économique (subventions, prix compensatoire) (5)
- références et innovations techniques (2) : exemple de l'acidification du lisier pas assez connu/maitrisé > serait à sécuriser (car corrosif et dangereux) et process à optimiser (moment de l'utilisation du NH3)
- formation (1)

Un producteur déclare *« tout à déjà été fait, sans aucune subvention ! »*

5/8 producteurs pensent que l'entraide avec la communauté agricole peut jouer un rôle pour réduire les émissions de GES ou de NH3, 2/8 ne savent pas, et le dernier n'y croit pas. Les sources d'entraide peuvent être :

- la mutualisation du matériel via les Cuma (3)
- les aides PCAET, notamment pour investir dans un pendillard et enfouisseur (1)
- les conseils et partages d'infos (1)
- la méthanisation collective (1)
- les échanges de parcelles pur une meilleure gestion des rotations (1)

2. Changements de marché, politique, société… qui encourageraient les producteurs à réduire les émissions de GES et/ou de NH3

Q.64 et 65

Les changements qui encourageraient les producteurs à réduire leurs émissions de GES et/ou de NH3 sont :

- **l**es contraintes ou avantages financiers, notamment via les contrats laiteries (7) : temps de pâturage minimum, CAP2ER à réaliser, nutriscore…
- les choix politiques (2), pour assurer notamment une rémunération adaptée et changer leur regard sur les producteurs
- l'acquisition de références techniques pour développer le conseil (1)
- une prise de conscience collective, et notamment des consommateurs pour qu'ils ne voient plus les agriculteurs comme des *« pollueurs »*

Certains producteurs précisent que *« si les changements sont trop drastiques, les agriculteurs arrêteraient le métier car on reste prisonnier de son système".* D'autres soulignent que *« çà reste des convictions de l'agriculteur avant tout, pas convaincu que l'agriculture puisse y faire quelque chose ".*

Les avis dont les producteurs tiennent le plus compte avant d'effectuer un changement sur l'exploitation pour réduire les émissions de GES ou NH3 : la moitié des enquêtés s'appuient sur 3 ou 4 sources de conseil, l'autres moitié ne s'appuyant que sur 1 à 2 sources ; les avis dont ils tiennent le plus compte sont : les conseillers divers (8) (structures de conseil, dont contrôle laitier, ou de recherche), les gestionnaires ou comptables/juristes (6), les salariés ou parents (1), les groupes d'agriculteurs (1), et les conseils de coopératives ou commerciaux (1).

CONNAISSANCE DES GES ET DU NH3

Q.66 à 69

Selon les producteurs enquêtés, les principaux GES sont :

- l'ammoniac - NH3 (5)
- le carbone - C02 (4)
- le dioxyde d'azote - N02 (4)
- le méthane - CH4 (4)
- le butane et le propane (1)
- les émissions de fumier et lisier (1)
- les rots et pets des vaches (1)

Les principales sources de pertes de NH3 dans les exploitations sont :

- le stockage du fumier et lisier (5)
- l'épandage (5)
- les pertes au pâturage (2)
- les engrais chimiques (2)
- l'excès d'azote dans les cultures et les rations (1)
- en bâtiment (1)

Le produit alimentaire qui provoque le plus d'émissions de GES est la viande pour 6/8 producteurs, les 2 restants déclarant ne pas savoir entre la viande et le blé. Les circonstances qui peuvent entrainer des émissions élevées de NH3 lors du stockage du fumier sont le temps chaud pour 5/8 producteur, le temps froid pour 1, et 2 producteurs déclarent ne pas savoir.

4. WP3.1 Farm leaflets

Farm plan reduction of emissions **Dairy farmer: Farm 1**

1. Description of farmers' future strategy on development of farm and reduction of emissions

It is an experimental farm involved in various research works and groups of breeders, particularly on the environmental theme. Motivated by a rationalization of the workforce (retirement) and by an innovative collective project optimizing the management of effluents, the choice of methanization was made in 2019. It has changed the way of working by reducing the working time (minus 1.5 FTE) and generates an annual gain of 7000 €. The farm has modified its method of effluents spreading, in order to make maximum use of what is brought to the soil, without losses in volatilization. The farm implemented the reduced tillage practice, for economic (high fuel costs) and environmental reasons. It did not implement no-tillage yet because it has not the adapted equipment, but the wish is to reduce ploughing even more, given its good technical results on the soil contamination of the plots. The farm has also reduced its first energy expenditure item: the milk tank. In the future, they would like to plant hedges because of their limited cost and the important benefits in terms of biodiversity, landscape maintenance, shade for heifers and the image of livestock farming in the society.

2. Which mitigation measures / practices were already taken?

1. Methanization
2. Reduced tillage (1 / 2 years instead of 1 / year)
3. Reduction of the energy consumption of the milk tank (layout of the tank to have a minimal consumption, use of the calories of the milk to generate hot water)
4. Spreading method (minimizing burial time of manure and use of drop-pipes for spreading)

3. Which mitigation measures are planned to be implemented and how?

1. Continue the reduction of ploughing in a more thorough way
2. Planting hedges

4. Expected effects on emissions (based on tool calculations, see attachment)

1. Measure 1: ....
   .....
   .....
2. Measure 2: ....
   .....
   .....
3. Measure 3: .....
   .....
   .....

5. Equipment involved; Investment and economics?

1. ....
2. ....
3. ....

Economics:

6. Attention points when implementing measures

1. ......
2. ....

7. Quote of farmer:
"With the societal evolutions, I am not comfortable with the spreading... I choose the time to do it depending on climate but also ...without neighbors around !"

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Figure 11 : WP3.1 – Farm leaflet – FR1

Farm plan reduction of emissions | **Dairy farmer: Farm 2**

1. Description of farmers' future strategy on development of farm and reduction of emissions

This farm is representative of the average Normand farm (in terms of surface area and production capacity) and, in 2017, it expanded by 40 ha and restructured its land plots. In the context of climate change, the farm's objective is to improve its protein autonomy, adapt its grassland mixtures, and produce sustainable quality products. In 2021, the manure spreading method was modified in order to limit ammonia emissions and a sustainable hedge management plan was implemented to increase carbon sequestration. The next changes planed concern animal feeding, with the objective of maximizing the feed value of forages in order to reduce concentrates. A building project is also underway, with the construction of a covered liquid manure tank.

2. Which mitigation measures / practices were already taken?

1. Expansion in 2017 (plus 40 ha) and restructuration of the land plots
2. Change of the liquid manure spreading method: in 2021 switch to drop-pipes with a burier
3. Implementation of a sustainable hedge management plan

3. Which mitigation measures are planned to be implemented and how?

1. Increase the feed value of forages to be able to reduce the use of concentrates
2. Construction of a new building with a covered liquid manure tank

4. Expected effects on emissions (based on tool calculations, see attachment)

1. Measure 1: ....

   ------
2. Measure 2: ....

   -----
3. Measure 3: .....

   -----

5. Equipment involved; Investment and economics?

1. ....
2. ....
3. ....

Economics:

6. Attention points when implementing measures

1. ......
2. ....

7. Quote of farmer:

" Implement emission mitigation measures requires financial compensations; this implies strong political choices and clear market segmentation "

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Figure 12 : WP3.1 – Farm leaflet – FR2

Farm plan reduction of emissions **Dairy farmer: Farm3**

1. Description of farmers' future strategy on development of farm and reduction of emissions

It is an experimental farm, including organic productions for part of it. It carries out various tests, in particular on GHG and leguminous grazing. In this perspective, it is equipped with GreenFeed® for methane emission measurements related to the animals' feeding. The farm has recently expanded (30 ha additional). Several renovation works have been carried out (white water treatment, spreading area, ...). There are also plans to make the mobile milking robot available for GHG measurement trials on conventional batches. In the future, one of the important way which is planed will be to reduce the number of unproductive animals on the farm, in particular through crossbreeding and the fattening of culled cows.

2. Which mitigation measures / practices were already taken?

1. Use of GreenFeed® to measure emissions related to animal feeding
2. Renovation of the white water treatment system (planted lagoon for natural purification)
3. Reduction of unproductive animals through crossbreeding

3. Which mitigation measures are planned to be implemented and how?

1. Work on the feed value of forages to reduce the use of concentrates
2. Construction of a new building with a covered slurry pit
3. Fattening culled cows

4. Expected effects on emissions (based on tool calculations, see attachment)

1. Measure 1: ....
   .....
   .....
2. Measure 2: ....
   .....
   .....
3. Measure 3: .....
   .....
   .....

5. Equipment involved; Investment and economics?

1. ....
2. ....
3. ....

Economics:

6. Attention points when implementing measures

1. ......
2. ....

7. Quote of farmer:

"When there are many people on the farm, we don't all have the same conviction about environmental management"

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Figure 13 : WP3.1 – Farm leaflet – FR3

Farm plan reduction of emissions **Dairy farmer: Farm4**

1. Description of farmers' future strategy on development of farm and reduction of emissions

This experimental farm is involved in numerous trials (lower calving age, protein toasting, corn silage valorization,...). It was restructured in 2020/21 for better use of the digital technology and to meet the new challenges of attractiveness of the profession: change of the milking parlour, increase from 120 to 150 dairy cows, creation of a bio-climatic building for post-weaning heifers, purchase of weighing troughs... For practical and economic reasons, the farm switched to the use of rapeseed meal and lowered the age at calving (grouped calving). The introduction of alfalfa was tested for more than 10 years, but abandoned because it requires too much work time (must be harvested in several times, which is difficult to manage with many employees). Crop rotation is also limited because some plots are too sandy. The development of a pond with agro-ecological infrastructures is planned. Hedges will also be planted, notably to limit the development of invasive plants in ditches. To limit external purchases, wood chips will be used as bedding material. Finally, the farm plans to build a biofermentor.

2. Which mitigation measures / practices were already taken?

1. Use of rapeseed cake
2. Decrease the calving age
3. Improvement of feed efficiency
4. Use of drop-pipes for liquid manure spreadings

3. Which mitigation measures are planned to be implemented and how?

1. Hedge plantations
2. Use of wood chips as bedding material for cows instead of wheat straw
3. Build a biofermentor

7. Quote of farmer:

"New technologies are a big help because we can't find employees in breeding anymore"
"It would take 1000 €/ha instead of 100 €/ha to cover the cost of additional labor for implementing good environmental practices"

4. Expected effects on emissions (based on tool calculations, see attachment)

1. Measure 1: ....
   .....
   ......
2. Measure 2: ....
   .....
   .....
3. Measure 3: .....
   .....
   .....

5. Equipment involved; Investment and economics?

1. ....
2. ....
3. ....

Economics:

6. Attention points when implementing measures

1. ......
2. ....

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Figure 14 : WP3.1 – Farm leaflet – FR4

Farm plan reduction of emissions **Dairy farmer: Farm 5**

1. Description of farmers' future strategy on development of farm and reduction of emissions

The farmers considered to move to organic status but they abandoned the project fearing a market saturation. Instead, they embarked on the "High Environmental Value" (HEV) standard. It is now certified level 3 since 2020. Considering the manpower shortage and the need to gain time and efficiency, the farmers are investing to be more resilient and more adapted to societal expectations. For these reasons, as well as to save fuel and preserve biodiversity, they have been practicing no-till for 20 years. They produce biogas for 10 years yet which allows them to diversify their income. For them, they consider that they already optimized their production system in the environmental domain, by deploying many other levers: photovoltaic, drying of protein fodder, equipment for animal welfare, scraping blade instead of fushing, feed optimization... Therefore, they consider that they are at the limit of their possibilities to reduce GHG emissions or to increase carbon sequestration. Next potential project (study in progress): supplying and recycling energy, in synergy with a nearby data center.

2. Which mitigation measures / practices were already taken?

1. No-till (since 20 years)
2. Methanization (10 years ago)
3. Photovoltaic
4. Drying of protein fodder
5. Investments for animal welfare (mats, water mattresses)
6. Scraping blade instead of flushing
7. Feeding optimization

3. Which mitigation measures are planned to be implemented and how?

1. Synergy with a data center: payment for the supply of renewable energy by the farm to power/cool the data center + recycling of the heat produced by the data center for drying on the farm
2. The farmers consider they are at the end of what they could do to mitigate their environmental impacts

4. Expected effects on emissions (based on tool calculations, see attachment)

1. Measure 1: ....
   .....
   ......
2. Measure 2: ....
   .....
   .....
3. Measure 3: .....
   .....
   .....

5. Equipment involved; Investment and economics?

1. ....
2. ....
3. ....

Economics:

6. Attention points when implementing measures

1. ......
2. ....

7. Quote of farmer:

"Doing projects to get out of our comfort zone and keep the pleasure of working: it's in our DNA! "

"Nitrogen efficiency is 60 to 70% compared to 30% before methanization; the organic matter of our soils has increased by 1 to 1.5 points"

"Be careful not to go at the expense of dairy performance"

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Figure 15 : WP3.1 – Farm leaflet – FR5

Farm plan reduction of emissions — Dairy farmer: Farm 6

1. Description of farmers' future strategy on development of farm and reduction of emissions

It is the first time that this farm participates in an experimental study. However, the farm manager is very involved in the livestock union world. In 2021, the producers set up methanization to ensure the transmission of a perennial system to their children. Although he declares that he has not made any changes on his farm specifically to reduce GHGs or increase carbon sequestration, he nevertheless limits ploughing by stopping it on 95% of his land, except in the case of grassland reversal or of a major problem with plot fouling. He adopted the no-till practice to simplify the work and reduce fuel costs. A new building, designed for the comfort and well-being of the animals, has just been built. It is equipped with mats separating urine from feces, with a scraping every 2 hours, and have an optimal ventilation. In view of all these recent innovations, no further changes are planned for the time being, as the producers would first like to gain some hindsight on the investments made.

2. Which mitigation measures / practices were already taken?

1. Construction of a new building
2. Implementation of methanization (fall 2021)
3. Limited ploughing (95% of the surface in no-till)
4. Effluent separator mat and scraping every 2 hours
5. Optimal ventilation of the building

3. Which mitigation measures are planned to be implemented and how?

1. No new measures planned, as many measures have been implemented recently and the producers want to see the effects of these investments first

4. Expected effects on emissions (based on tool calculations, see attachment)

1. Measure 1: ....
   .....
   ......
2. Measure 2: ....
   .....
   .....
3. Measure 3: .....
   .....
   .....

5. Equipment involved; Investment and economics?

1. ....
2. ....
3. ....

Economics:

6. Attention points when implementing measures

1. ......
2. ....

7. Quote of farmer:

"We were tired of producing milk so cheaply (less than a liter of water!), we wanted to pass on a sustainable system to our children; without methanization, we would have stopped milk."

"8 times out of 10 we make our choices for the survival of the farm, before conviction"

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Figure 16 : WP3.1 – Farm leaflet – FR6

Farm plan reduction of emissions | **Dairy farmer: Farm 7**

1. Description of farmers' future strategy on development of farm and reduction of emissions

It is an organic farm which obtained the "High Environmental Value" (HEV) standard as well. It is also an educational farm with the possibility to receive large groups of people (60 beds). The main changes on the farm began in June 2019 with the installation of the botherhood. The farm expanded from 117 ha to 159 ha to be able to be independent in terms fodder production. The old building, too small, and not well located (heart of the village) was abandoned. The new building has been converted to a composted bedded pack barn based on miscanthus in order to optimize the animal's well-being and to limit the laboriousness of the work. The changes planned for the future are to increase the protein autonomy on the farm (currently around 70%), in order to adapt to the new obligations of the dairy sector for 2023 (the 100% French milk label obtention will notably be based on the origin of the nitrogenous corrector used). The producers also wish to invest in a sorter for the sale crop (faba bean) and to set up the cultivation of miscanthus (strong absorbent litter capabilities). A few years ago, methanization was considered in order to reduce GHG emissions. But this idea was abandoned because it was too expensive, not adapted to the farm, and considered to be too uncertain about the quality of the digesta to feed the soil.

2. Which mitigation measures / practices were already taken?

1. Organic farm
2. New building with composted bedded pack based on miscanthus
3. Animals - permanent grazing

3. Which mitigation measures are planned to be implemented and how?

1. Increase the protein crop cultivation to increase and reach the protein autonomy on the farm
2. Cultivating miscanthus for the composted bedded pack barn

4. Expected effects on emissions (based on tool calculations, see attachment)

1. Measure 1: ....
   .....
   ......
2. Measure 2: ....
   .....
   .....
3. Measure 3: .....
   .....
   .....

5. Equipment involved; Investment and economics?

1. ....
2. ....
3. ....

Economics:

6. Attention points when implementing measures

1. ......
2. ....

7. Quote of farmer:

"Climate change requires crop adaptation".

"What would be very good for a better management of rotations would be to develop plot exchanges between farmers"

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Figure 17 : WP3.1 – Farm leaflet – FR7

Farm plan reduction of emissions **Dairy farmer: Farm 8**

1. Description of farmers' future strategy on development of farm and reduction of emissions

The farmer is an elected official who is very involved in local agricultural life and the world of research. The farm participates in various projects, notably on the selection of more sustainable and environmentally friendly breeds and follows the Ecophyto plan for crop cultivations (minimal use of pesticides). Milk is qualified as being non-GMO. Recently, the farm has undergone several changes: raising beef cattle (to carry on trials), developing broiler productions (for educational purposes) and replacing rapeseed with cereals (rapeseed is considered to be too demanding in energy). Temporary grasslands with legumes have been set up in order to increase the protein value of the animal ration and for carbon sequestration purpose. In the next 5 years the farmer wants to limit GHG and ammonia emissions while increasing carbon sequestration. They will therefore choose the best practices based on the results of the ongoing trials, especially those on spreading methods, and will implement them considering both the economical value and the environmental gain.

2. Which mitigation measures / practices were already taken?

1. Involved in the Ecophyto plan (minimal use of pesticides) and in environmental research projects (nitrogen emission assessment associated to the type and period of spreading)
2. Replacement of rapeseed by cereals (in order to lower the energy demand)
3. New temporary grassland based on legumes have been created

3. Which mitigation measures are planned to be implemented and how?

1. Modification of the spreading methods (type, period) according to the results of the current trials and possibly :
   - the use of drope-pipes and
   - burring liquid manure right after spreading

4. Expected effects on emissions (based on tool calculations, see attachment)

1. Measure 1: ....
   .....
   ......
2. Measure 2: ....
   .....
   .....
3. Measure 3: .....
   .....
   .....

5. Equipment involved; Investment and economics?

1. ....
2. ....
3. ....

Economics:

6. Attention points when implementing measures

1. ......
2. ....

7. Quote of farmer:

"Farmers should no longer be seen by all (politicians and consumers) as polluters"

farming

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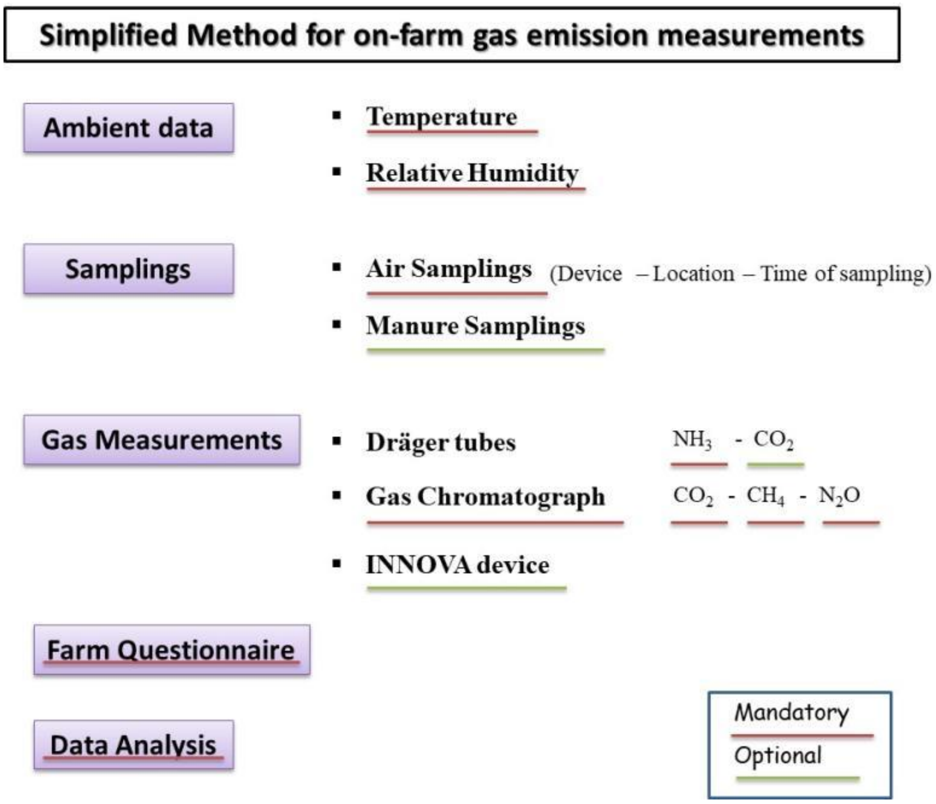
FACCE ERA-GAS ERA-NET SUSAN ICT AGRI era-net

Figure 18 : WP3.1 – Farm leaflet – FR8

5. Gas measurement protocol with the Simplified Method

Protocol for measuring greenhouse gas and ammonia emissions in cattle buildings

Visual Summary



Introduction

A simplified method has been developed in France (Ponchant *et al.*, 2008) to make gas emissions measurements in different housing systems for cattle easier. In France, cattle buildings are generally ventilated naturally which makes the air flow rate difficult to estimate. With this simplified method these calculations are not necessary anymore.

The objective of this method is to make measurements easy to carry out in commercial cattle housing. It allows estimating emission of farms depending on the type of housing and farmers practices.

The types of cattle housing are very diverse due to differences in ventilation, size of barn, animal types, type and quantity of litter, scrapping frequency, etc.

It was not possible to provide a document which would be adapted to all situations. Therefore, we decided to present the use of this simplified method in a general way. This means that you may have to adapt some of the steps to the specificities of your farms.

This document presents:

- 1- How to do the measurements
- 2- How to report the farm results and to do the calculations
- 3- Annexes with complementary details

Protocol used for air sampling and measurements

A factsheet presenting the equipment needed for measurements, and their use in farms as well as the farm questionnaire, are available in the Annexes.

Temperature and hygrometry

To be able to interpret the evolution of the gas concentrations as a function of climate, temperature and hygrometry inside and outside the building at the time measurements must be known. at least, two thermo-hygrometers (Voltcraft® DL-140TH/Datalogger - Figure 19 or similar recording sensors) are installed in areas representative of the indoor and outdoor environment during the gas measurements (no direct sunlight, no windy areas - must be unreachable by animal, 1 m above ground and 1 m apart from walls or openings) . It is recommended to allow at least 20 minutes for the sensor to be stabilized, plus at least 15 minutes of useful measurements. The measurement of the three parameters (Temperature, Dew Point and Relative Humidity) is carried out every 30 seconds after activation of the thermo-hygrometers. The data will be downloaded using the Datalogger® software and stored in an Excel format (Figure 20).

Figure 19 : Thermo-Hygrometer Voltcraft® DL-140TH/Datalogger

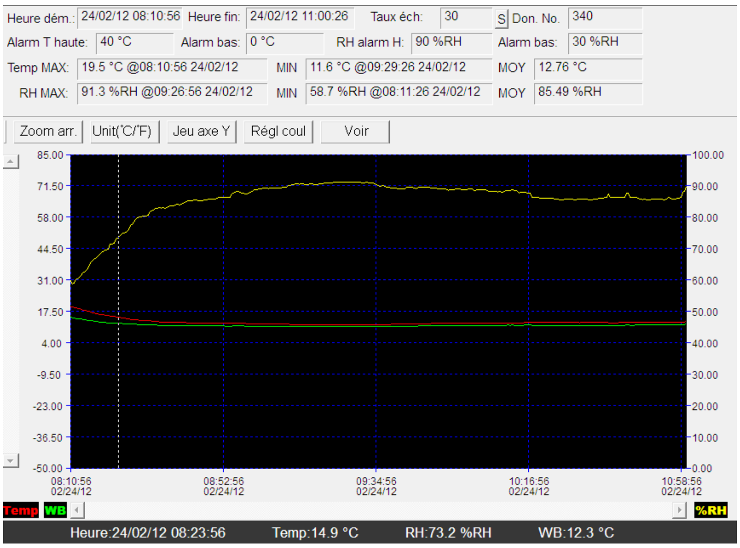


Figure 20 : Example of temperature and humidity data collected (VoltSoft®)

Figure 21: Example of thermo-hygrometer locations in the Derval experimental farm

Air sampling : location and management

1.1.1 Position of measurements

Different strategies can be used to do air sampling when different animals category are inside housings:

- With dairy cows mainly: focus your air sampling in the area occupied by the cows.
- If other animal categories are well represented circulate where all the animals are.

1.1.2 Air sampling management

Two air samples are done at the farms, representative of the outdoor and indoor environments. A minimum of 10 minutes of air sampling[1] must be carried out using a vacuum chamber, an air pump (SKC brand) with low flow rate and a 10 liter FlexFoil® bag, sealed and designed for gas sampling. The non-absorbent, resistant and inert plastic and the sealed valve make them appropriate to keep the gases before being analysed..The analyses of gas concentration of the sampling bags will be done: (i) at the farm with Dräger tubes for ammonia (NH_3) and carbon dioxide (CO_2 – not mandatory), (ii) in laboratory (EnVisaGes lab) from the glass tubes sent and for the main agricultural greenhouse gas (CO_2, CH_4, N_2O). The procedure will be explained later in this document.

The FlexFoil® bag is placed in an easily transportable vacuum chamber. The air pumped (Figure 23 and Figure 22) creates a pressure difference, the bag is then filled with air through the hose fixed on a 2m stick. The FlexFoil® bag must be filled with a minimum of 2.5 liters in order to be able to do about 20 gas concentration measurements. To avoid any risk of clogging of the sampling system or the introduction of dust in the bag, membrane and fiberglass filters are located at the air inlet of the pump and at the air inlet before the sampling bag respectively. To connect all the components of the sampling system, TYGON® hoses (flexible plastic that does not absorb gases) are used (Figure 5).

Figure 22 : Air Pump

Figure 23 : FlexFoil ® bag installed in the vacuum chamber

[1] The sampling duration may vary (15-25 minutes) to make sure that bags are well filled. The operator must therefore record the sampling duration of each sample.

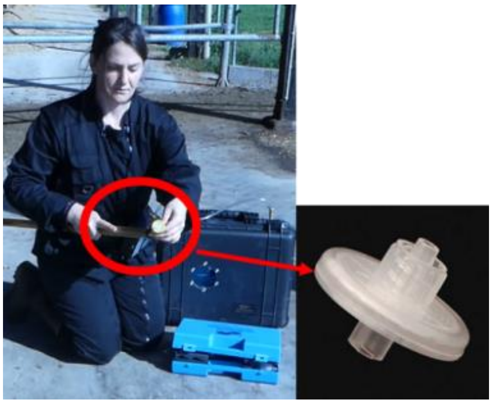


Figure 24 : Example of filter that is installed on the stock to avoid dust entering into the bag

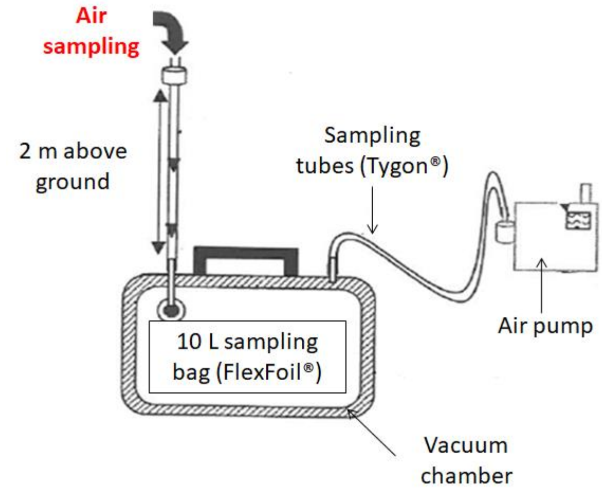


Figure 25 : Diagram of the sampling equipment assembly with vacuum chamber and air pump (Source: Aude Brachet, 2007)

Due to the cost of the sampling material (bags and tubes), the bags are reused from one farm to another. Two different bags are used on one farm and then rinsed with clean air (or industrial nitrogen in pressurized bottles) using a small aquarium air pump or a laboratory vacuum pump.

The **outdoor air sampling** (Figure 6) is carried out by circulating, if possible, all around the building, at a distance of 5 to 10 meters, avoiding as far as possible the emission zones which could biased the measurements (manure, pit, working farm machinery, other emitting buildings, etc.). It is possible to use a GPS for path registration but it is not necessary for the calculations.

The **indoor sampling** (Figure 7) is done by circulating lengthwise in the different parts of the building where are the dairy cows at the time of measurement, trying to be as representative as possible of the soiled surfaces (40% of the droppings on the lying area and 60% on the feeding area for dairy cow buildings). Therefore, in order for the experimenter to have time to sample all areas of the building, the air flow rate of the pump must be set at a low and constant value (0.2 to 1l/minute).

Figure 7: Indoor air sampling

Both samples are taken at a height of 2m to avoid direct influences from animals and litter. Also, the temperature, humidity and ventilation conditions are fluctuant around walls so it is a good practice to keep a distance of 2 meters from the walls. In spite of all the precautions taken, walking inside the building is not always easy (cows may be agitated or badly distributed in the building, automatic scraping in progress, etc...), that is why it is important to note all incidents or phenomena occurring while measuring for better in[illegible]ults.

The time of sampling must take several criteria into account (animal population, feeding phase, climatic conditions).

The measurement should, indeed, be carried out about 1 to 2 hours after the morning feeding distribution in order to avoid the effect of feeding on CH_4 and also NH_3 emissions.

If you want to do measurements in 2 farms the same day then it is recommended to always do the measurements at the same time of the day (ex: Farm A, between 1 and 2h after feeding in the morning and Farm B, 1 to 2h before feeding in the afternoon). Doing so, the changes in emissions will be due to the changes of the farm practices and not to the time of measurements.

During the grazing period, the measurement in the barn must be done at least 1 hour after the animals have returned in the barn which means that the feeding phase is not considered in this case.

Figure 6: Outdoor air sampling

The **climatic conditions** (rain, fog, wind…) should also be reported the day of measurements (reported in the questionnaire). On very windy days, measurements should be avoided, because strong air circulation in the building has a direct influence on the gas concentration gradients.

Farm questionnaire

In order to complete the measurements carried out on the farm before carrying out the emission calculations and to facilitate the interpretation of the results, a farmer questionnaire was developed (Annex 2). It is divided into several parts: the first part gathers general information to identify the typology of the farm; a second part concerns the building where the measurements are carried out (living area surfaces, materials, orientation of the building with respect to the wind, etc.); finally, the third part gathers information to help calculate the mass balances (straw rate, milk quantity and composition, average stage of lactation, average weight, feed ration, etc.).

A series of photos of the building and its environment is also useful for a good memorization of the conditions of the measurement (conformation of the building, number and categories of animals present, surface accessible to the animals present, presence of a manure/pit in the building or nearby, etc.).

Gas sampling and measurement

1.1.3 On-farm air sample analysis (Dräger tubes – NH_3)

After filling in the Flexfoil® bags inside and outside the barn, you will measure the NH_3 concentration with Dräger tubes.

1- Break the two ends of the tube,

2- Insert the tube into the pump; the arrow must be directed toward the pump,

3- Connect the other end of the tube to the bag with flexible tubing and open the sampling bag (unscrew the valve),

4- Use the hand pump Empty completely the bellow; the circular indicator turns black; wait enough so that the bellows is completely unfolded (pressure indicator turns back white). The number of strokes must be the one indicated on the tube (depending on pump models, you can read the number of stroke directly on the pump),

5- Disconnect the tube from the sampling bag and screw the valve,

6- Concentration is read on the graduated scale printed on the tube.

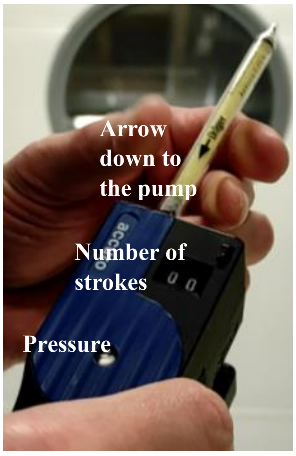


Figure 8: Dräger tube inserted into the hand pump

7- If the concentration read is at the lowest level of gas detection of the chosen tube (close to the first graduation) or if you want increase the reading accuracy of the measurement, you can reconnect the tube to the sampling bag and do the same operation again. Doing so, you will have to divide the resulting concentration by 2.

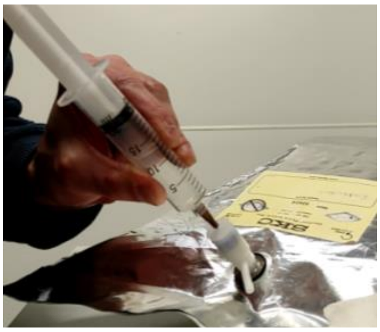
Figure 8: Dräger tube (detail)

Figure 9: Dräger tube connected to the Flexfoil® bag (detail)

1.1.4 Air sample to be sent for analysis (GC-glass tubes – GHG)

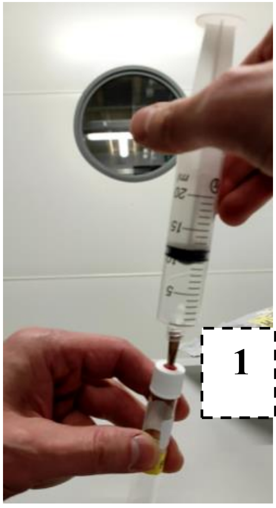
1- Use the 30ml syringe (if you receive the 20ml and the 50ml only then use the 20ml one and overfill it, that is: suck the air more than the 20ml level) to collect the air from the bag.

<u>Note</u>: for the needle use the brown one ONLY! Because the other ones are too wide and would damage the septum) Also, push gently but firmly and STRAIGHT otherwise you will break the needle.



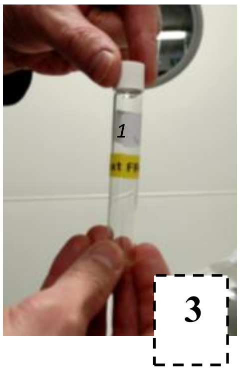
<u>Figure 10 :</u> Air sampling from the Flexfoil® bag

2- Insert the syringe through the cap. The syringe plunger must go down without applying any pressure. If it is not the case, it means that it was not correctly emptied. Then replace it.



3- Then empty <u>completely</u> the syringe (you will feel a resistance. It is normal since we need to have an overpressure in the tube – cf.video)

4- Label the tube for GC analysis with your farm code and add a unique number to ease the referencing and future checking if necessary.



<u>Figure 11 :</u> Air sampling into the tubes

5- Clean the syringe (fill it completely then empty it) three times.

6- Send the samples to :

Anne-Sophie Lissy
INRAE Transfer EnVisaGES - Bâtiment de Bioclimatologie
Route de la Ferme
78850 Thiverval-Grignon
FRANCE
(Tel: +33.7.76.60.82.58)

Note: The tubes can be stored (not more than a month) at room temperature and away from light (do not store behind a window).

For more detail <u>watch the video</u> (from the 10min 15sec duration)

Methodology for data processing

For calculating the on-farm gas emissions, the proposed method is based on the comparison of gas gradient concentrations and on the mass balance approach at the building scale. Idele / INRAE will provide the Excel calculation file so that each partner will be able to estimate the emissions based on the gas concentrations measured at their farms.

Emission calculations at the building scale using gas gradient concentrations and the mass balance approach (Paillat et al, 2005)

1.1.5 Gas gradient concentration

Equation for calculating emissions from the air flow and gas concentrations:

$$Gas\ Emissions = Q_{air} * \rho i * Gas\ gradient \qquad \text{Equation 1}$$

Where:

Q_{air} : is the air flow rate, and

ρi : air density

The gas gradient concentrations will be measured in farms:

$$Gas\ gradient = (Cgas_{int} - Cgas_{ext}) \qquad \text{Equation 2}$$

The unknown left is: $Qair * \rho i$

The "Simplified Method" was built to find a way to simplify the gas emission calculations so that it becomes possible to avoid the estimation of the air flow rate and air density in the building. To do so this unknown was assimilate to a single coefficient "a": $a = Qair * \rho$i.

The resulting simplified equation is applicable to all the gases studied and this coefficient can be estimated as follows:

$$a = \frac{EC-CO2}{GradientC-CO2} \qquad \text{Equation 3}$$

or

$$a = \frac{EC-CH4}{GradientC-CH4} \qquad \text{Equation 4}$$

or

$$a = \frac{EN-NH3}{GradientN-NH3} \qquad \text{Equation 5}$$

or

$$a = \frac{EN-N2O}{GradientN-N2O} \qquad \text{Equation 6}$$

Where: EC and EN are the carbon and nitrogen emissions respectively.

From equations 3 and 4:

$$\frac{EC-CO2}{GradientC-CO2} = \frac{EC-CH4}{GradientC-CH4}$$ Equation 7

then

$$EC\text{-}CH4 = \frac{EC-CO2 \ x \ \ Gradient \ C-CH4}{GradientC-CO2}$$ Equation 8

Each gas can also be compared to CO_2 using the same way and one comes up to the following equations:

$$EN\text{-}NH3 = \frac{EC-CO2 \ x \ \ Gradient \ N-NH3}{GradientC-CO2}$$ Equation 9

and

$$EC\text{-}N2O = \frac{EC-CO2 \ x \ \ Gradient \ N-N2O}{GradientC-CO2}$$ Equation 10

1.1.6 Mass balance approach[2]

Within the framework of the Simplified Method, losses may be assimilated to gases getting out of the building in the form of carbon (CO_2 and CH_4) and nitrogen (NH_3, N_2O) elements (cf. Fig 12).

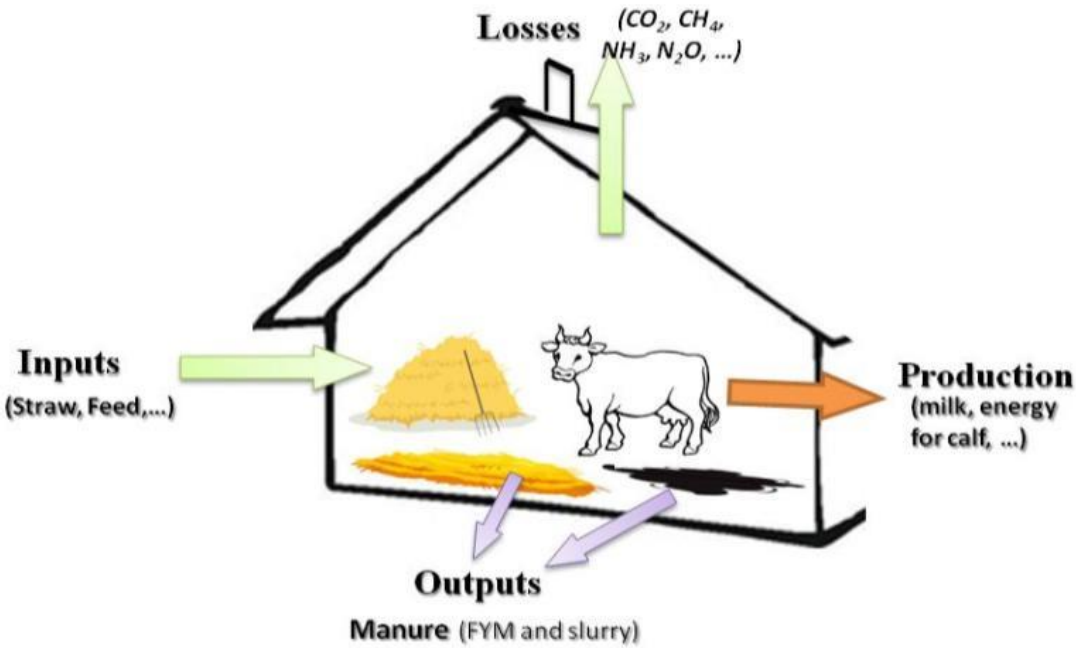


Figure 12 : Input/output balance in livestock buildings

[2] : For more information concerning this mass balance approach and the link with the questionnaire where several data needed for these calculations are collected, see the annex 3.

Carbon and nitrogen losses can then be calculated as follows:

$$C\ Losses = E_{C\text{-}CO2} + E_{C\text{-}CH4} \quad \text{Equation 11}$$

$$N\ Losses = E_{N\text{-}NH3} + E_{N\text{-}N2O} \quad \text{Equation 12}$$

Losses can also be estimated by the difference between the inputs (feed, straw) and outputs (production and waste). Therefore:

$$C\ Losses = C_{Ingested} + C_{litter} - C_{milk} - C_{Growth} - C_{gestation} - C_{Mobilization} - C_{Excretion} \quad \text{Equation 13}$$

$$N\ Losses = N_{Ingested} + N_{litter} - N_{milk} - N_{growth} - N_{gestation} - N_{Mobilization} - N_{Excretion} \quad \text{Equation 14}$$

1.1.7 Combination of the as gradient concentration and mass balance approaches

Combining the equations 11 and 8:

$$C\ Losses = E_{C\text{-}CO2} + \frac{EC-CO2\ x\ \ Gradient\ C-CH4}{GradientC-CO2}$$

$$C\ Losses = E_{C\text{-}CO2}\ \ x\ (1 + \frac{Gradient\ C-CH4}{GradientC-CO2})$$

$$E_{C\text{-}CO2} = \frac{C\ Losses}{(1 + \frac{Gradient\ C-CH4}{GradientC-CO2})}$$

Using the equation 13:

$$E_{C\text{-}CO2} = \frac{(C_{feed} + C_{litter} - C_{milk} - C_{Growth} - C_{gestation} - C_{Mobilization} - C_{Excretion})}{(1 + \frac{Gradient\ C-CH4}{GradientC-CO2})}$$

With the farm questionnaire, C Losses can be estimated, and the gradient of C-CH_4 and C-CO_2 are measured. Therefore, EC-CO_2 can be calculated.

Once EC-CO_2 estimated, EC-CH_4, EC-NH_3 and EC-N_2O can be calculated using the equations 8, 9 and 10 respectively.

Note that calculations need specific C and N contents for estimating losses adequately. Currently default data are based on the French situation. They are described in the next section. For better precision, each partner can adapt them using country specific data.

Limitations associated to the use of the simplified method

Limitations of the sampling time

The Simplified Method is based on farm gas samples carried out during 15 to 20 minutes on a specific season. This could therefore raise the question of the temporal representativeness of the measurements whether for the day of for the season.

To avoid the underestimation of the CH_4 and NH_3 emissions, it was recommended that measurements would be taken in the middle of the day (Brachet A., 2007). However, during the grazing period, the operator must carry out the measurement when cows are in the barn, and so generally between the morning milking and the following grazing. Measurements during periods when animals are partially inside are not recommended for these tests.

In order to validate the adaptability of this method, the emission decrease after the exit of the animals and the way in which the elements of the carbon balance are distributed according to the presence of the animals, should be studied more specifically.

Currently, the most robust method is to calculate emissions proportionally of the time of presence in the building. But this may not fully account for the real distributions of droppings on living areas that are modified according to the attendance time of cows in the building.

The same issue can be found for buildings with bedded pack barn. It would then be good, as much as possible, to perform 3 air samplings and measurements: the 1st week of accumulation, in the middle of accumulation and during the last week of accumulation.

Also, if measurements are carried out three days in a row in the same building, the farmer's practices should not be different and, it would then be possible to evaluate the impact of other parameters than the farmer's ones, such as the climatic conditions.

Finally, farm practices in building change over seasons. Therefore, it would be best to do on-farm measurements at different times of the year to account for this variability.

Overall, it is therefore recommended to perform multiple measurements in the same farm to obtain results as representative as possible of the period of measurements. But these numerous samplings are not always possible.

Limitations of the sampling locations

The method may also have limitations associated to the spatial variability of gas emissions in buildings. The inside and outside gas sampling could be influenced by the experimenter's pathway. For instance, it is sometimes not possible to go around the building, so the experimenter has to go back and forth in a limited zone. Also, if this pathway corresponds to a start or end zone of ventilation, this may influence the gradient of gas concentration. For the experimenter, the main concern is to make sure that the air samples are as representative of the sampling environment (inside or outside) as possible.

Limitations of the analyzing method

If using the INNOVA analyzer, the way the gas analyzer is configured is a key element which must be well evaluated to avoid interferences between the different gases studied. If the rations/filters are in the building or close to it at the time of the measurements, a specific configuration of the INNOVA® analyzer (addition of a filter avoiding interference between volatile compounds and ammonia) or the use of a very selective concentration measurement technique, are strongly recommended.

Limitations of the calculation method

With the building mass balance method, there may be a slight overestimation of CO_2, CH_4, NH_3, N_2O emissions as carbon and nitrogen may escape in the forms such as N_2. Moreover, the calculation is based on a number of equations that were not fully validated (Maxin model).

Strengths of the "Simplified Method"

Every method has its own limitations and strengths. This method is no exception. In our case, there are a number of factors that could influence the final result but they can also be lowered by collecting on-farm information as precisely as possible through the farm questionnaire.

But, on the other side, this method is very robust and powerful. It shows many strengths and among them:

- Easy on-farm implementation
- Quick measurements (about 2h in farms)
- Not expensive
- No need of strong expertise
- Protocol easy to follow
- Can be implemented several times a year depending on the objective
- Can be applied on different systems
- Enable to compare systems

Technical memo sheet for the course of a measurement day

To be prepared before:

- Order the agronomic analyses (to obtain the bottles and sample bags)
- Print the farmer questionnaires and the gas concentration record sheets.
- Prepare all material (rinse the FlexFoil® bags, *check the analyzer – if you use one*)
- *Start the analyzer (INNOVA) at least 4 hours in advance (in a room at about 20°C).*

Working list:

- Gas Measurements :
  - 2 Thermo-hygrometers
  - Computer with Datalogger® software or CD driver for installation of thermo-hygrometers
  - 2 FlexFoil bags per farm (indoor and outdoor samplings)
  - Vacuum chamber (suitcase)
  - Air pump
  - Belt (to hang up the pump)
  - Stick, about 2 m high
  - Tygon tube: from the vacuum chamber to the sampling point
  - Tygon tube + filter: from vacuum chamber to FlexFoil bag
  - Tygon tube: from the vacuum chamber to the pump
  - Vacuum or SKC pump or industrial bottle of Nitrogen gas (for rinsing the FlexFoil bags)
  - Power bars and extension electrical cords
  - *Gas analyzer – if you use one (with water-stop)*

- Excreta sampling
  (not mandatory but may need to be done if you estimate that the default values from French studies would not be appropriate to your country specific situation):
  - Bottles and sample bags
  - A large garbage bin or large black tarp (to mix the manure and homogenize the samplings)
  - Plastic gloves
  - Black markers
  - Garbage bags
  - Boots
  - Cooler (sample transportation)

To do on the farm:

- Setting all thermo-hygrometers first to allow the measurements to stabilize before doing the air sampling. Avoid direct sun and keep them unreachable to the animals.
- Carry out the indoor and outdoor air samplings (preferably 1 to 2 hours after the morning feeding distribution and 2 hours after the dairy cows enter the building).
- Fill out the questionnaire with the breeder
- Count the animals present
- *Carry out and label a manure sampling (representative of what is produced in the building)*

Back in laboratory:

- Analyze the air sampling from the indoor and outdoor bags
- Gas concentrations stored in an Excel file for future calculations
- *Freeze the manure samples – if samplings have been done*

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MINISTÈRE
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L'ALIMENTATION

ADEME

Agence de l'Environnement
et de la Maîtrise de l'Energie

6. Farm questionnaire

Farm Questionnaire - Simplified GHG measurements in buildings

Farm code :

Date of measurements: / /

Time of measurements: ____________________

Meteorological conditions ____________________

the day of measurements (rain, wind - strength and direction; fog , etc. – Photo can help)

SECTION I – Farm Operation – general information

SECTION II – Building and animal data

A. ***Building plan***
B. ***Herd management***
C. ***Floor information / bedding material management***
D. ***Manure management***

SECTION III - Not mandatory but interesting for final interpretations

SECTION I – Farm Operation – general information

1) **Number of buildings and type of housing (1 = main building with lactating cows)**

Building n°	Type of housing
1	
2	
3	

4	

2) Number of animals (the day of the measurement); animals may be in two buildings or on pasture

Animals categories	Building (n°)	Number	Building (n°)	Number	Pasture	Number
Lactating Dairy Cow						
Dairy Cows (dry/cull)						
Youngstock 2-3 years old						
Youngstock 1-2 years old						
Youngstock 6 months - 1yr						
Female calves <6 months						
Male calves < 6 months						
Steers (castrated - slaughtered at 18-26mth)						
Bulls (slaughtered at 3yrs)						
Suckler cows						
Breeding males						

3. How are the cows housed? (check the boxes on the right - more than one can be crossed)

TIE-STALL	Liquid manure = Slurry	❑
	Solid Manure (liquid separated)	❑
CUBICLE housing	Slatted floor	❑
	Scraping alley (slurry) covered exercise / walking area	❑
	Scraping alley (slurry) uncovered exercise / walking area	❑
	Scraping alley (solid manure; urine separated) covered exercise / walking area	❑
	Scraping alley (solid manure; urine separated) uncovered exercise / walking alley	❑
Bedded Pack / Deep straw area (Solid manure)	Complete bedding place	❑
	with Slatted alley	❑
	with Scraping alley (slurry)	❑
	with Scraping alley (solid manure; urine separated)	❑
	Uncovered exercise / walking area	❑
SLOPING Straw Floor (Slurry)	Covered exercise / walking area	❑
	Uncovered exercise / walking area	❑
OTHER housing (to be adapted to regional specificities)		❑

4) Building areas for dairy animals? (To be filled in if the plans –cf. next section– do not allow calculating them and if several type of areas can be identified)

AREA (m²)	**Cows**	**Other** (which?) :	**Other** (which?) :
Resting area			
Walking area, including feeding alley			
Feed corridor (where farmer transports the feeds to cows)			
Waiting area for milking			
Other : _____________			

SECTION II – Building and animal data where the measurements are done

A. Building plan

5) **Floor plan main building** (length, width of the building and for each animal category area / pen); copy the building plan or sketch it – also locate the feed and manure storages; also indicate direction of the long side of building, using N / W / S / E as coordinates

6) **Sectional view including height** (specify openings and their dimensions)

7) Is there mechanical ventilation in main building?

No

If yes, air flow? ....(m^3/hour); number of ventilators/fans .....; where ....

8) **Are there other buildings close to the main building where the measurements are done? (within 40m) ? Yes / No**

If yes, are they in the wind plume / wind direction towards the main building on day of measurement ....

B. Herd management

9) How many cows and other animals are housed in the main building? (see question 2)

("Commonly observed": to be filled in if the situation in general in the same season – *winter, spring, summer, fall, grazing period* – is different from the one of the day of measurement)

	The day of measurement		**Commonly observed in this season (if different)**	
	Number	**Occupied area**	**Number**	**Occupied area**
Cows				
Youngstock 2-3 yr				
Younstock 1-2 years				
Youngstock ½ - 1 yr				
Calves				
Breeding males				

10) When are the cows present in this barn? (3 options)

	1- Permanent housing	**2- Permanent grazing**	**3- Grazing or exercise outside in combination with housing**
The day of measurement	❑	❑	**From ________h to ________h (and from ________h to ________h)** **Last return from grazing / outside exercise was at __________ hour**
Commonly observed during this season	❑	❑	**From ________h to ________h (and from ________h to ________h)** **Last return from grazing / outside exercise was at __________ hour**

11) What is the lactation stage of the dairy cows?

	Average duration since calving (days)
The day of measurement	
Commonly observed during this season	

12) What is the average production and milk composition of the cows in this building?

	Average cow production (l/day)	**Average Fat (g/l)**	**Average Protein (g/l)**	**Urea (mg/l)**
The day of measurement				
Commonly observed during this season				

13) **What is the average weight of the cows in this building?**

	Average weight of cows
The day of measurement	
Commonly observed during this season	

14) **At what time before visit was feed distributed in the building?**

	Feed distribution (time of day)
The day of measurement	
Commonly observed during this season	

15) **What feed is distributed to the lactating cows in this building?** (kg/cow - specify if the answer is: **dry or wet matter**) – Note: only quantities are reported here

	Feed					
	Forages		Concentrates		Minerals	
	Pen 1	Pen 2	Pen 1	Pen 2	Pen 1	Pen 2
The day of measurement	(kg)	(kg)	(kg)	(kg)	(kg)	(kg)
Commonly observed during this season Starting the……. Ending the…...…						

16) **What feed is distributed to the dry cows in this building, if any?** (kg/cow - specify if the answer is: dry or wet matter) – Note: only quantities are reported here

	Feed		
	Forages	Concentrates	Minerals
The day of measurement	(kg)	(kg)	(kg)
Commonly observed during this season (Starting the……..….. Ending the…...……….)	(kg)	(kg)	(kg)

17) **What feed is distributed to the youngstock in this building, if any?** (kg/animal - specify if the answer is: dry or wet matter) – Note: only quantities are reported here

	Feed		
	Forages	Concentrates	Minerals
The day of measurement	(kg)	(kg)	(kg)
Commonly observed during this season (Starting the……..….. Ending the…...……….)	(kg)	(kg)	(kg)

C) Floor information / bedding material management

18) **What bedding material is used?** wheat or barley straw, sawdust, wood chips, other : ………….

19) **For main building with cubicles**
    Material in cubicles (straw, sawdust, sand, mattress, …) …………….

20) **For main buildings with deep litter straw or composting bedded pack**
    How often is the bedding material removed? Per _____ days/weeks/months/year *(circle)*

21) **What is the age of the largest part of bedding material at the time of measurement?**
    Age : months______________ days_______________

22) **How much bedding material is brought into this main building (**under question 18 or 20)
    (kg/cow per day/week/month)? (circle)

For dairy cows: ....

For dry cows, if separated: ……………..

For young stock, if separated: ……………..

23) **Do you use additives (biological or physical product) in the building (floor, slurry)?**

Type____

Quantity____

Frequency of applications ____

24) **Type of floor: slatted; closed concrete, urine not separated; closed concrete, urine separated; artificial floor; etc.**

____

25) **Have the concrete floors been treated, like grooved? If yes, what type of treatment?**

____

26) **What is the slope of the floor in the walking alleys?**

No slope : ☐

Yes, …….......... (%)

D) Manure management

27) Manure type in this building? (Cross the corresponding boxes)

Type of waste	From		
	Resting area	Walking alley	Feeding alley
Solid Manure			
Slurry			
…………… ..			

***28)* What type of manure scraping do you use?** *(circle)*

No Scraping (go to Q29)

Scraping: V = butterfly; U = small blades; with machine; robot; flushing; ....

29) For scraping areas, how often are scrapings done? *(circle)*

(number) ________ hours / days / weeks

30) How do you store the wastes from the building (where measurements are done)? (more answers are possible)

Type of waste	**Storage structures**
Slurry	❑ Pit under slatted floor ❑ Uncovered outdoor tank / silo/ lagoon ❑ Fully covered outside tank / silo/ lagoon ❑ Other:_______________________________________ How often is slurry transported to outside storage and how? ……………………..……………………………
Solid Manure	❑ Accumulation on lying area (like in deep straw and bedded pack) ❑ Storage on the field ❑ Stockpile – no walls uncovered ❑ Stockpile – surrounded by walls uncovered ❑ Stockpile – covered (roof) ❑ Other:_______________________________________ How often is the manure / bedding material removed from lying area? .....………………………………………………………..

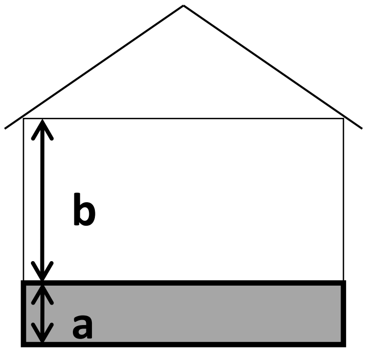
SECTION III - Not mandatory but interesting for final interpretations

(Can be collected through informal discussions or just observations)

31) What are the types of roofs and walls? (effects on indoor T° and Air movements)

Roofing: Insolated roof? Yes No (circle)

- ❏ Closed ridge
- ❏ Open ridge without windbreaks
- ❏ Open ridge with windbreaks
- ❏ Industrial roof with one straight slope
- ❏ Transparent / horticulture roof
- ❏ Other_______________________________



Side walls: - Height of solid walls (a):________________

- Permeable material height (b):___________________

- Type of permeable material (b) (estimate in meters if more than one type is used):

- ❏ Wooden cladding - Dimensions : ___x___ / spacing : ___
- ❏ Perforated sheet metal cladding / dimensions : ___x___ / perforation : ___
- ❏ Sheet metal cladding with louvers /dimensions : ___x___ / perforation : ___
- ❏ Plastic windbreak net or grid / dimensions : ___x___ / perforation : ___
- ❏ Other_______________________ / dimensions: ___x___ / perforation : ___

32) What type of drinker do you use (automatic, manually filled...)? Are there any leaks which could dilute the litter? (effect on manure / bedding characteristics)

____

____

Annexe1: Mass balance approaches

Mass balance at the building level

The carbon and nitrogen contents in the straw entering the building are estimated from the quantity of straw specified by the farmer and the reference straw composition (INRA, 2007).

The quantities of carbon and nitrogen in the wastes leaving the building are estimated from:

- references of excreta quantities according to the type of excreta and the type of housing (Tables 1 and 2).
- and analyses of on-site collected dejecta or reference analyses of the composition of dejecta leaving the building (Table 2).

Distribution of manure types by housing (LIFE Circular, 2001)[1].

%	Very compact manure	Compact manure	Soft manure	Liquid manure
Cubicles				
- Slurry scraped corridor cubicles	-	-	-	100
- Soft manure scraped corridor cubicles	-	-	100	-
Deep litter				
- Deep litter with scraped lane soft manure				
o Unemptied straw area accessible to cars.	40	-	60	-
o Unemptied straw area not accessible to cars.	-	-	100	-
o Emptied straw area not accessible to cars.	-	-	100	-
- Deep litter with scraped slurry lane				
o Unemptied straw area accessible to cars.	40	-	-	60
o Unemptied straw area not accessible to cars.	-	-	-	100
o Emptied straw area not accessible to cars.	-	-	-	100
- Deep litter with slatted floor lane				
o Unemptied straw area accessible to cars.	40	-	-	60
o Unemptied straw area not accessible to cars.	-	-	-	100
o Emptied straw area not accessible to cars.	-	-	-	100
Straw slope				
- Slope straw scraped lane soft manure (vendean system)	-	40	60	-

[1] : These references are based on main French barns and could be adapted to local conditions

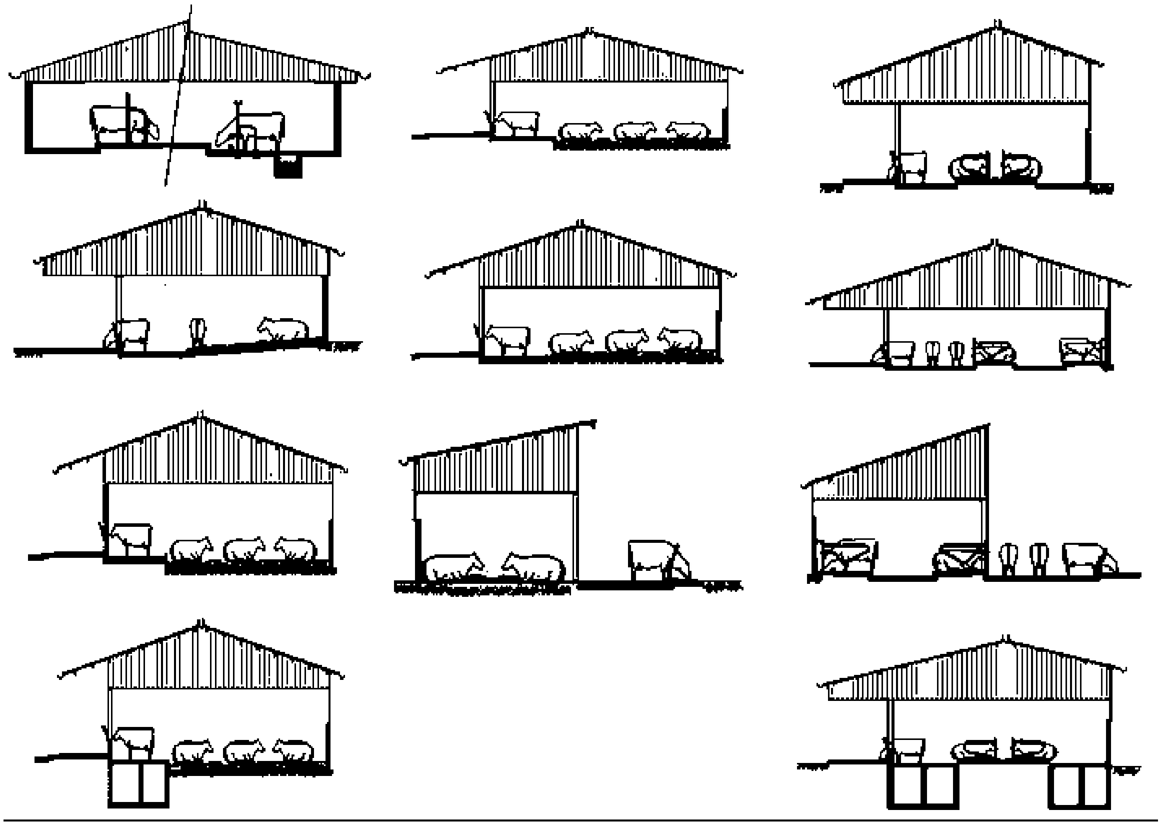


Figure 13 : Illustration of the French diversity of the cattle housings

Quantities and compositions of dairy cattle effluents (Bodet *et al.* , 2001)[1].

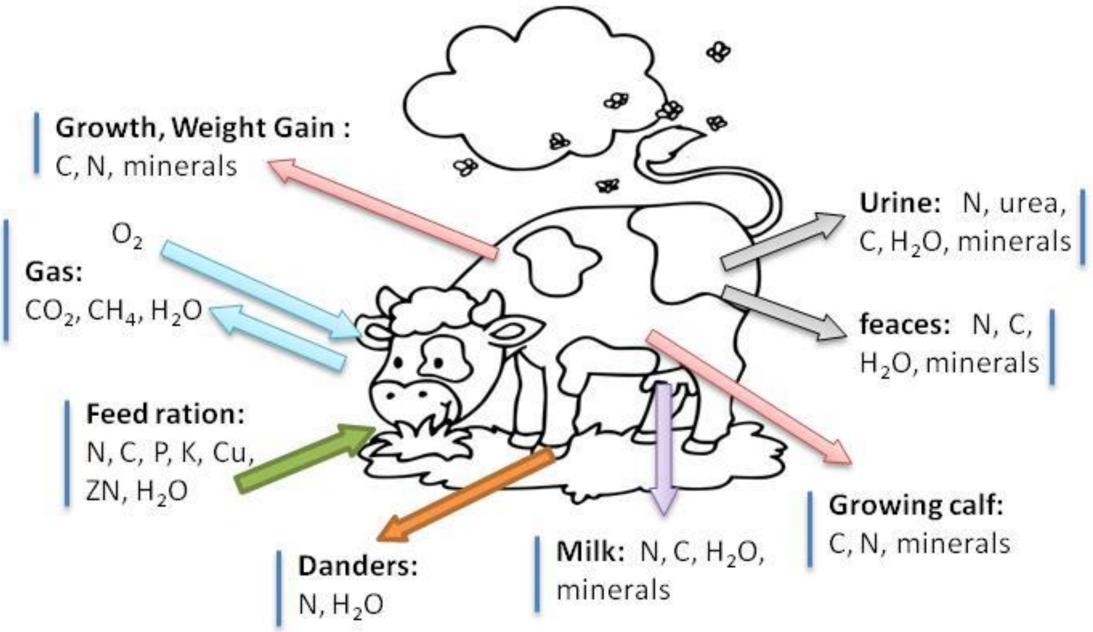
	Quantity produced	MS %	MO %	N g/kg	P2O5 g/kg	K2O g/kg
Liquid manure	60 L/LU/d	11,1	8,9	4	2	5
Very compact manure of accumulated litter	36.98 kg/LU/d	22,1	18	5,8	2,3	9,6
Compact manure from stanchion barn	41.09 kg/LU/d	18,5	15,2	5,3	1,7	7,1
Soft manure + FM slurry	56.44 kg/LU/d	16,4	13,0	4,7	2,0	6,1

[1] **: These references are based on main French barns and could be adapted to local conditions**

Mass balance at the animal level

For carbon and nitrogen quantities related to dairy cow intake and production, it is necessary to use mass balance models at the animal level. In this study, the Maxin-INRA (2006) model was used:

$$X_{ingested} = X_{milk} + X_{growth} + X_{gestation} + X_{mobilization} + X_{urine} + X_{feces} + X_{gas}$$



<u>Figure 14</u>: Mass balance at the animal level (after Maxin G., 2006)

Several animal and production data are then important to collect:

- the dry matter provided in the animal rations,
- the average animal age,
- the average daily weight gain (DWG)
- the average live weight,
- the milk quantity produced,
- the fat and protein milk content and
- the stage of gestation.

Some data will be set automatically in the calculator, such the average DWG which is set to zero for adult animals.

Annex 2: Manure sampling – (not mandatory for CCCFarming)

Recommendations for those performing manure samplings

Solid manure sampling

It is necessary to take samples from several places in the building due to the heterogeneity of the manure. Indeed, the composition of the manure is not the same according to the animal behavior (feeding, lying or drinking area), the rate and frequency of changing the beddings, feeding etc. Therefore, it is recommended to make 5 to 6 samplings over the entire thickness of the solid manure before mixing all of them. To get the most representative manure sample, ideally the sample should be first halved, leaving only a portion to be re-mixed and divided in half again. This operation is repeated until a sub-sample of 2 to 3 kg is obtained and placed in a 10 liter plastic bag.

This method can be done in the manure storage location, but has limitations when sampling is done in the building with animals around.

Liquid manure sampling

Samples can be taken in the slurry tank and preferably after being mixed. If it is not the case then it is better to sample close to where the tank is fed to be able to get the more recent manure. Note that for liquid manure composition variations are much smaller than for solid manure so reference values can be use.

Annex 3: Manure sample analyses – (not mandatory for CCCFarming)

Process and type of analyses

- All samples collected are frozen before being sent in batches to the analytical laboratory. Freezing the samples prevents any change in the composition of the effluent between the time of sampling and the time of analysis.

- The samples (2 to 3 kg) are dried, finely crushed and sieved at 2mm in order to obtain a homogeneous mixture for the following analyses:

  - Dry Matter (DM) content: gravimetry (NF EN ISO 13040 (U44-306))
  - Mineral Materials (MM) : gravimetry (NF EN ISO 13039 (U44-304))
  - Organic Matter (OM) content: calculation (=DM-MM) (NF EN ISO 13039 (U44-304))
  - Organic carbon content: calculation (=OM/2)
  - Total nitrogen content: modified Kjeldahl method (NF EN 13654-1 (U44-310-1))
  - The C/N ratio: calculation
  - Ammonia nitrogen content: distillation
  - Total phosphorus : ICP (NF EN ISO 13650 (U44-302))
  - Total potassium: ICP (NF EN ISO 13650 (U44-302))
  - Density: gravimetry

Annex 4: Gas measurement with the INNOVA® analyzer (not mandatory for CCCFarming)

Gas concentrations can be measured with the INNOVA® 1412 gas analyzer. This analyzer is a photo-acoustic infrared spectrometer capable of measuring several gases simultaneously (Figure 12).

If you are able to use this type of analyzer in your institute, the measurements must be done within 24 hours after sampling and this for several reasons:

- to minimize gas interactions in the FlexFoil® bag.
- to avoid temperature changes inside the bag, which can generate condensation and dissolution of ammonia.

Figure 14: FlexFoil® bag connected to the air inlet of the bag and then to the INNOVA®

The configuration of the multi-gas analyzer is detailed in the following table:

Type of gas	Reference of the filter used	Gas detection threshold (ppm)	Filter position
N_2O	UA 0985	0,03	A
CO_2	UA 0982	1,5	B
Ethanol	UA 0973	0,10	C
NH_3	UA 0979	0,5	D
CH_4	UA 0969	0,4	E
H_2O	SB 0527		W

Note:

In previous studies, the analyzer was transported to the sampling site but the initial concentrations found were always different and very often negatives. This was due to the fact that this device requires a warm up phase which lasts for about 2h30 before stabilizing. Therefore, for these measurements, the analyzer should not be moved and must be turned on at least 2h30 prior to the first air sample measurement (the concentrations read on the analyzer must be stabilized before the bag is plugged in).

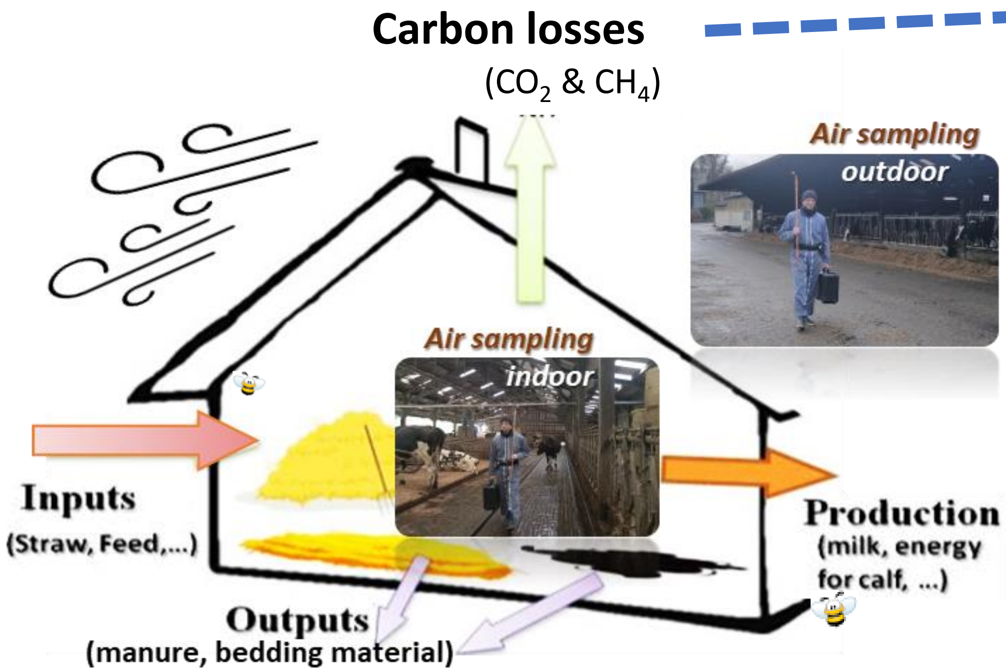
Livestock building emission assessment

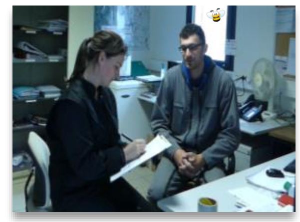
Objectives of the study and farm observations

Objectives

- Help implementing **mitigation strategies** by identifying emission **hot spots**
- Identifying **low emission sources** to **consolidate** and possibly **disseminate**

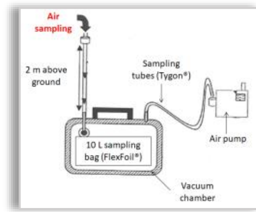
Farm observations





Carbon losses

On-farm **questionnaire** (evaluation of the organic material getting in and out of the building)



Gas gradients

Concentration analysis (evaluation of increases in the building)

$$\frac{\textit{Carbon losses}}{\textit{Gas gradients}} =$$

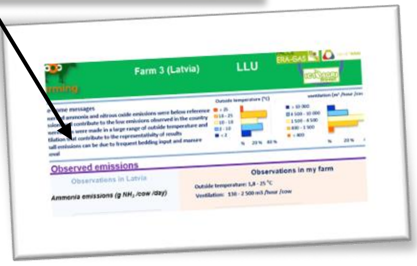
CO_2 Emissions	CH_4 Emissions	N_2O Emissions	NH_3 Emissions

Livestock building emission assessment

Guidelines for interpretations

FACCE ERA-GAS
ERA-NET SUSAN
ICT-AGRI era-net

Take home message



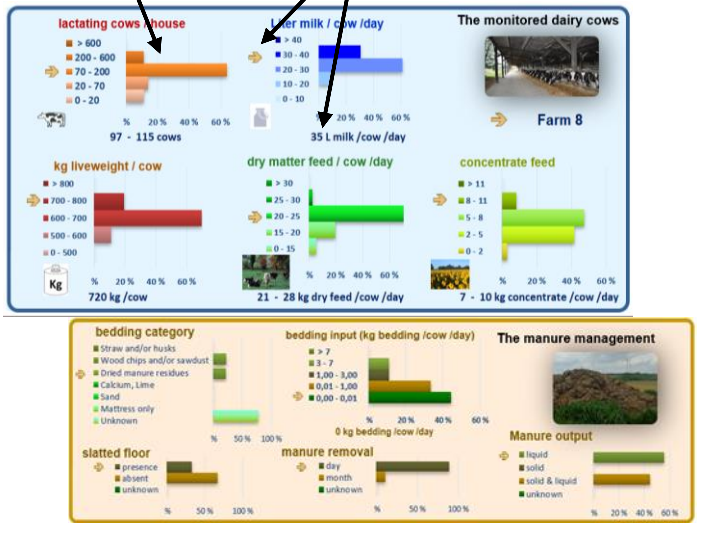
***Take Home Message** based on the graphs below*

The emission estimates are « Much higher » for CH_4 and « Higher » and « Much higher » for N_2O than the reference EF.
Looking at the farm description :
- *the use of slatted floor could explain the CH_4 result;*
- *dried manure is used for bedding material and higher uses of concentrates (arrows) than the average could explain the N_2O results.*

Horizontal bars are for the **farm description**

1- Graphs present the **country situation**

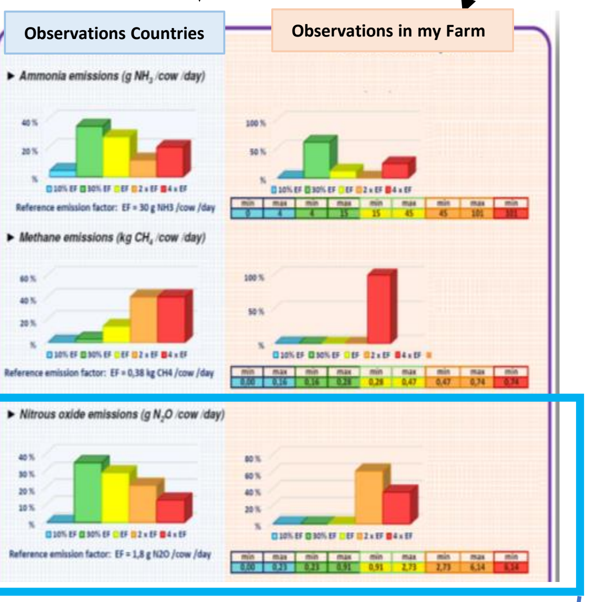
2- Arrow and numbers below graphs present the **farm situation**



Vertical bars are for the **emission calculations**

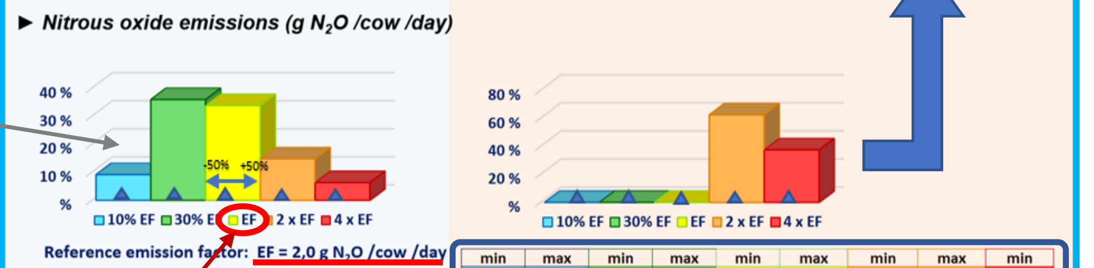
1- Left graphs for the **country situation**

2- Right graphs for the **farm situation**



Gas emission distribution
of the country (or farm)
(emissions are not presented through only one value)

farm signature



min	max	min	max	min	max	min	max	min
0,00	0,23	0,23	0,91	0,91	2,73	2,73	6,14	6,14

Observations are distributed into 5 classes

1- Much lower
2- Lower
3- Neutral
4- Higher
5- Much higher …

…than the reference

The neutral class corresponds to reference emission factor (EF) for each gas which is found in the National Inventory Report

Limits of the classes

Farm 1 (Germany)

Survey of housing emissions (2021 - 2023)

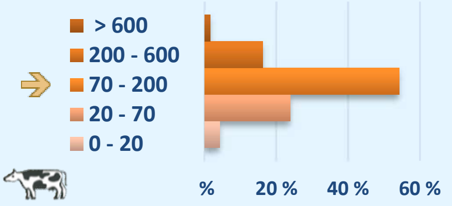
JLU

Farm visited by Lena Fehmer (2021 - 2022)

My farm vs the diversity of visited dairy units in all countries

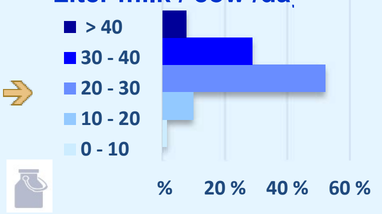
Tier	2b	2a	1	not used	total (3 gases)
nb obs.	0	0	4	8	12

lactating cows / house



68 - 81 cows

Liter milk / cow /day

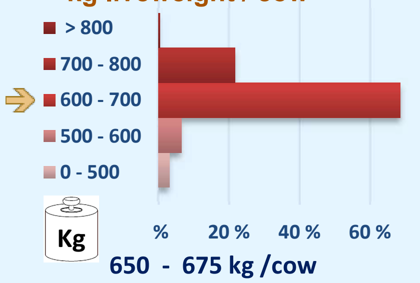


25 L milk /cow /day

The monitored dairy cows

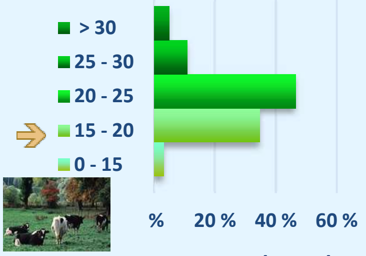
Farm 1

kg liveweight / cow



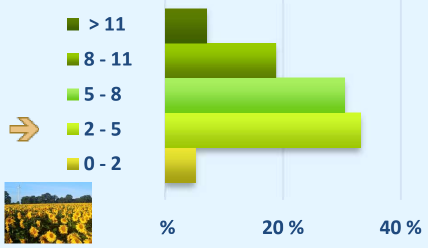
650 - 675 kg /cow

dry matter feed / cow /day



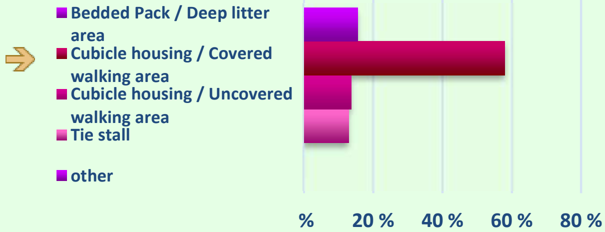
16 - 18 kg dry feed /cow /day

concentrate feed

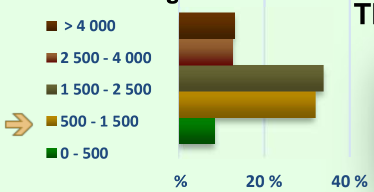


2 - 5 kg concentrate /cow /day

Housing category



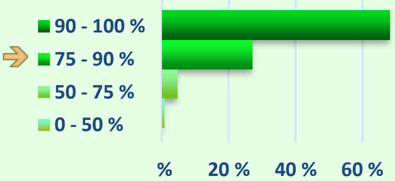
housing area



1345,3 - 1354,3 m² /house

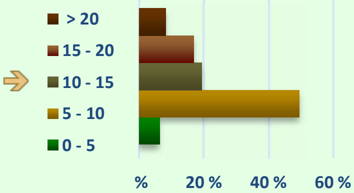
The monitored house

feed lactating cows (% feed all animals)



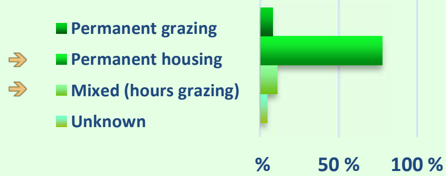
80 - 93 % total house

cow area



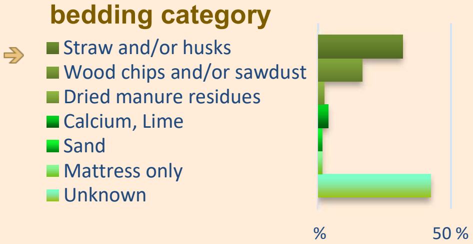
13,6 - 15,6 m² /lactating cow

grazing option

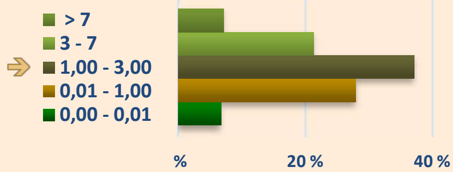


0 - 8 hours grazing /day

bedding category



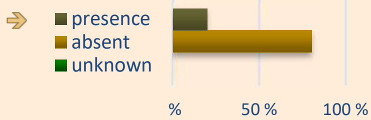
bedding input (kg bedding /cow /day)



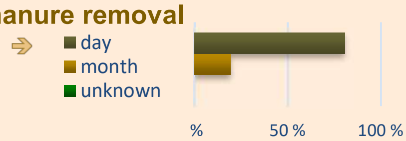
1,5 kg bedding /cow /day

The manure management

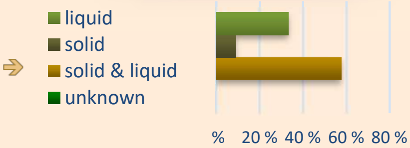
slatted floor



manure removal



Manure output



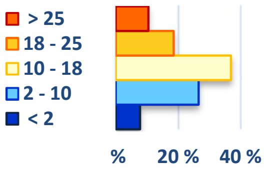
farming

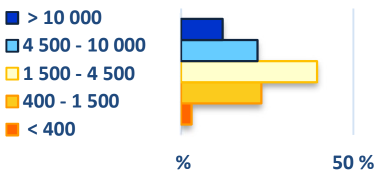
Farm 1 (Germany) JLU

FACCE ERA-GAS ERA-NET SUSAN ICT AGRI era-net

Take-home messages

the "house signature" could not be observed; when high ammonia emissions were repeatedly observed, improvements in manure management could be tested





Observed emissions

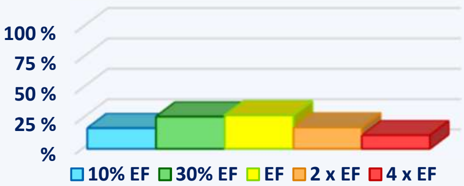
Observations in all countries

Observations in my farm

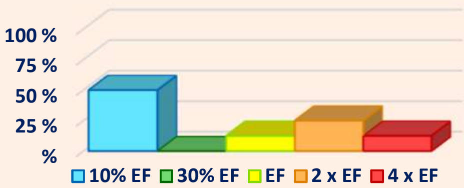
Outdoor temperature 4,6 - 16 °C

Ventilation 750 - 3800 m3 /hour /cow

► Ammonia emissions (g NH3 /cow /day)



Reference emission factor: EF = 30 g NH3 /cow /day



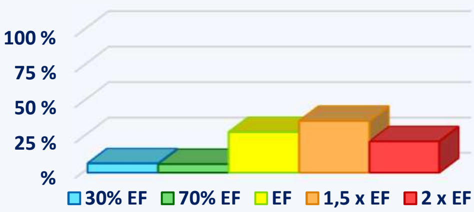
min	max	min	max	min	max	min	max	min
0	4	4	15	15	45	45	101	101

min: 1 g NH3 /cow /day

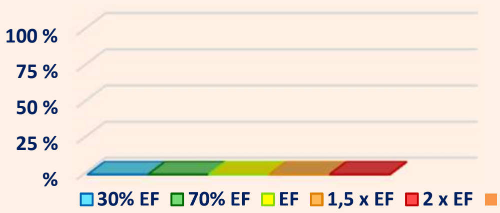
max: 120 g NH3 /cow /day

n: 8 emissions

► kg CH4 /cow /day (kg CH4 /cow /day)



Reference emission factor: EF = 0,38 kg CH4 /cow /day



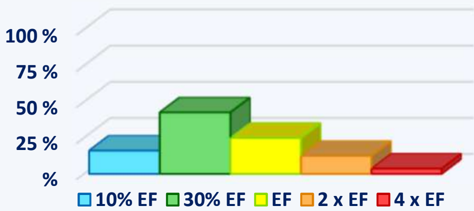
min	max	min	max	min	max	min	max	min
0,00	0,19	0,19	0,30	0,30	0,45	0,45	0,65	0,65

min: 0,00 kg CH4 /cow /day

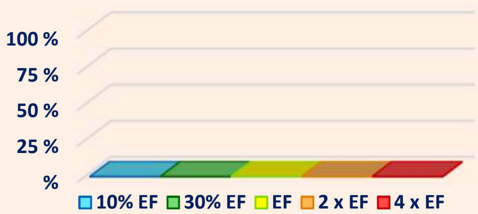
max: 0,00 kg CH4 /cow /day

n: 0 emissions

► Nitrous oxide emissions (g N2O /cow /day)



Reference emission factor: EF = 1,8 g N2O /cow /day



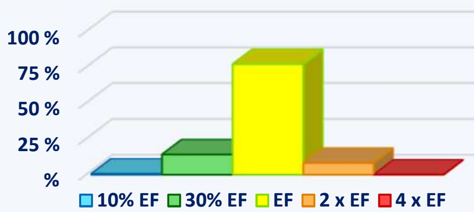
min	max	min	max	min	max	min	max	min
0,00	0,23	0,23	0,91	0,91	2,73	2,73	6,14	6,14

min: 0,00 g N2O /cow /day

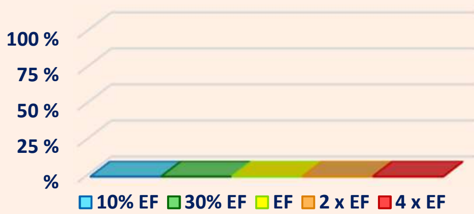
max: 0,00 g N2O /cow /day

n: 0 emissions

► GHG emissions (kg eq CO2 /L milk)



Reference emission factor: EF = 0,40 kg eq CO2 /L milk



min	max	min	max	min	max	min	max	min
0,00	0,05	0,05	0,20	0,20	0,61	0,61	1,36	1,36

min: 0,00 kg eq CO2 /L milk

max: 0,00 kg eq CO2 /L milk

Farm 2 (Germany)

Survey of housing emissions (2021 - 2023)

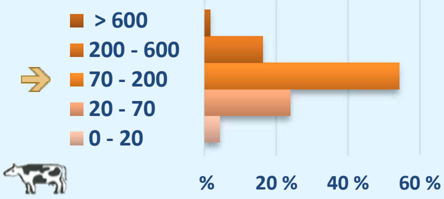
JLU

Farm visited by Lena Fehmer (2021 - 2022)

My farm vs the diversity of visited dairy units in all countries

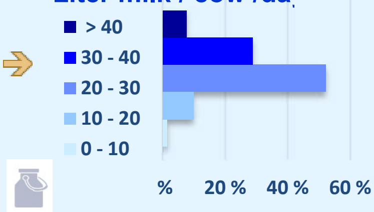
Tier	2b	2a	1	not used	total (3 gases)
nb obs.	0	0	3	9	12

lactating cows / house



126 - 142 cows

Liter milk / cow /day

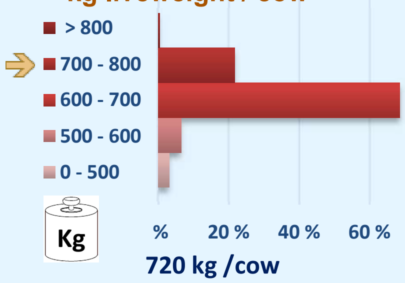


36 L milk /cow /day

The monitored dairy cows

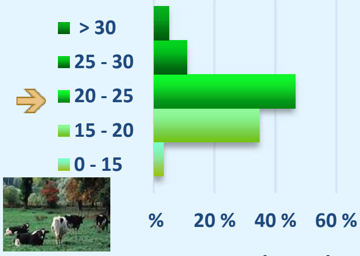
Farm 2

kg liveweight / cow



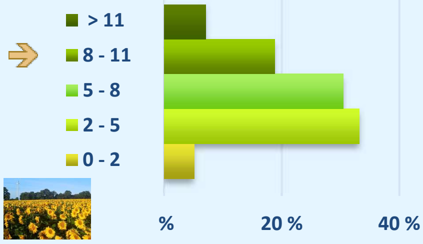
720 kg /cow

dry matter feed / cow /day



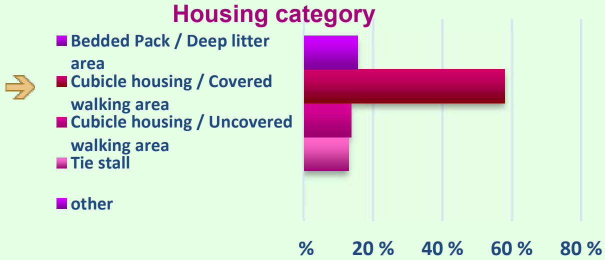
22 - 24 kg dry feed /cow /day

concentrate feed

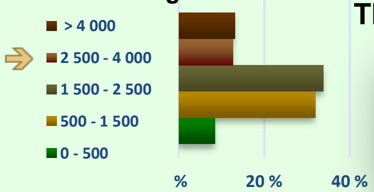


8 - 9 kg concentrate /cow /day

Housing category



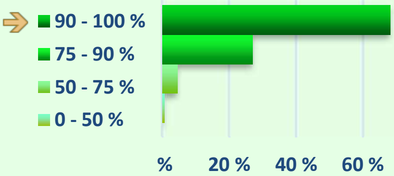
housing area



3720 - 3741 m² /house

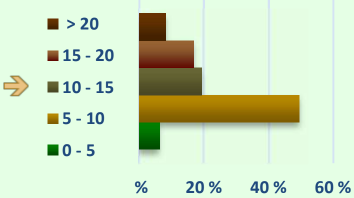
The monitored house

feed lactating cows (% feed all animals)



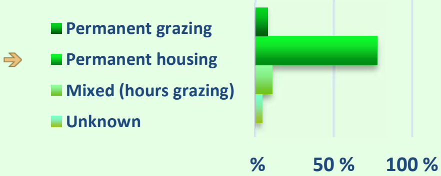
88 - 94 % total house

cow area

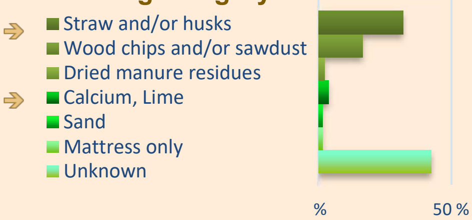


11,7 - 13,5 m² /lactating cow

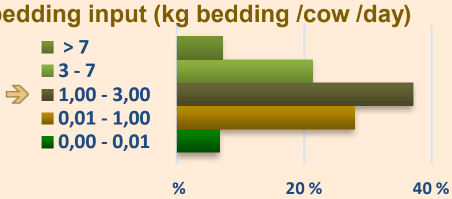
grazing option



bedding category



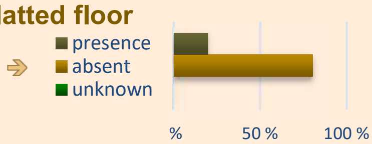
bedding input (kg bedding /cow /day)



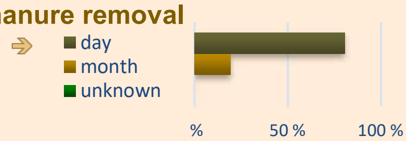
1,0 kg bedding /cow /day

The manure management

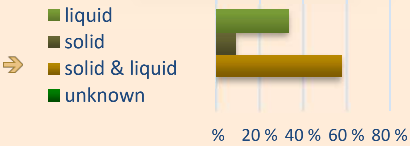
slatted floor



manure removal



Manure output



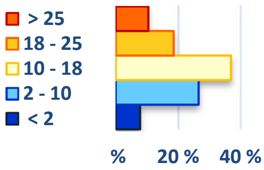
Farm 2 (Germany) JLU

FACCE ERA-GAS ERA-NET SUSAN ICT AGRI era-net

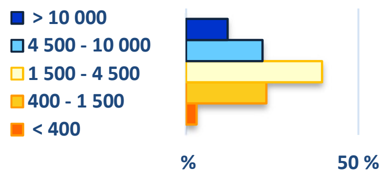
Take-home messages

the "house signature" could not be observed; when high ammonia emissions were repeatedly observed, improvements in manure management could be tested

Outdoor temperature (°C)



Ventilation (m3 /hour /cow)



Observed emissions

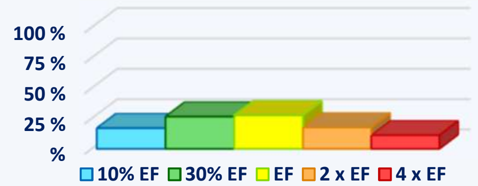
Observations in all countries

Observations in my farm

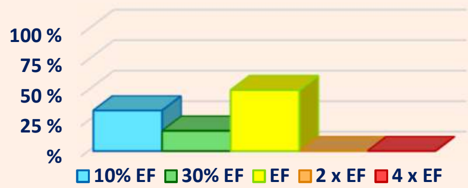
Outdoor temperature -1,0 - 28 °C

Ventilation 1 600 - 8600 m3 /hour /cow

► *Ammonia emissions (g NH3 /cow /day)*



Reference emission factor: EF = 30 g NH3 /cow /day



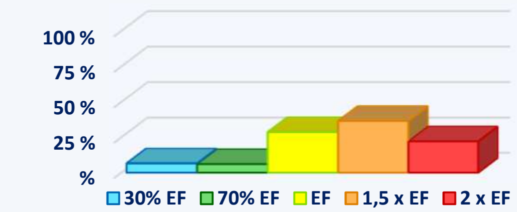
min: 2 g NH3 /cow /day

max: 37 g NH3 /cow /day

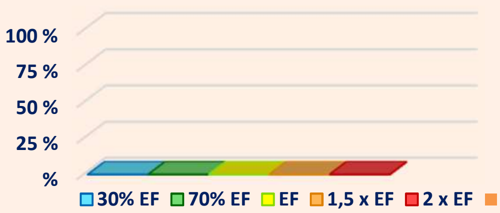
n: 6 emissions

min	max	min	max	min	max	min	max	min
0	4	4	15	15	45	45	101	101

► *kg CH4 /cow /day (kg CH4 /cow /day)*



Reference emission factor: EF = 0,38 kg CH4 /cow /day



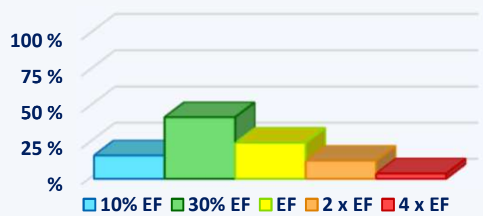
min: 0,00 kg CH4 /cow /day

max: 0,00 kg CH4 /cow /day

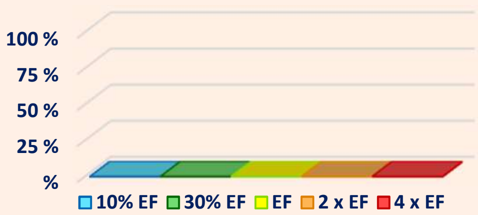
n: 0 emissions

min	max	min	max	min	max	min	max	min
0,00	0,19	0,19	0,30	0,30	0,45	0,45	0,65	0,65

► *Nitrous oxide emissions (g N2O /cow /day)*



Reference emission factor: EF = 1,8 g N2O /cow /day



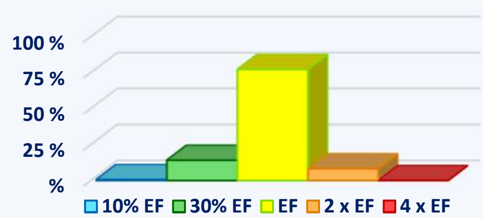
min: 0,00 g N2O /cow /day

max: 0,00 g N2O /cow /day

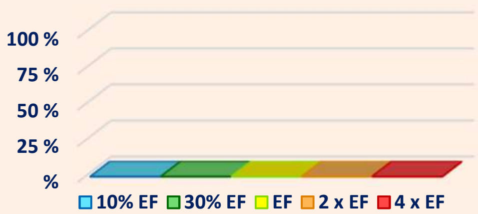
n: 0 emissions

min	max	min	max	min	max	min	max	min
0,00	0,23	0,23	0,91	0,91	2,73	2,73	6,14	6,14

► *GHG emissions (kg eq CO2 /L milk)*



Reference emission factor: EF = 0,40 kg eq CO2 /L milk



min: 0,00 kg eq CO2 /L milk

max: 0,00 kg eq CO2 /L milk

min	max	min	max	min	max	min	max	min
0,00	0,05	0,05	0,20	0,20	0,61	0,61	1,36	1,36

Farm 3 (Germany)

Survey of housing emissions
(2021 - 2023)

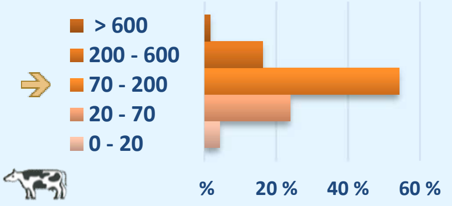
JLU

Farm visited by Lena Fehmer (2020 - 2022)

My farm vs the diversity of visited dairy units in all countries

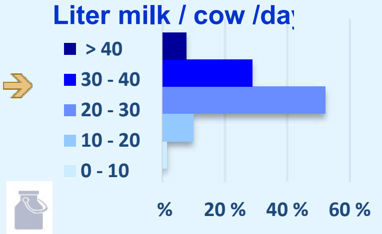
Tier	2b	2a	1	not used	total (3 gases)
nb obs.	0	2	1	9	12

lactating cows / house



64 - 88 cows

Liter milk / cow /day

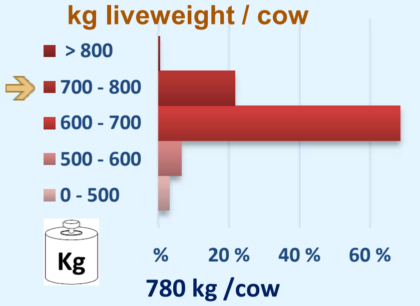


36 L milk /cow /day

The monitored dairy cows

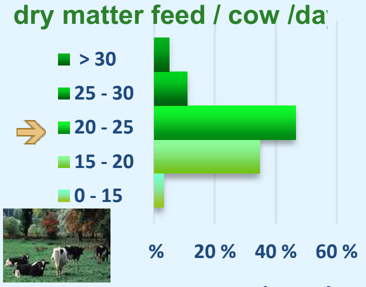
Farm 3

kg liveweight / cow



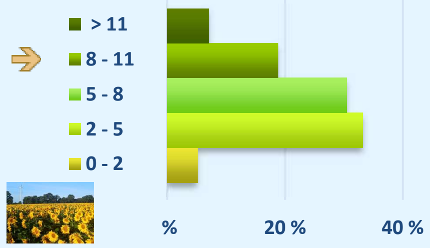
780 kg /cow

dry matter feed / cow /day



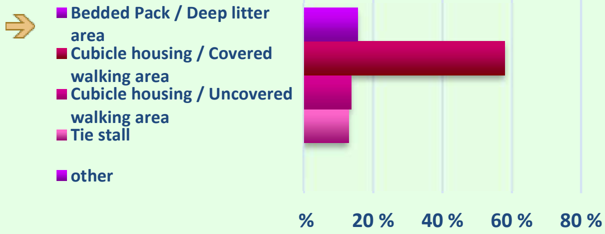
24 - 24 kg dry feed /cow /day

concentrate feed

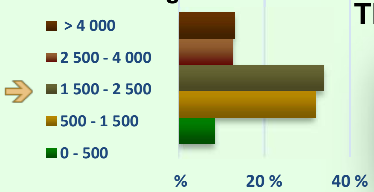


10 kg concentrate /cow /day

Housing category



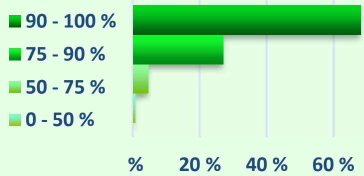
housing area



2082 m² /house

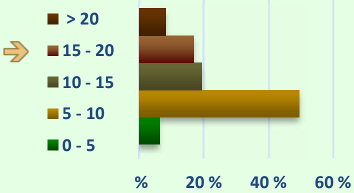
The monitored house

feed lactating cows (% feed all animals)



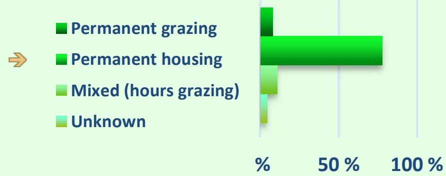
(no data)

cow area

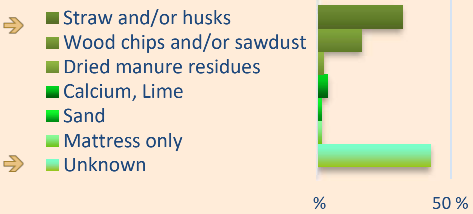


16,7 - 19,0 m² /lactating cow

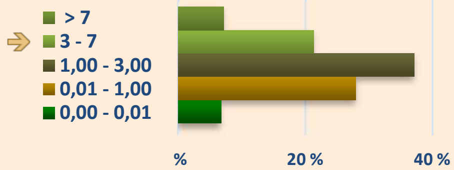
grazing option



bedding category



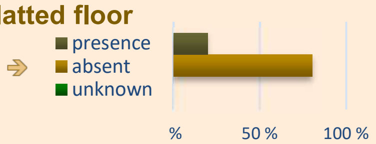
bedding input (kg bedding /cow /day)



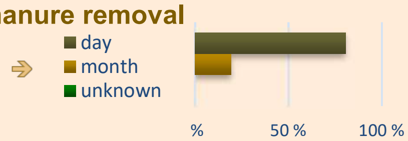
2,9 - 8,9 kg bedding /cow /day

The manure management

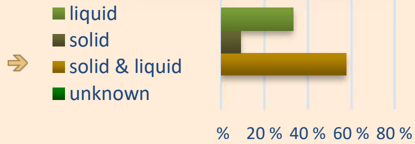
slatted floor



manure removal



Manure output

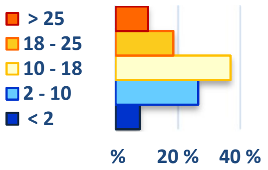


Farm 3 (Germany) JLU

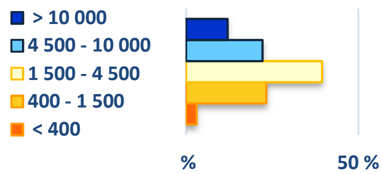
Take-home messages

the "house signature" could not be observed; when high ammonia emissions were repeatedly observed, improvements in manure management could be tested

Outdoor temperature (°C)



Ventilation (m3 /hour /cow)



Observed emissions

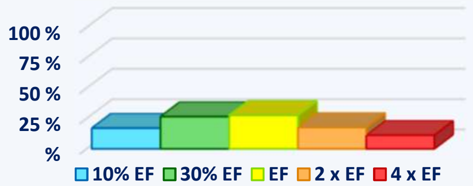
Observations in all countries

Observations in my farm

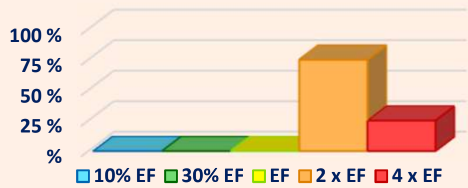
Outdoor temperature 4,8 - 28 °C

Ventilation 2 100 - 53000 m3 /hour /cow

► Ammonia emissions (g NH3 /cow /day)



Reference emission factor: EF = 30 g NH3 /cow /day



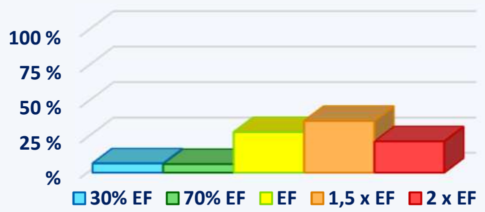
min: 48 g NH3 /cow /day

max: 110 g NH3 /cow /day

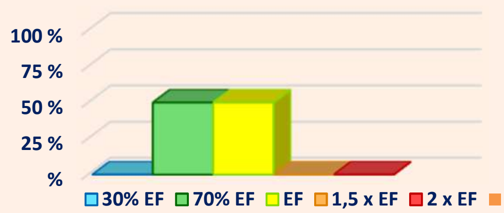
n: 4 emissions

min	max	min	max	min	max	min	max	min
0	4	4	15	15	45	45	101	101

► kg CH4 /cow /day (kg CH4 /cow /day)



Reference emission factor: EF = 0,38 kg CH4 /cow /day



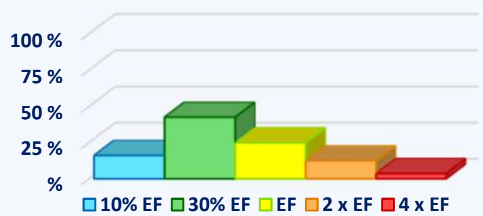
min: 0,3 kg CH4 /cow /day

max: 0,4 kg CH4 /cow /day

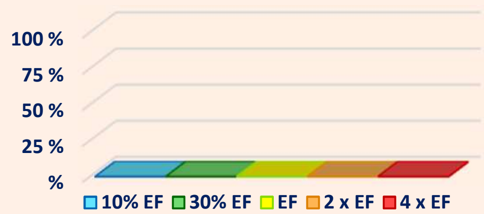
n: 2 emissions

min	max	min	max	min	max	min	max	min
0,00	0,19	0,19	0,30	0,30	0,45	0,45	0,65	0,65

► Nitrous oxide emissions (g N2O /cow /day)



Reference emission factor: EF = 1,8 g N2O /cow /day



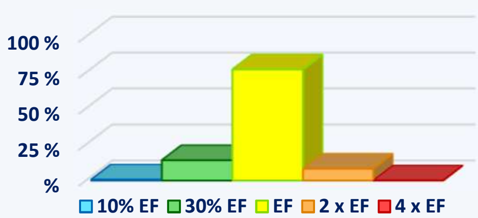
min: 0,00 g N2O /cow /day

max: 0,00 g N2O /cow /day

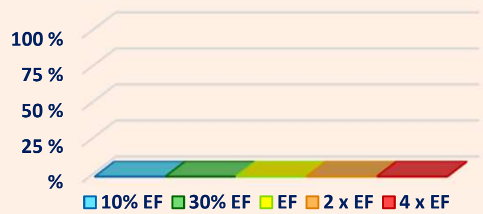
n: 0 emissions

min	max	min	max	min	max	min	max	min
0,00	0,23	0,23	0,91	0,91	2,73	2,73	6,14	6,14

► GHG emissions (kg eq CO2 /L milk)



Reference emission factor: EF = 0,40 kg eq CO2 /L milk



min: 0,00 kg eq CO2 /L milk

max: 0,00 kg eq CO2 /L milk

min	max	min	max	min	max	min	max	min
0,00	0,05	0,05	0,20	0,20	0,61	0,61	1,36	1,36

Farm 4 (Germany)

Survey of housing emissions (2021 - 2023)

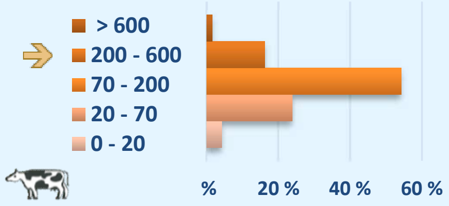
JLU

Farm visited by Lena Fehmer (2020 - 2022)

My farm vs the diversity of visited dairy units in all countries

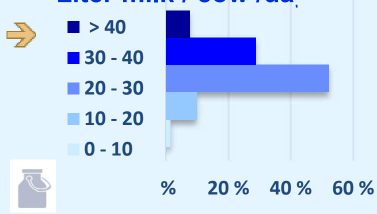
Tier	2b	2a	1	not used	total (3 gases)
nb obs.	0	0	4	8	12

lactating cows / house



338 - 476 cows

Liter milk / cow /day

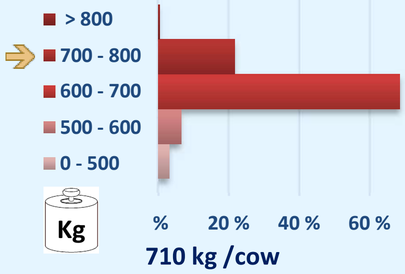


42 L milk /cow /day

The monitored dairy cows

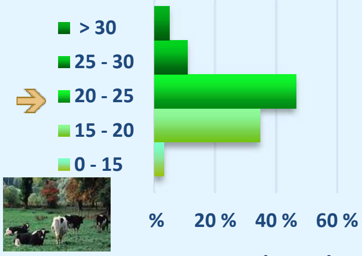
Farm 4

kg liveweight / cow



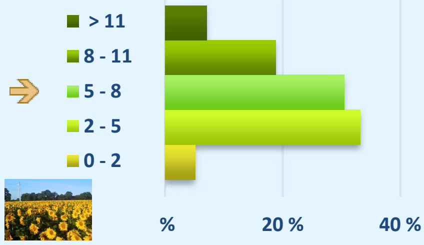
710 kg /cow

dry matter feed / cow /day



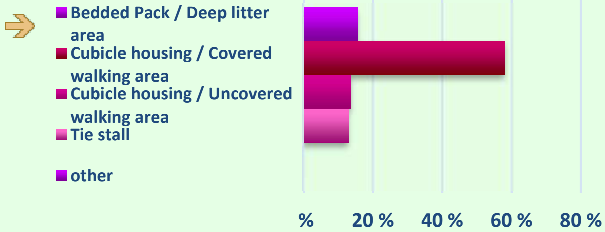
21 - 24 kg dry feed /cow /day

concentrate feed

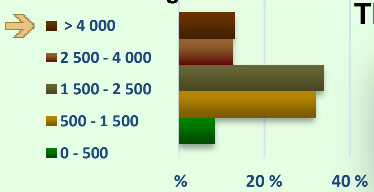


7 - 9 kg concentrate /cow /day

Housing category



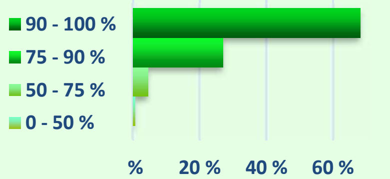
housing area



6517 m² /house

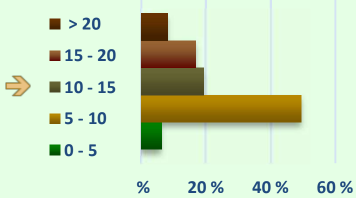
The monitored house

feed lactating cows (% feed all animals)



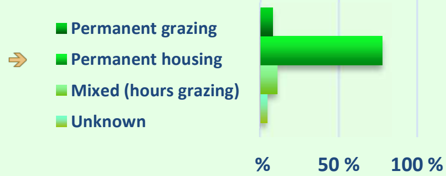
(no data)

cow area

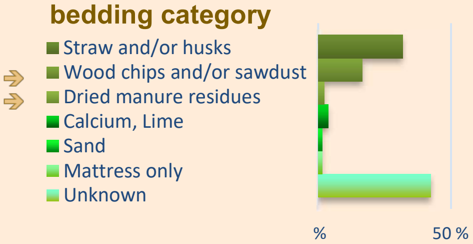


10,6 - 14,9 m² /lactating cow

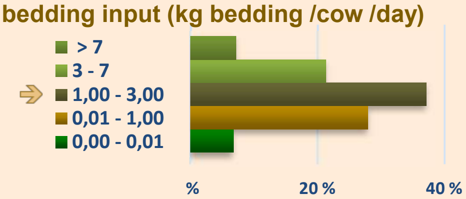
grazing option



bedding category



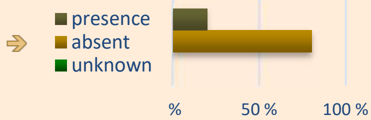
bedding input (kg bedding /cow /day)



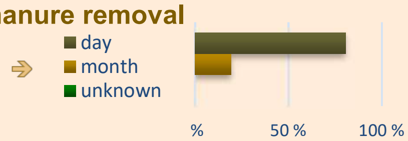
0,4 - 6,0 kg bedding /cow /day

The manure management

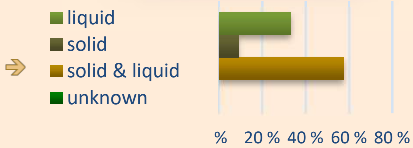
slatted floor



manure removal



Manure output

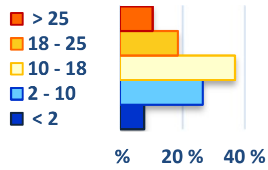


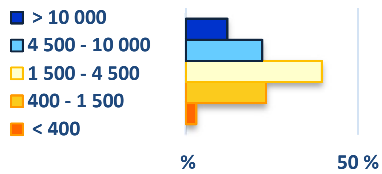
Farm 4 (Germany) JLU

FACCE ERA-GAS · ERA-NET SUSAN · ICT-AGRI era-net

Take-home messages

the "house signature" could not be observed; when high ammonia emissions were repeatedly observed, improvements in manure management could be tested





Observed emissions

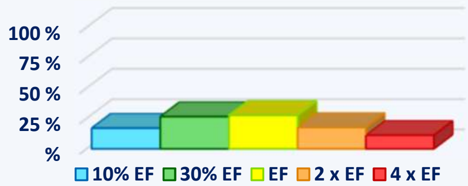
Observations in all countries

Observations in my farm

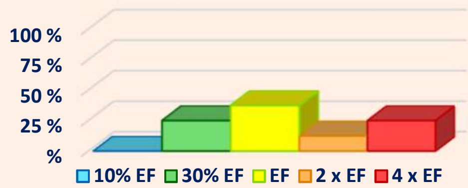
Outdoor temperature 6,1 - 25 °C

Ventilation 1 700 - 24000 m3 /hour /cow

► ***Ammonia emissions (g NH3 /cow /day)***



Reference emission factor: EF = 30 g NH3 /cow /day



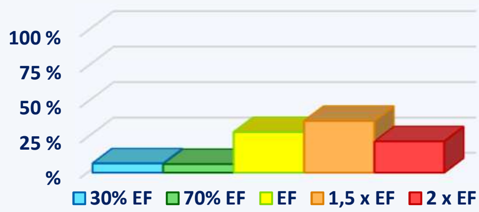
min: 11 g NH3 /cow /day

max: 440 g NH3 /cow /day

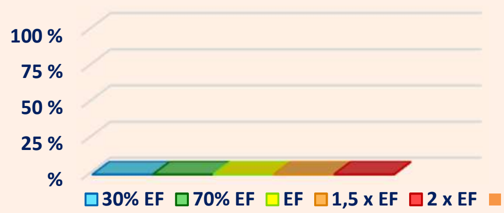
n: 8 emissions

min	max	min	max	min	max	min	max	min
0	4	4	15	15	45	45	101	101

► ***kg CH4 /cow /day (kg CH4 /cow /day)***



Reference emission factor: EF = 0,38 kg CH4 /cow /day



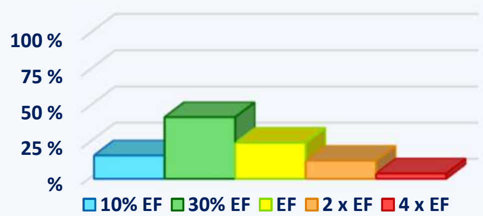
min: 0,00 kg CH4 /cow /day

max: 0,00 kg CH4 /cow /day

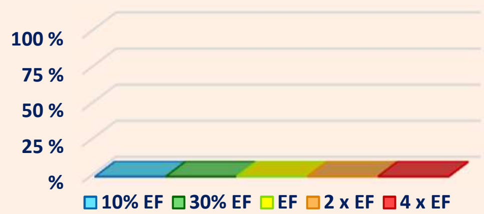
n: 0 emissions

min	max	min	max	min	max	min	max	min
0,00	0,19	0,19	0,30	0,30	0,45	0,45	0,65	0,65

► ***Nitrous oxide emissions (g N2O /cow /day)***



Reference emission factor: EF = 1,8 g N2O /cow /day



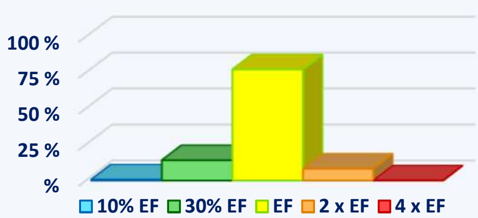
min: 0,00 g N2O /cow /day

max: 0,00 g N2O /cow /day

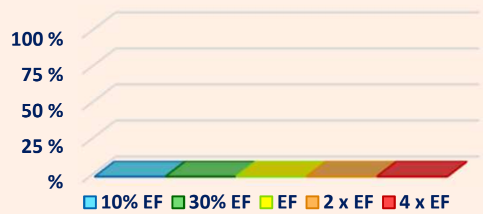
n: 0 emissions

min	max	min	max	min	max	min	max	min
0,00	0,23	0,23	0,91	0,91	2,73	2,73	6,14	6,14

► ***GHG emissions (kg eq CO2 /L milk)***



Reference emission factor: EF = 0,40 kg eq CO2 /L milk



min: 0,00 kg eq CO2 /L milk

max: 0,00 kg eq CO2 /L milk

min	max	min	max	min	max	min	max	min
0,00	0,05	0,05	0,20	0,20	0,61	0,61	1,36	1,36

Farm 5 (Germany)

Survey of housing emissions
(2021 - 2023)

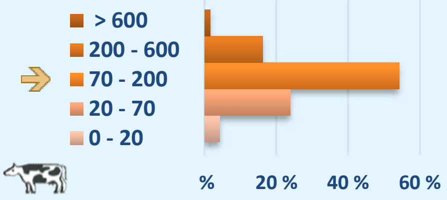
JLU

Farm visited by Lena Fehmer (2021 - 2022)

My farm vs the diversity of visited dairy units in all countries

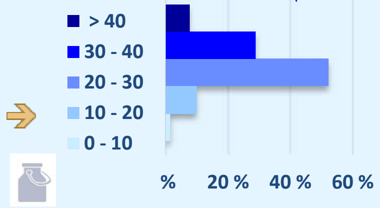
Tier	2b	2a	1	not used	total (3 gases)
nb obs.	0	0	4	8	12

lactating cows / house



70 - 87 cows

Liter milk / cow /day

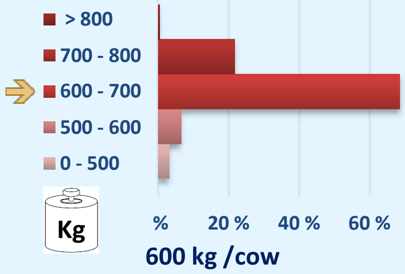


17 L milk /cow /day

The monitored dairy cows

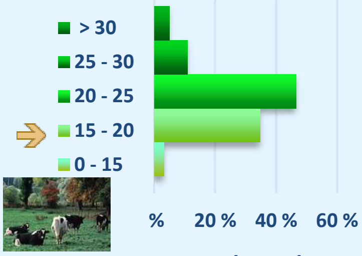
Farm 5

kg liveweight / cow



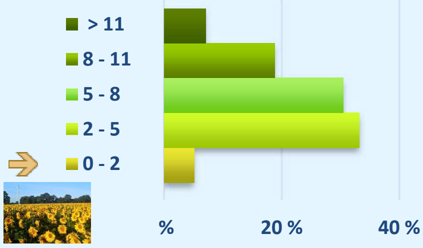
600 kg /cow

dry matter feed / cow /day



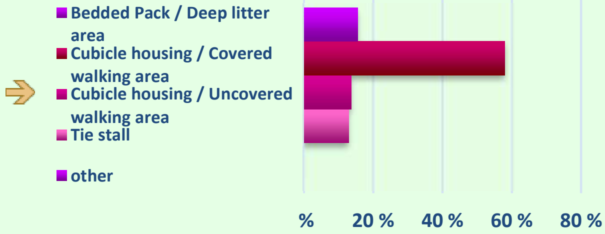
17 kg dry feed /cow /day

concentrate feed

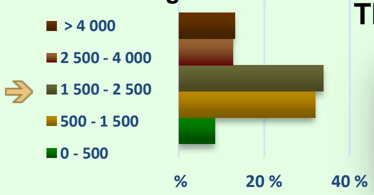


0 kg concentrate /cow /day

Housing category



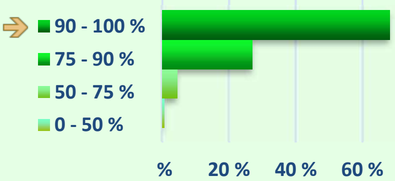
housing area



1895 - 1945 m² /house

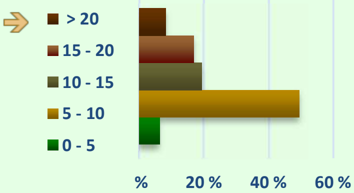
The monitored house

feed lactating cows (% feed all animals)



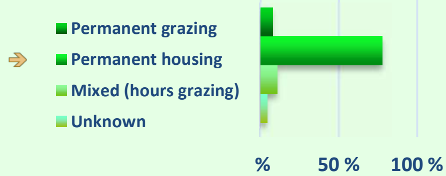
100 % total house

cow area

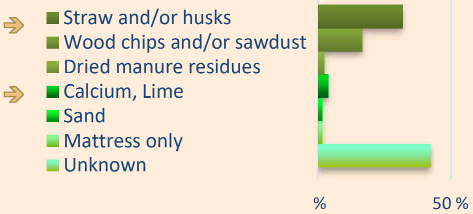


19,5 - 24,2 m² /lactating cow

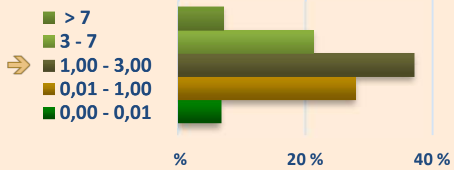
grazing option



bedding category



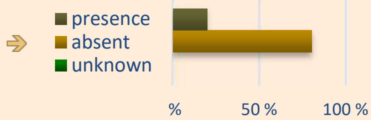
bedding input (kg bedding /cow /day)



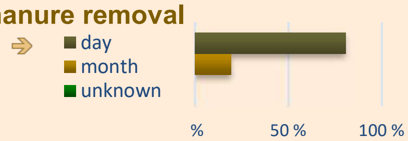
2,8 kg bedding /cow /day

The manure management

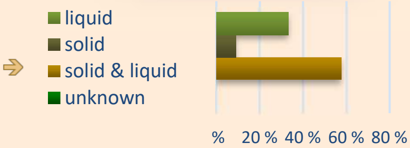
slatted floor



manure removal



Manure output

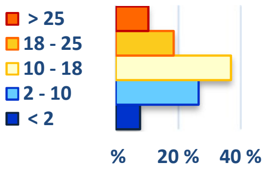


Farm 5 (Germany) JLU

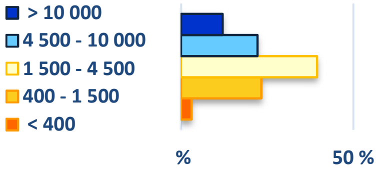
Take-home messages

the "house signature" could not be observed; when high ammonia emissions were repeatedly observed, improvements in manure management could be tested

Outdoor temperature (°C)



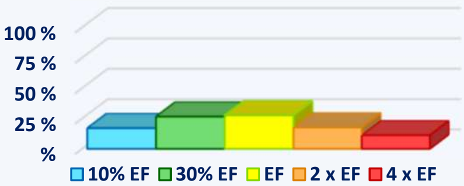
Ventilation (m3 /hour /cow)



Observed emissions

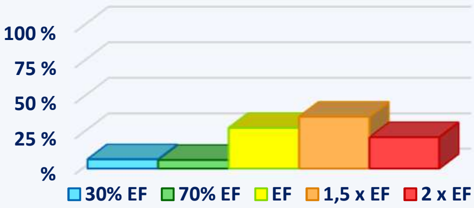
Observations in all countries

► *Ammonia emissions (g NH3 /cow /day)*



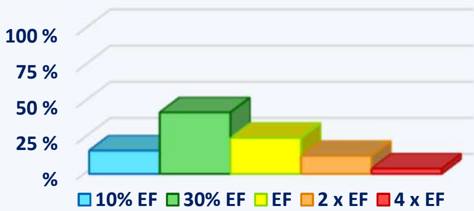
Reference emission factor: EF = 30 g NH3 /cow /day

► *kg CH4 /cow /day (kg CH4 /cow /day)*



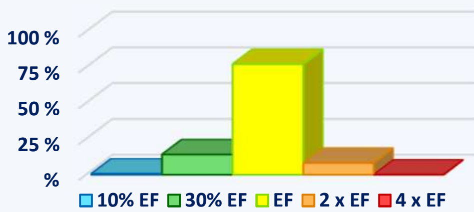
Reference emission factor: EF = 0,38 kg CH4 /cow /day

► *Nitrous oxide emissions (g N2O /cow /day)*



Reference emission factor: EF = 1,8 g N2O /cow /day

► *GHG emissions (kg eq CO2 /L milk)*

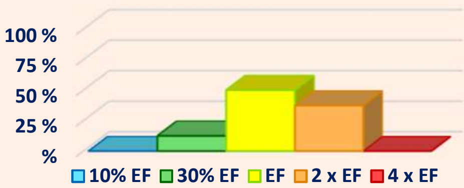


Reference emission factor: EF = 0,40 kg eq CO2 /L milk

Observations in my farm

Outdoor temperature 0,3 - 16 °C

Ventilation 950 - 19000 m3 /hour /cow

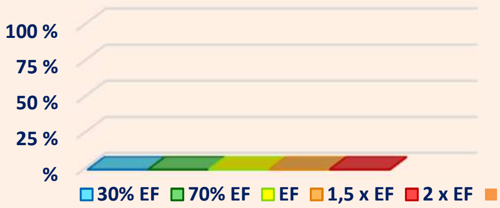


min: 11 g NH3 /cow /day

max: 71 g NH3 /cow /day

n: 8 emissions

min	max	min	max	min	max	min	max	min
0	4	4	15	15	45	45	101	101

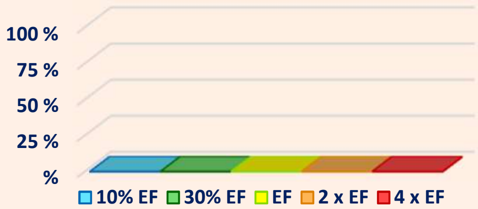


min: 0,00 kg CH4 /cow /day

max: 0,00 kg CH4 /cow /day

n: 0 emissions

min	max	min	max	min	max	min	max	min
0,00	0,19	0,19	0,30	0,30	0,45	0,45	0,65	0,65

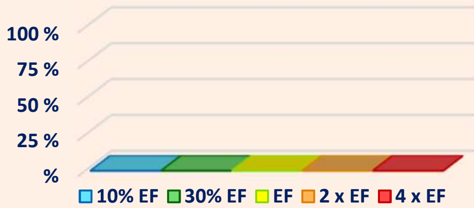


min: 0,00 g N2O /cow /day

max: 0,00 g N2O /cow /day

n: 0 emissions

min	max	min	max	min	max	min	max	min
0,00	0,23	0,23	0,91	0,91	2,73	2,73	6,14	6,14



min: 0,00 kg eq CO2 /L milk

max: 0,00 kg eq CO2 /L milk

min	max	min	max	min	max	min	max	min
0,00	0,05	0,05	0,20	0,20	0,61	0,61	1,36	1,36

farming

Farm 6 (Germany)

Survey of housing emissions (2021 - 2023)

JLU

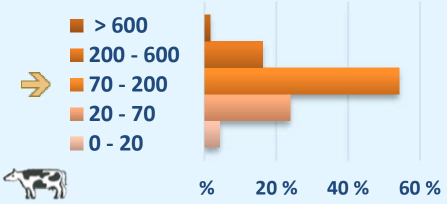
Farm visited by Lena Fehmer (2020 - 2021)

FACCE ERA-GAS ERA-NET SUSAN ICT-AGRI era-net

My farm vs the diversity of visited dairy units in all countries

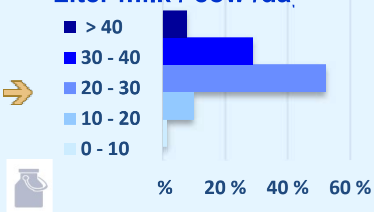
Tier	2b	2a	1	not used	total (3 gases)
nb obs.	0	0	3	9	12

lactating cows / house



80 - 88 cows

Liter milk / cow /day

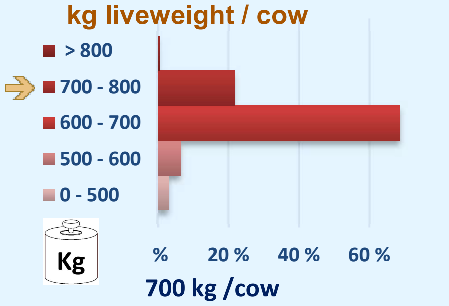


26 L milk /cow /day

The monitored dairy cows

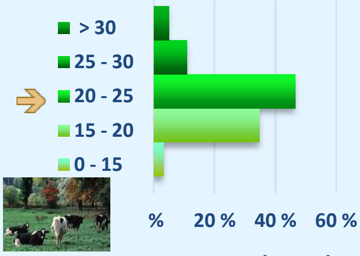
Farm 6

kg liveweight / cow



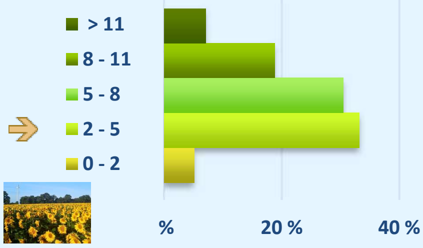
700 kg /cow

dry matter feed / cow /day



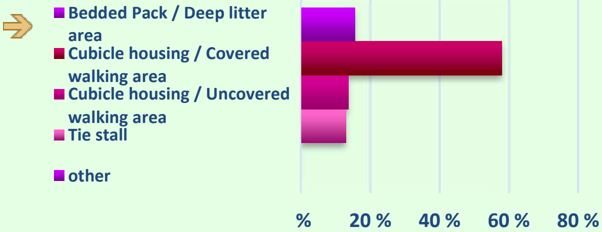
19 - 21 kg dry feed /cow /day

concentrate feed

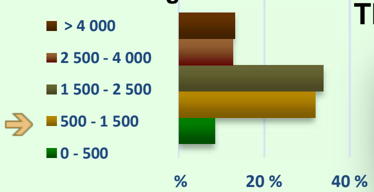


3 - 4 kg concentrate /cow /day

Housing category



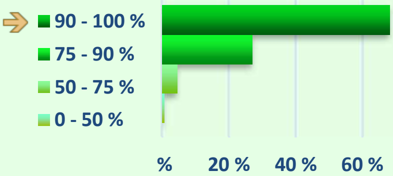
housing area



739 m² /house

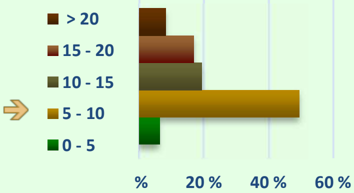
The monitored house

feed lactating cows (% feed all animals)



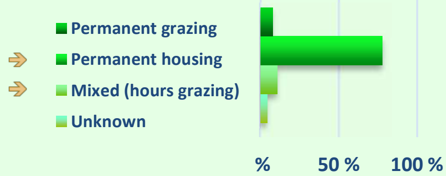
100 % total house

cow area



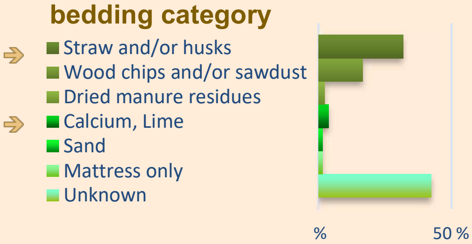
6,2 m² /lactating cow

grazing option

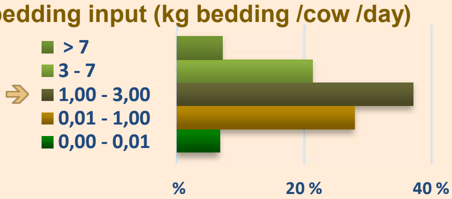


0 - 4 hours grazing /day

bedding category



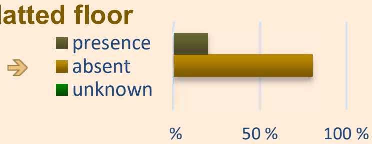
bedding input (kg bedding /cow /day)



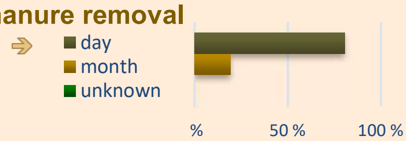
1,5 kg bedding /cow /day

The manure management

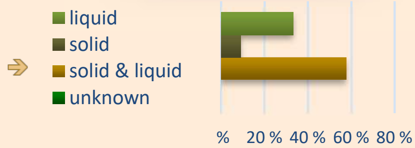
slatted floor



manure removal



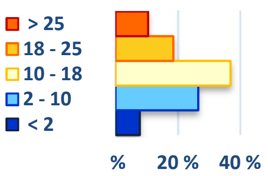
Manure output

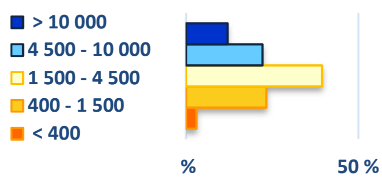


Farm 6 (Germany) JLU

Take-home messages

the "house signature" could not be observed; when high ammonia emissions were repeatedly observed, improvements in manure management could be tested





Observed emissions

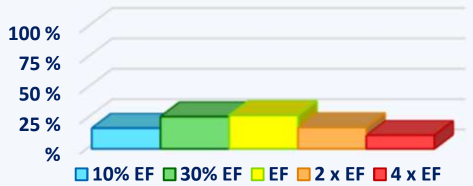
Observations in all countries

Observations in my farm

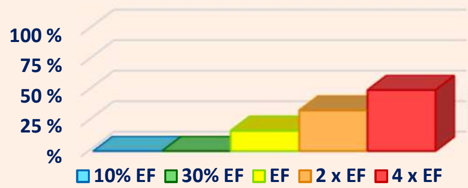
Outdoor temperature 3,9 - 28 °C

Ventilation 2 000 - 18000 m3 /hour /cow

► *Ammonia emissions (g NH3 /cow /day)*



Reference emission factor: EF = 30 g NH3 /cow /day



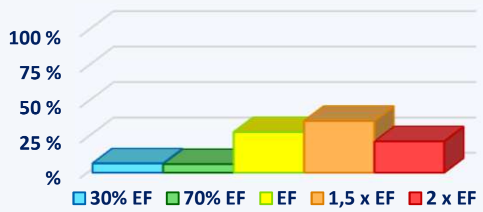
min: 22 g NH3 /cow /day

max: 230 g NH3 /cow /day

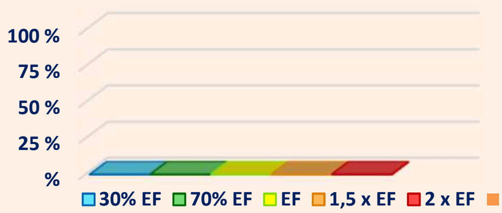
n: 6 emissions

min	max	min	max	min	max	min	max	min
0	4	4	15	15	45	45	101	101

► *kg CH4 /cow /day (kg CH4 /cow /day)*



Reference emission factor: EF = 0,38 kg CH4 /cow /day



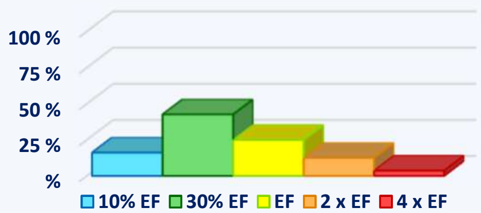
min: 0,00 kg CH4 /cow /day

max: 0,00 kg CH4 /cow /day

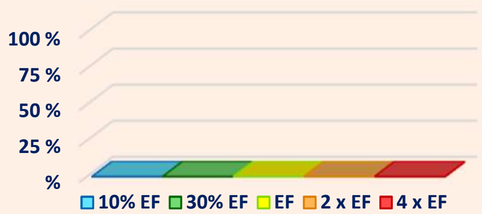
n: 0 emissions

min	max	min	max	min	max	min	max	min
0,00	0,19	0,19	0,30	0,30	0,45	0,45	0,65	0,65

► *Nitrous oxide emissions (g N2O /cow /day)*



Reference emission factor: EF = 1,8 g N2O /cow /day



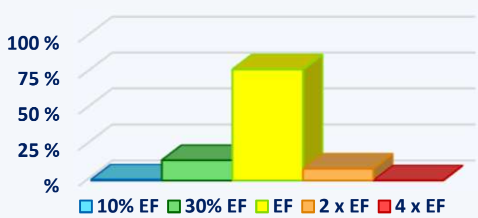
min: 0,00 g N2O /cow /day

max: 0,00 g N2O /cow /day

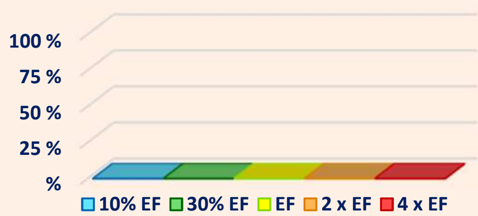
n: 0 emissions

min	max	min	max	min	max	min	max	min
0,00	0,23	0,23	0,91	0,91	2,73	2,73	6,14	6,14

► *GHG emissions (kg eq CO2 /L milk)*



Reference emission factor: EF = 0,40 kg eq CO2 /L milk



min: 0,00 kg eq CO2 /L milk

max: 0,00 kg eq CO2 /L milk

min	max	min	max	min	max	min	max	min
0,00	0,05	0,05	0,20	0,20	0,61	0,61	1,36	1,36

farming

Farm 7 (Germany)

Survey of housing emissions (2021 - 2023)

JLU

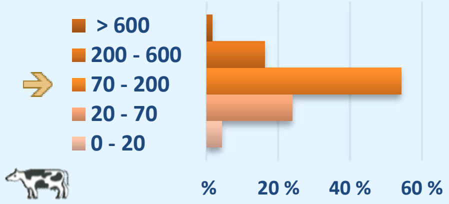
Farm visited by Lena Fehmer (2020 - 2021)

FACCE ERA-GAS ERA-NET SUSAN ICT AGRI era-net

My farm vs the diversity of visited dairy units in all countries

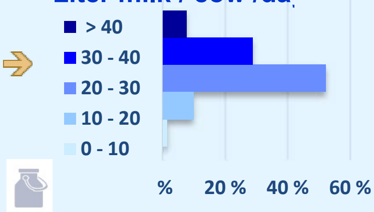
Tier	2b	2a	1	not used	total (3 gases)
nb obs.	0	0	3	9	12

lactating cows / house



90 - 100 cows

Liter milk / cow /day

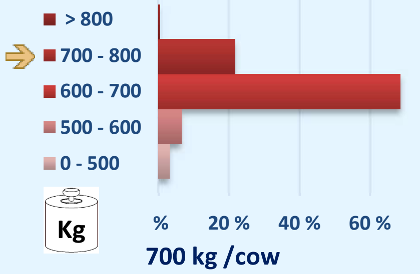


32 L milk /cow /day

The monitored dairy cows

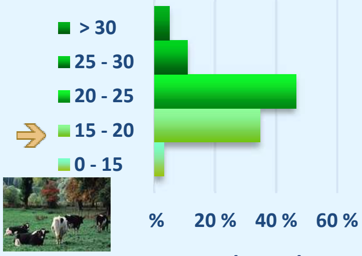
Farm 7

kg liveweight / cow



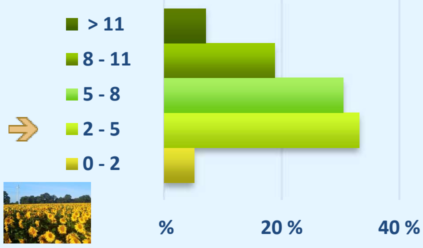
700 kg /cow

dry matter feed / cow /day



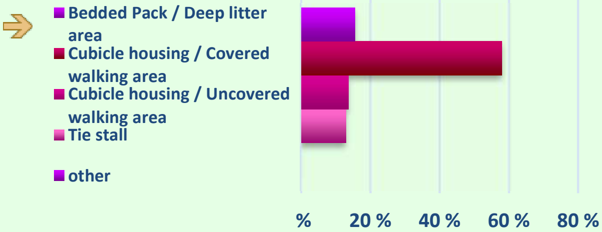
17 kg dry feed /cow /day

concentrate feed

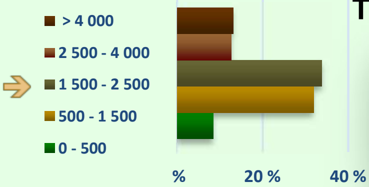


5 kg concentrate /cow /day

Housing category



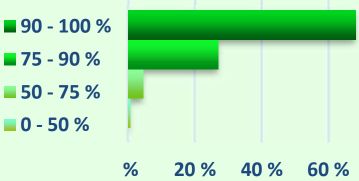
housing area



1955 - 1957 m² /house

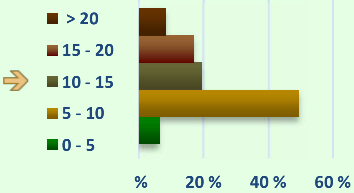
The monitored house

feed lactating cows (% feed all animals)



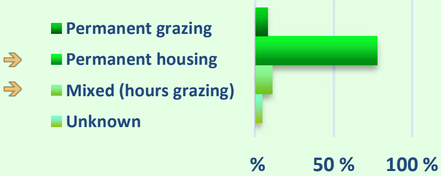
(no data)

cow area



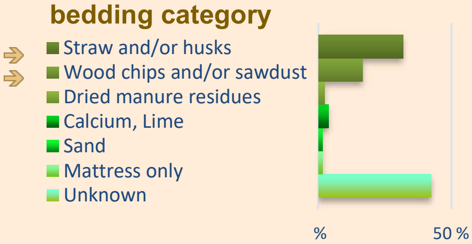
14,2 - 15,5 m² /lactating cow

grazing option

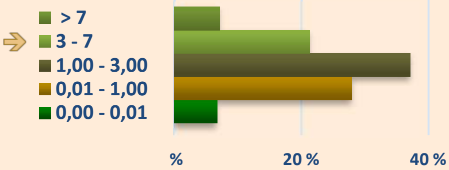


0 - 8 hours grazing /day

bedding category



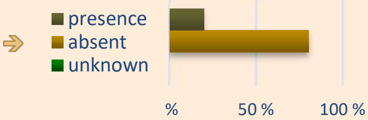
bedding input (kg bedding /cow /day)



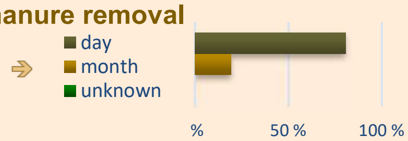
2,7 - 8,1 kg bedding /cow /day

The manure management

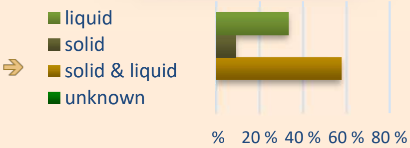
slatted floor



manure removal



Manure output

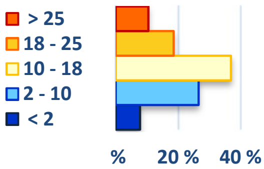


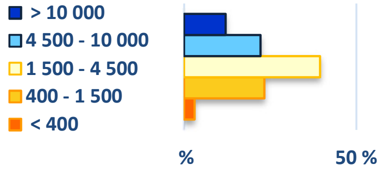
Farm 7 (Germany) JLU

FACCE ERA-GAS · ERA-NET SUSAN · ICT-AGRI era-net

Take-home messages

the "house signature" could not be observed; when high ammonia emissions were repeatedly observed, improvements in manure management could be tested





Observed emissions

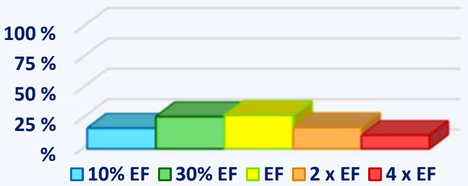
Observations in all countries

Observations in my farm

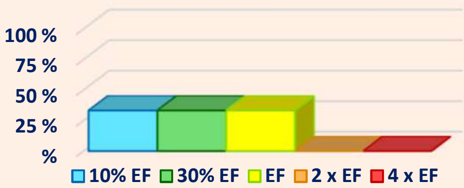
Outdoor temperature 3,3 - 24 °C

Ventilation 1 500 - 44000 m3 /hour /cow

► Ammonia emissions (g NH3 /cow /day)



Reference emission factor: EF = 30 g NH3 /cow /day



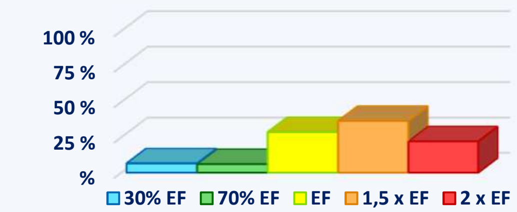
min: 2 g NH3 /cow /day

max: 27 g NH3 /cow /day

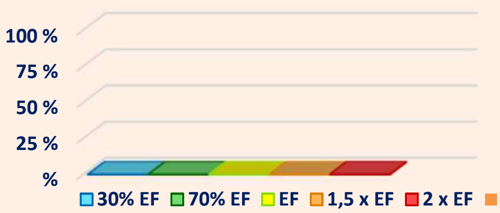
n: 6 emissions

min	max	min	max	min	max	min	max	min
0	4	4	15	15	45	45	101	101

► kg CH4 /cow /day (kg CH4 /cow /day)



Reference emission factor: EF = 0,38 kg CH4 /cow /day



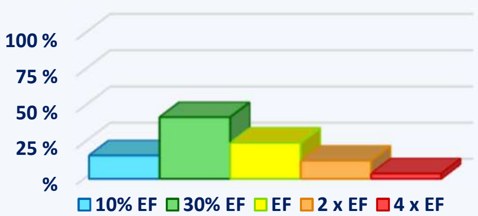
min: 0,00 kg CH4 /cow /day

max: 0,00 kg CH4 /cow /day

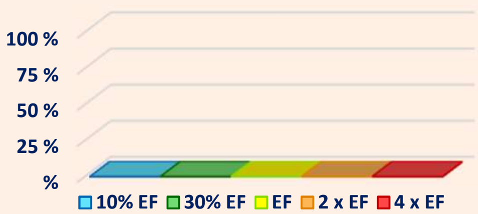
n: 0 emissions

min	max	min	max	min	max	min	max	min
0,00	0,19	0,19	0,30	0,30	0,45	0,45	0,65	0,65

► Nitrous oxide emissions (g N2O /cow /day)



Reference emission factor: EF = 1,8 g N2O /cow /day



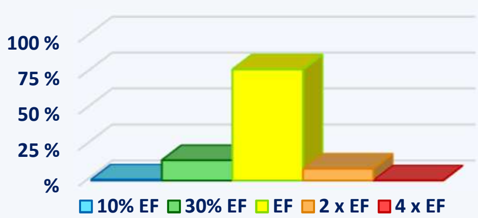
min: 0,00 g N2O /cow /day

max: 0,00 g N2O /cow /day

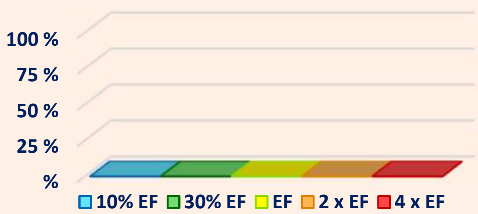
n: 0 emissions

min	max	min	max	min	max	min	max	min
0,00	0,23	0,23	0,91	0,91	2,73	2,73	6,14	6,14

► GHG emissions (kg eq CO2 /L milk)



Reference emission factor: EF = 0,40 kg eq CO2 /L milk



min: 0,00 kg eq CO2 /L milk

max: 0,00 kg eq CO2 /L milk

min	max	min	max	min	max	min	max	min
0,00	0,05	0,05	0,20	0,20	0,61	0,61	1,36	1,36

Farm 8 (Germany)

Survey of housing emissions (2021 - 2023)

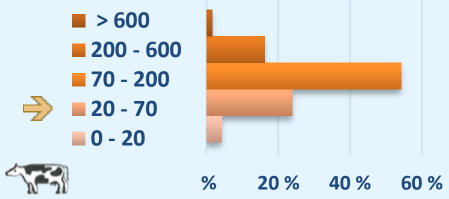
JLU

Farm visited by Lena Fehmer (2021 - 2022)

My farm vs the diversity of visited dairy units in all countries

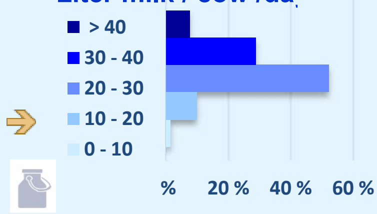
Tier	2b	2a	1	not used	total (3 gases)
nb obs.	0	0	2	10	12

lactating cows / house



43 - 56 cows

Liter milk / cow /day

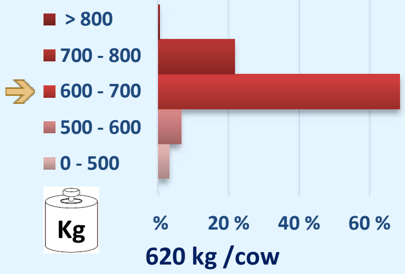


22 L milk /cow /day

The monitored dairy cows

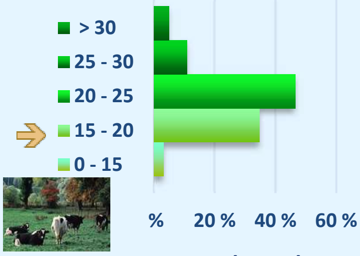
Farm 8

kg liveweight / cow



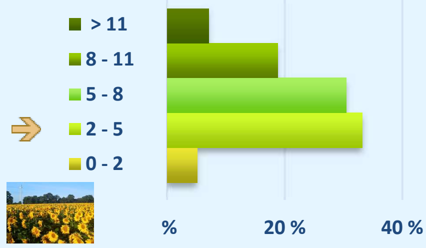
620 kg /cow

dry matter feed / cow /day



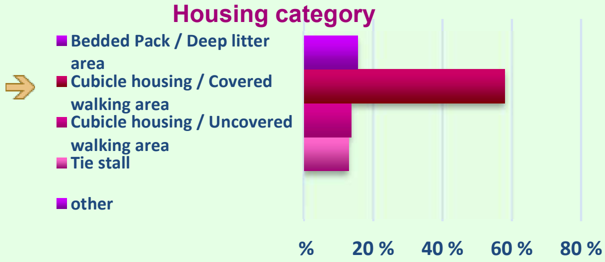
19 kg dry feed /cow /day

concentrate feed

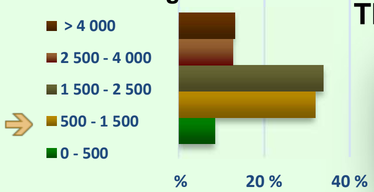


3 kg concentrate /cow /day

Housing category



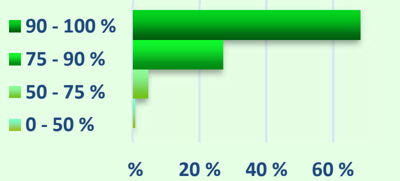
housing area



266,6 - 1174 m² /house

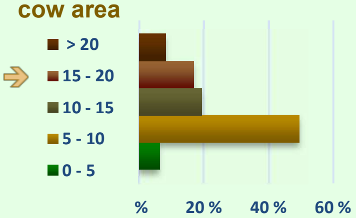
The monitored house

feed lactating cows (% feed all animals)



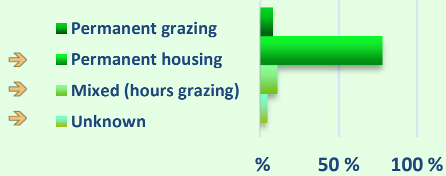
(no data)

cow area



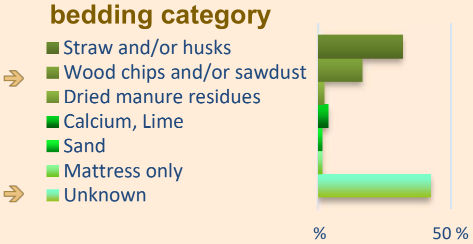
2,0 - 17,9 m² /lactating cow

grazing option

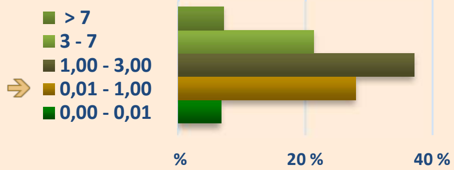


0 - 7 hours grazing /day

bedding category



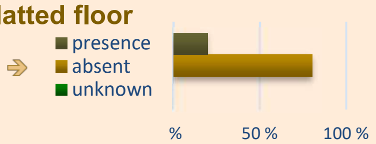
bedding input (kg bedding /cow /day)



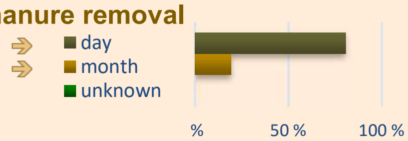
0,5 kg bedding /cow /day

The manure management

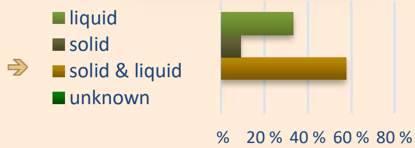
slatted floor



manure removal



Manure output



farming

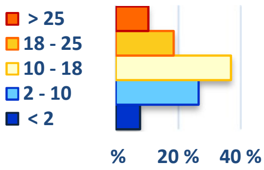
Farm 8 (Germany) JLU

FACCE ERA-GAS ERA-NET SUSAN ICT AGRI era-net

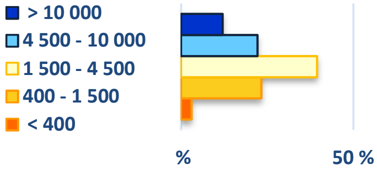
Take-home messages

the "house signature" could not be observed; when high ammonia emissions were repeatedly observed, improvements in manure management could be tested

Outdoor temperature (°C)



Ventilation (m3 /hour /cow)



Observed emissions

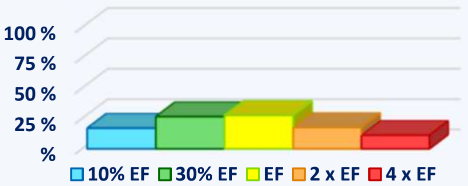
Observations in all countries

Observations in my farm

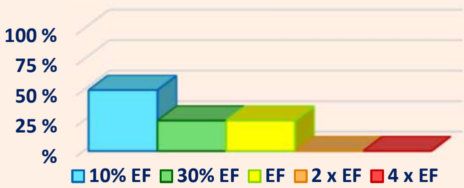
Outdoor temperature 9,5 - 12 °C

Ventilation 420 - 26000 m3 /hour /cow

► *Ammonia emissions (g NH3 /cow /day)*



Reference emission factor: EF = 30 g NH3 /cow /day



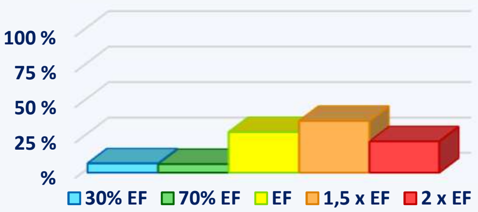
min: 1 g NH3 /cow /day

max: 17 g NH3 /cow /day

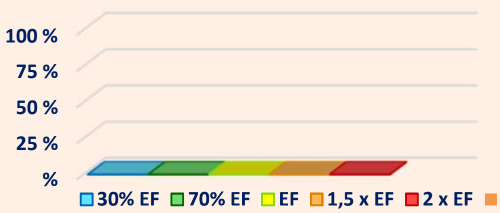
n: 4 emissions

min	max	min	max	min	max	min	max	min
0	4	4	15	15	45	45	101	101

► *kg CH4 /cow /day (kg CH4 /cow /day)*



Reference emission factor: EF = 0,38 kg CH4 /cow /day



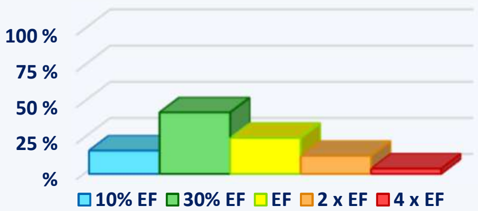
min: 0,00 kg CH4 /cow /day

max: 0,00 kg CH4 /cow /day

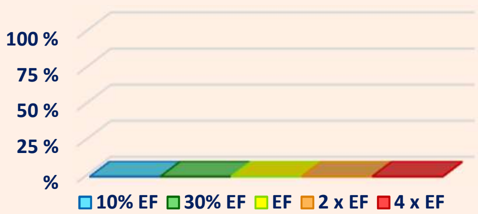
n: 0 emissions

min	max	min	max	min	max	min	max	min
0,00	0,19	0,19	0,30	0,30	0,45	0,45	0,65	0,65

► *Nitrous oxide emissions (g N2O /cow /day)*



Reference emission factor: EF = 1,8 g N2O /cow /day



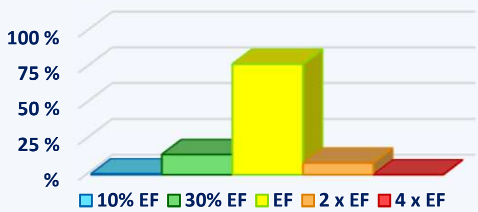
min: 0,00 g N2O /cow /day

max: 0,00 g N2O /cow /day

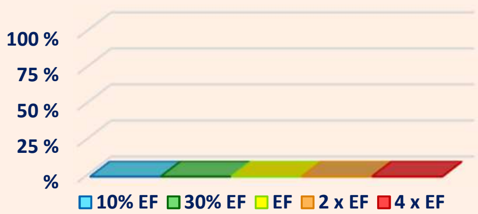
n: 0 emissions

min	max	min	max	min	max	min	max	min
0,00	0,23	0,23	0,91	0,91	2,73	2,73	6,14	6,14

► *GHG emissions (kg eq CO2 /L milk)*



Reference emission factor: EF = 0,40 kg eq CO2 /L milk



min: 0,00 kg eq CO2 /L milk

max: 0,00 kg eq CO2 /L milk

min	max	min	max	min	max	min	max	min
0,00	0,05	0,05	0,20	0,20	0,61	0,61	1,36	1,36

Farm 9 (Germany)

Survey of housing emissions (2021 - 2023)

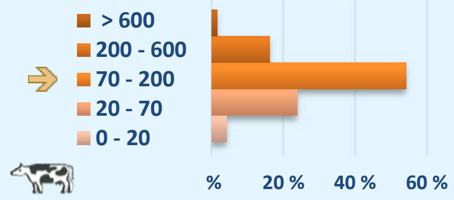
JLU

Farm visited by Lena Fehmer (2021 - 2022)

My farm vs the diversity of visited dairy units in all countries

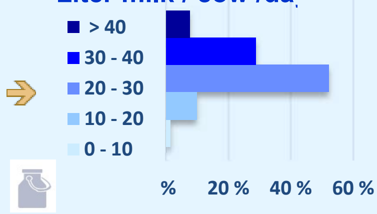
Tier	2b	2a	1	not used	total (3 gases)
nb obs.	0	0	2	10	12

lactating cows / house



76 - 82 cows

Liter milk / cow /day

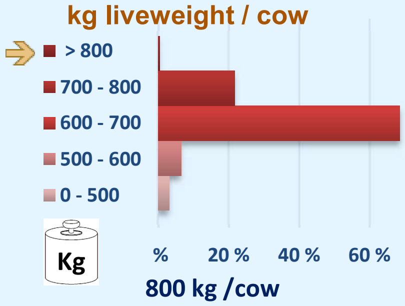


27 L milk /cow /day

The monitored dairy cows

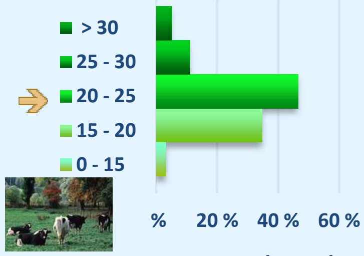
Farm 9

kg liveweight / cow



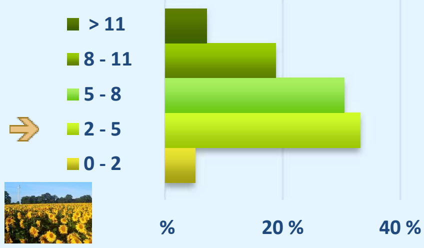
800 kg /cow

dry matter feed / cow /day



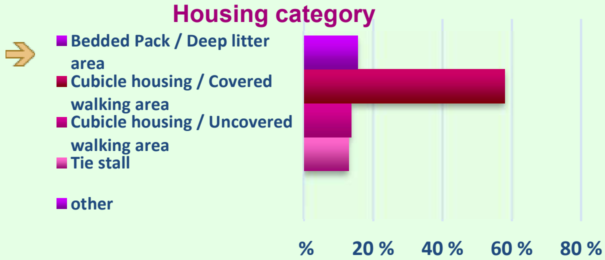
20 - 20 kg dry feed /cow /day

concentrate feed

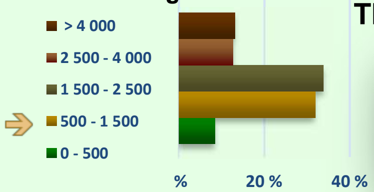


5 kg concentrate /cow /day

Housing category



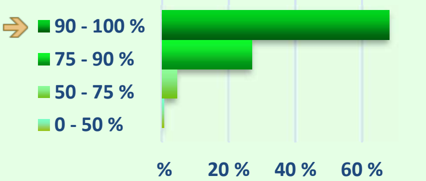
housing area



1418 m² /house

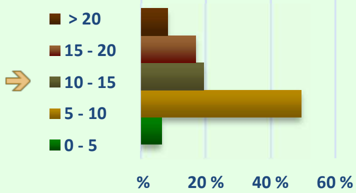
The monitored house

feed lactating cows (% feed all animals)



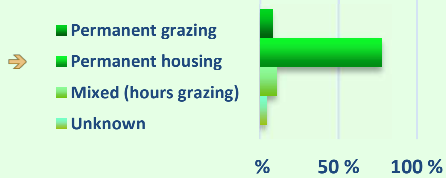
100 % total house

cow area

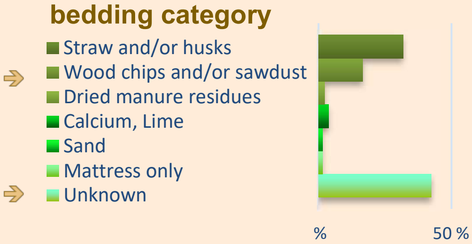


13,4 - 14,4 m² /lactating cow

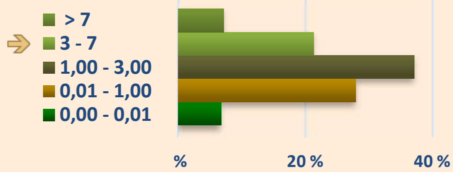
grazing option



bedding category



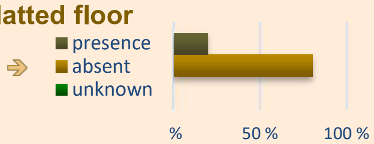
bedding input (kg bedding /cow /day)



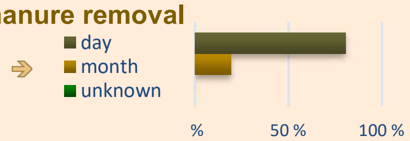
2,0 - 4,0 kg bedding /cow /day

The manure management

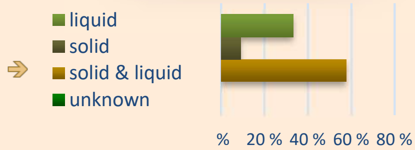
slatted floor



manure removal



Manure output



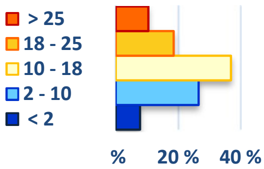
Farm 9 (Germany) JLU

FACCE ERA-GAS · ERA-NET SUSAN · ICT-AGRI era-net

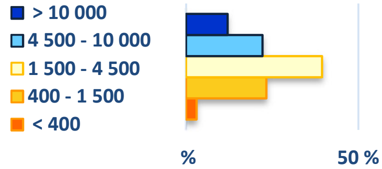
Take-home messages

the "house signature" could not be observed; when high ammonia emissions were repeatedly observed, improvements in manure management could be tested

Outdoor temperature (°C)



Ventilation (m3 /hour /cow)



Observed emissions

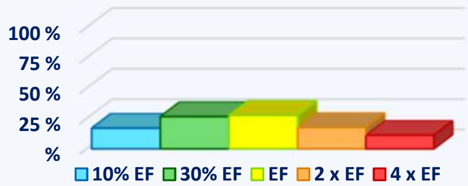
Observations in all countries

Observations in my farm

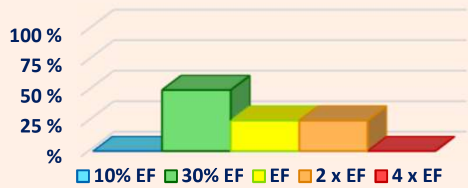
Outdoor temperature 4,5 - 27 °C

Ventilation 4 200 - 9900 m3 /hour /cow

► *Ammonia emissions (g NH3 /cow /day)*



Reference emission factor: EF = 30 g NH3 /cow /day



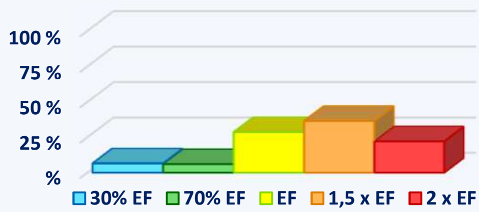
min: 5 g NH3 /cow /day

max: 76 g NH3 /cow /day

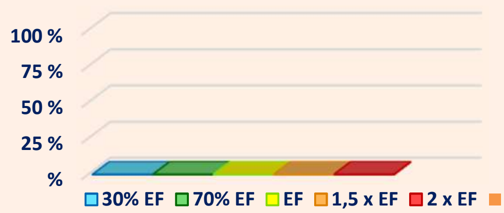
n: 4 emissions

min	max	min	max	min	max	min	max	min
0	4	4	15	15	45	45	101	101

► *kg CH4 /cow /day (kg CH4 /cow /day)*



Reference emission factor: EF = 0,38 kg CH4 /cow /day



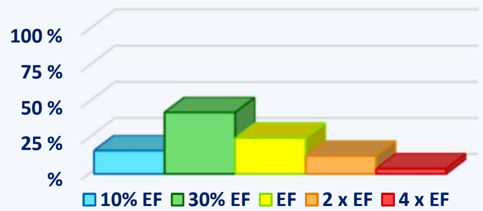
min: 0,00 kg CH4 /cow /day

max: 0,00 kg CH4 /cow /day

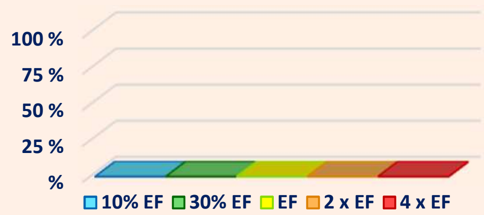
n: 0 emissions

min	max	min	max	min	max	min	max	min
0,00	0,19	0,19	0,30	0,30	0,45	0,45	0,65	0,65

► *Nitrous oxide emissions (g N2O /cow /day)*



Reference emission factor: EF = 1,8 g N2O /cow /day



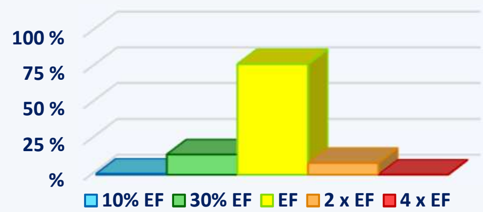
min: 0,00 g N2O /cow /day

max: 0,00 g N2O /cow /day

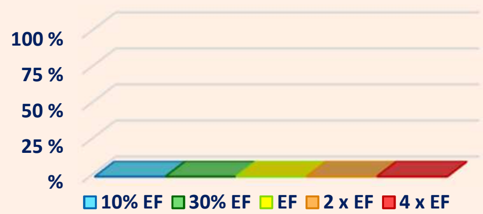
n: 0 emissions

min	max	min	max	min	max	min	max	min
0,00	0,23	0,23	0,91	0,91	2,73	2,73	6,14	6,14

► *GHG emissions (kg eq CO2 /L milk)*



Reference emission factor: EF = 0,40 kg eq CO2 /L milk



min: 0,00 kg eq CO2 /L milk

max: 0,00 kg eq CO2 /L milk

min	max	min	max	min	max	min	max	min
0,00	0,05	0,05	0,20	0,20	0,61	0,61	1,36	1,36

Farm 10 (Germany)

Survey of housing emissions (2021 - 2023)

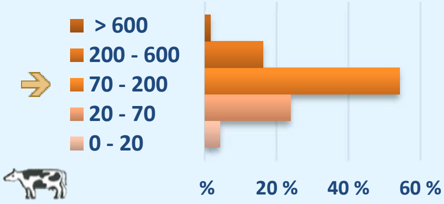
JLU

Farm visited by Lena Fehmer (2021 - 2022)

My farm vs the diversity of visited dairy units in all countries

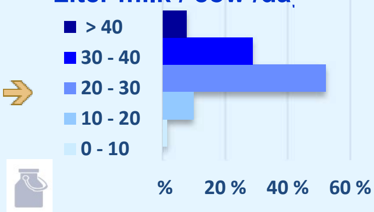
Tier	2b	2a	1	not used	total (3 gases)
nb obs.	0	1	4	7	12

lactating cows / house



68 - 77 cows

Liter milk / cow /day

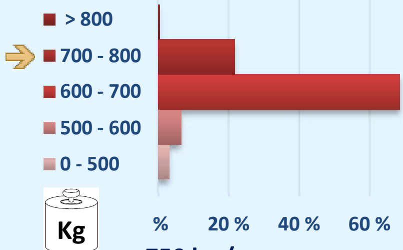


31 L milk /cow /day

The monitored dairy cows

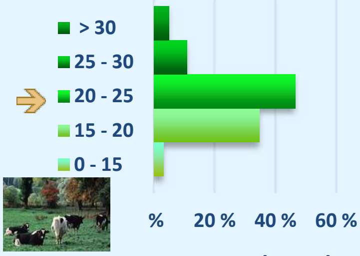
Farm 10

kg liveweight / cow



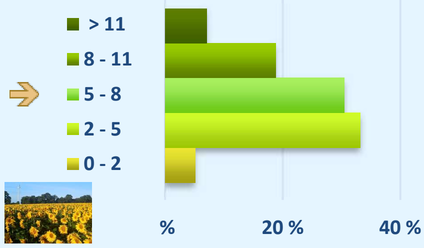
750 kg /cow

dry matter feed / cow /day



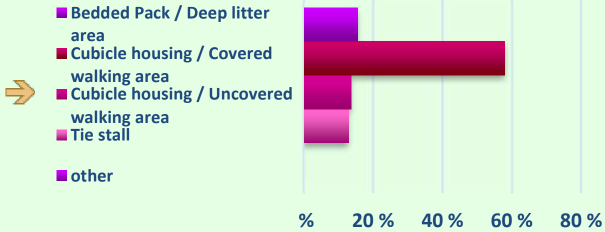
19 - 22 kg dry feed /cow /day

concentrate feed

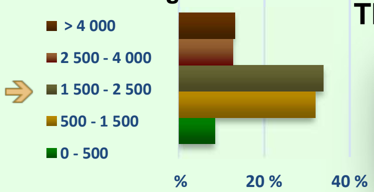


5 - 7 kg concentrate /cow /day

Housing category



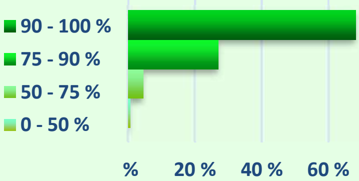
housing area



1927,24 m² /house

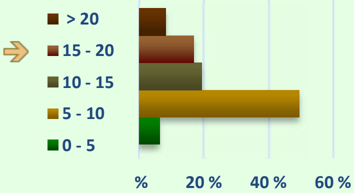
The monitored house

feed lactating cows (% feed all animals)



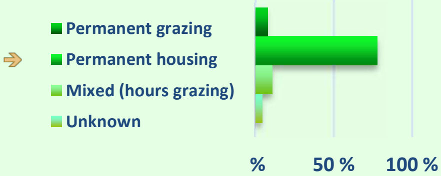
(no data)

cow area

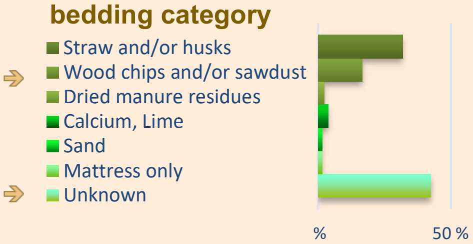


14,8 - 16,8 m² /lactating cow

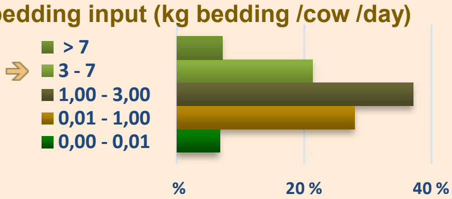
grazing option



bedding category



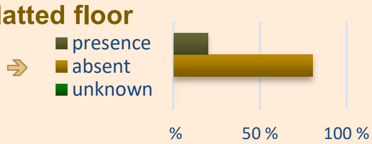
bedding input (kg bedding /cow /day)



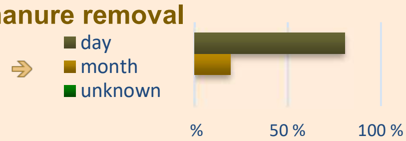
2,0 - 7,0 kg bedding /cow /day

The manure management

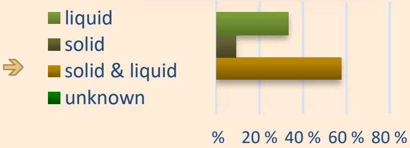
slatted floor



manure removal



Manure output

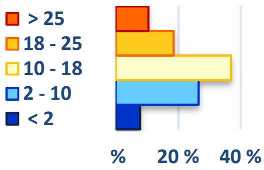


Farm 10 (Germany) JLU

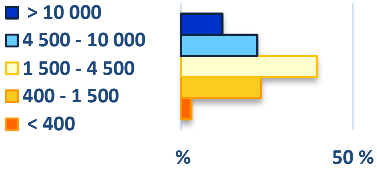
Take-home messages

the "house signature" could not be observed; when high ammonia emissions were repeatedly observed, improvements in manure management could be tested

Outdoor temperature (°C)



Ventilation (m3 /hour /cow)



Observed emissions

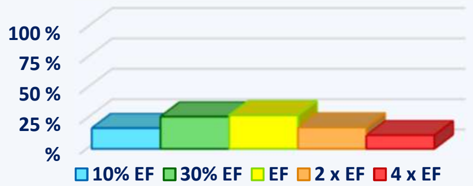
Observations in all countries

Observations in my farm

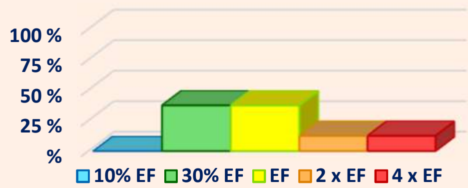
Outdoor temperature 3,2 - 28 °C

Ventilation 1 300 - 40000 m3 /hour /cow

► ***Ammonia emissions (g NH3 /cow /day)***



Reference emission factor: EF = 30 g NH3 /cow /day



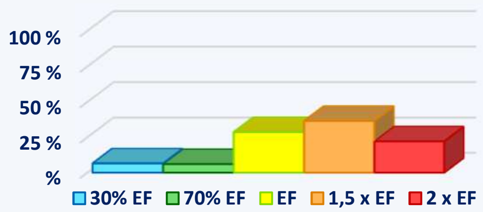
min: 4 g NH3 /cow /day

max: 120 g NH3 /cow /day

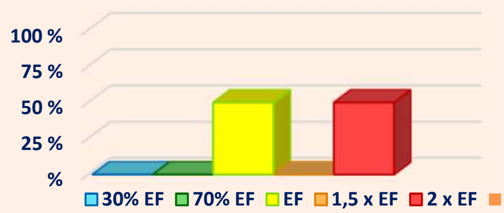
n: 8 emissions

min	max	min	max	min	max	min	max	min
0	4	4	15	15	45	45	101	101

► ***kg CH4 /cow /day (kg CH4 /cow /day)***



Reference emission factor: EF = 0,38 kg CH4 /cow /day



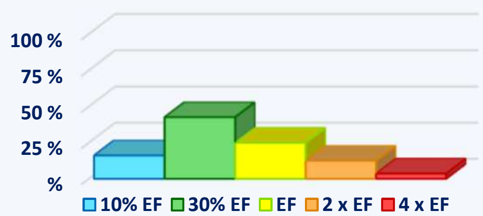
min: 0,4 kg CH4 /cow /day

max: 0,7 kg CH4 /cow /day

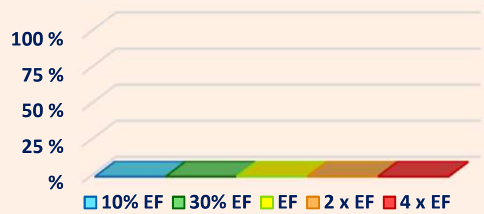
n: 2 emissions

min	max	min	max	min	max	min	max	min
0,00	0,19	0,19	0,30	0,30	0,45	0,45	0,65	0,65

► ***Nitrous oxide emissions (g N2O /cow /day)***



Reference emission factor: EF = 1,8 g N2O /cow /day



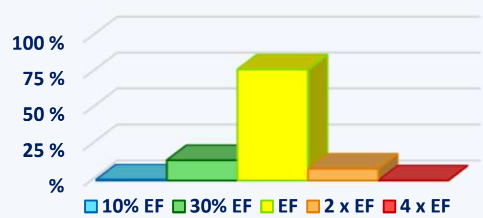
min: 0,00 g N2O /cow /day

max: 0,00 g N2O /cow /day

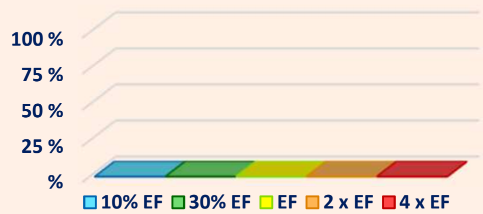
n: 0 emissions

min	max	min	max	min	max	min	max	min
0,00	0,23	0,23	0,91	0,91	2,73	2,73	6,14	6,14

► ***GHG emissions (kg eq CO2 /L milk)***



Reference emission factor: EF = 0,40 kg eq CO2 /L milk



min: 0,00 kg eq CO2 /L milk

max: 0,00 kg eq CO2 /L milk

min	max	min	max	min	max	min	max	min
0,00	0,05	0,05	0,20	0,20	0,61	0,61	1,36	1,36

Farm 11 (Germany)

Survey of housing emissions (2021 - 2023)

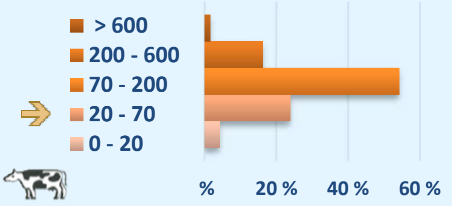
JLU

Farm visited by Lena Fehmer (2021 - 2022)

My farm vs the diversity of visited dairy units in all countries

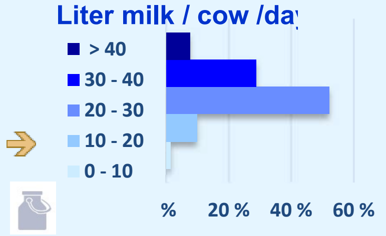
Tier	2b	2a	1	not used	total (3 gases)
nb obs.	0	1	4	7	12

lactating cows / house



51 - 57 cows

Liter milk / cow /day

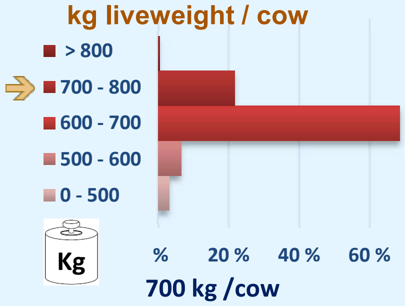


23 L milk /cow /day

The monitored dairy cows

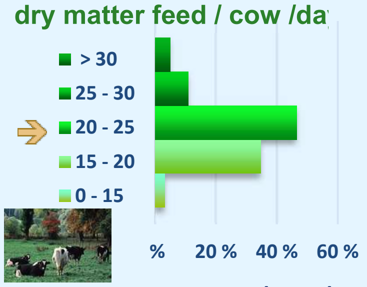
Farm 11

kg liveweight / cow



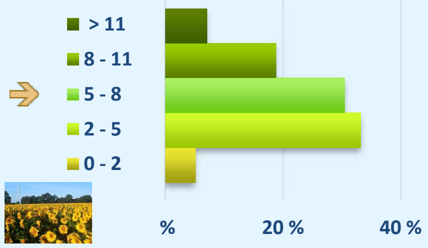
700 kg /cow

dry matter feed / cow /day



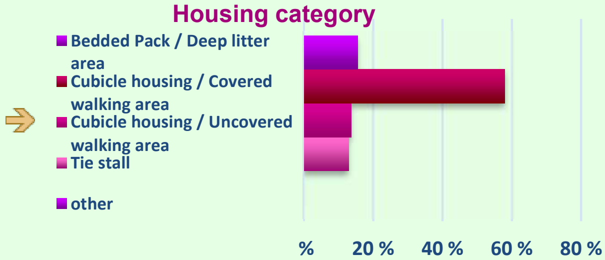
20 - 22 kg dry feed /cow /day

concentrate feed

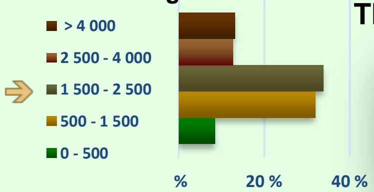


4 - 5 kg concentrate /cow /day

Housing category



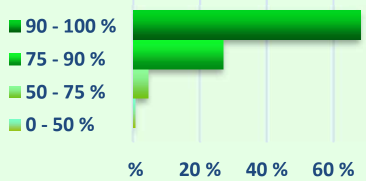
housing area



1575,02 m² /house

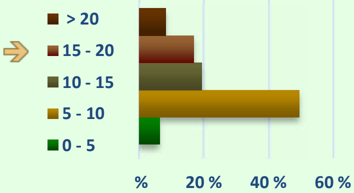
The monitored house

feed lactating cows (% feed all animals)



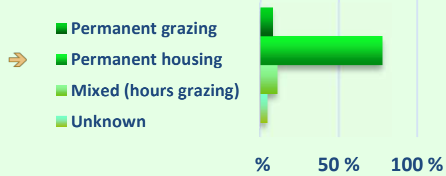
(no data)

cow area

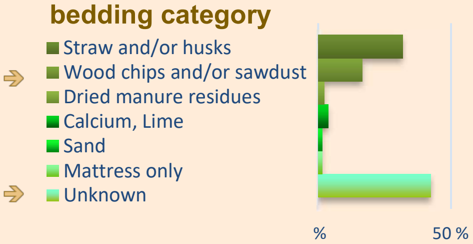


17,6 - 19,6 m² /lactating cow

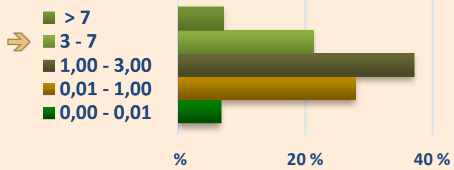
grazing option



bedding category



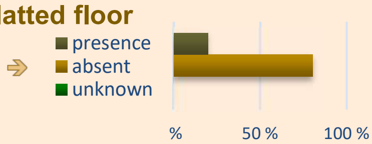
bedding input (kg bedding /cow /day)



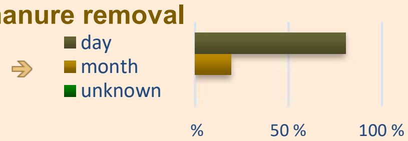
0,4 - 8,7 kg bedding /cow /day

The manure management

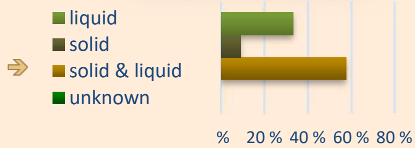
slatted floor



manure removal



Manure output

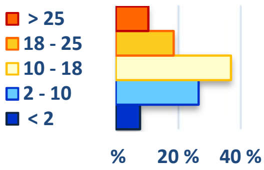


Farm 11 (Germany) JLU

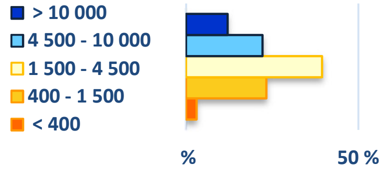
Take-home messages

the "house signature" could not be observed; when high ammonia emissions were repeatedly observed, improvements in manure management could be tested

Outdoor temperature (°C)



Ventilation (m3 /hour /cow)



Observed emissions

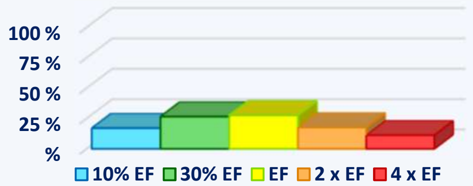
Observations in all countries

Observations in my farm

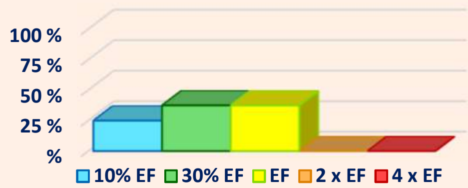
Outdoor temperature 7,6 - 26 °C

Ventilation 2 600 - 29000 m3 /hour /cow

► *Ammonia emissions (g NH3 /cow /day)*



Reference emission factor: EF = 30 g NH3 /cow /day



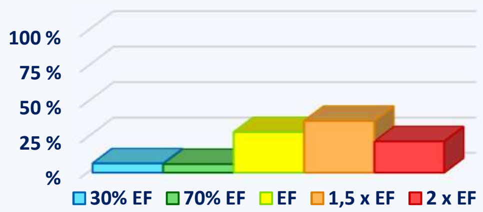
min: 3 g NH3 /cow /day

max: 24 g NH3 /cow /day

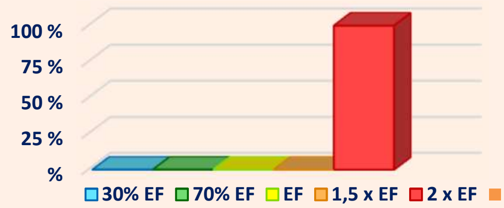
n: 8 emissions

min	max	min	max	min	max	min	max	min
0	4	4	15	15	45	45	101	101

► *kg CH4 /cow /day (kg CH4 /cow /day)*



Reference emission factor: EF = 0,38 kg CH4 /cow /day



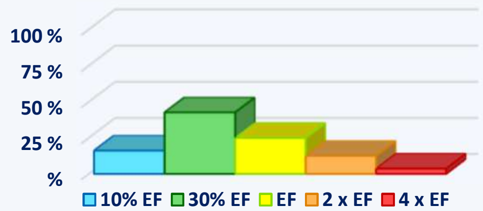
min: 0,7 kg CH4 /cow /day

max: 1 kg CH4 /cow /day

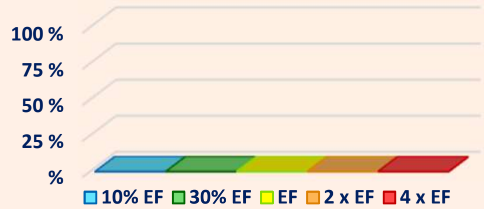
n: 2 emissions

min	max	min	max	min	max	min	max	min
0,00	0,19	0,19	0,30	0,30	0,45	0,45	0,65	0,65

► *Nitrous oxide emissions (g N2O /cow /day)*



Reference emission factor: EF = 1,8 g N2O /cow /day



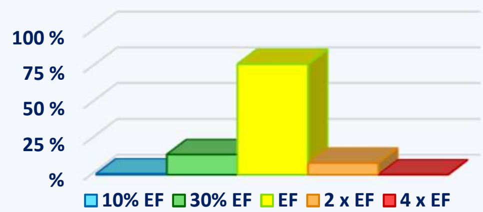
min: 0,00 g N2O /cow /day

max: 0,00 g N2O /cow /day

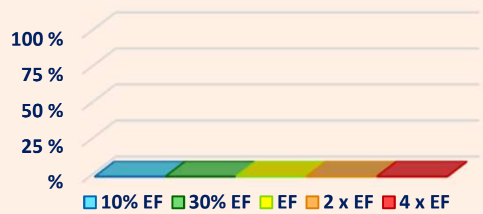
n: 0 emissions

min	max	min	max	min	max	min	max	min
0,00	0,23	0,23	0,91	0,91	2,73	2,73	6,14	6,14

► *GHG emissions (kg eq CO2 /L milk)*



Reference emission factor: EF = 0,40 kg eq CO2 /L milk



min: 0,00 kg eq CO2 /L milk

max: 0,00 kg eq CO2 /L milk

min	max	min	max	min	max	min	max	min
0,00	0,05	0,05	0,20	0,20	0,61	0,61	1,36	1,36

Farm 12 (Germany)

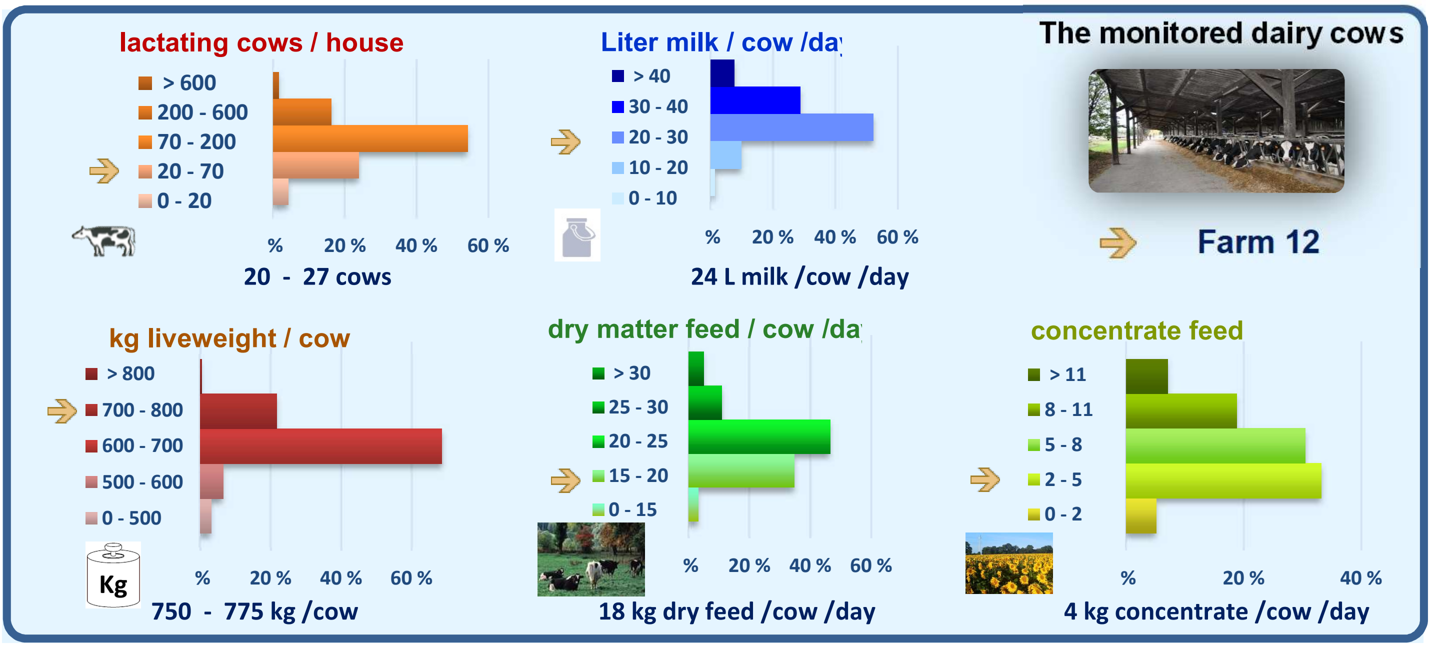
Survey of housing emissions (2021 - 2023)

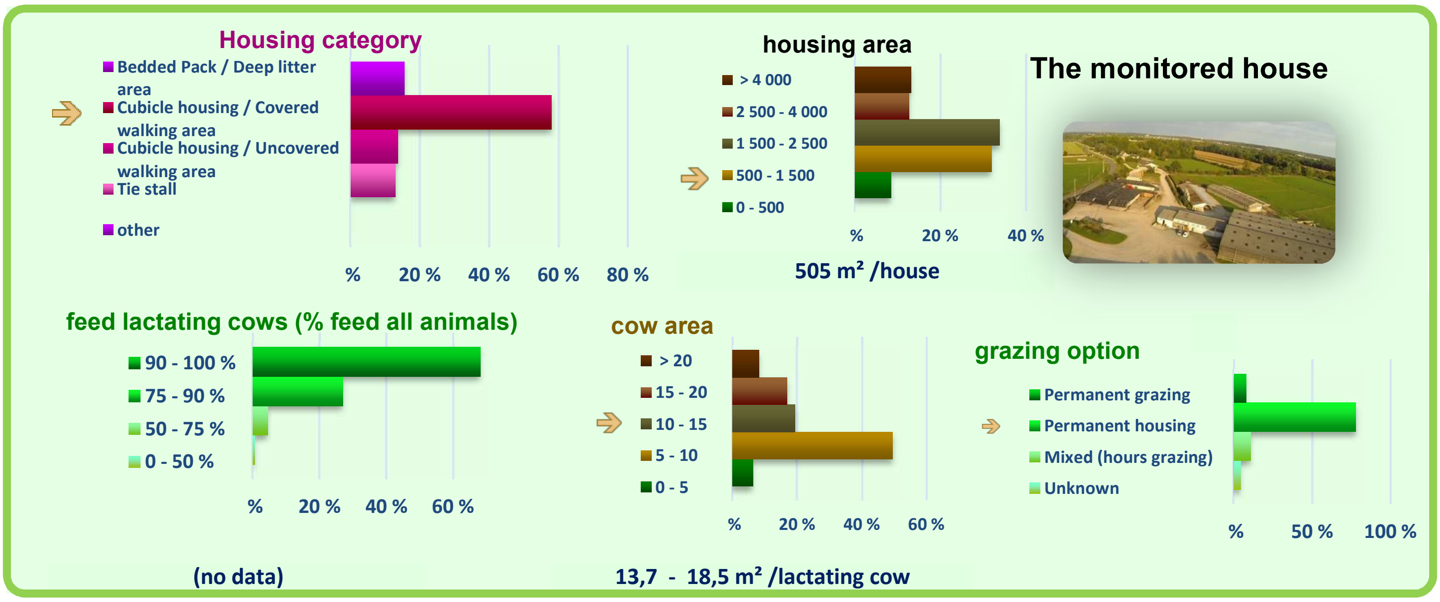
JLU

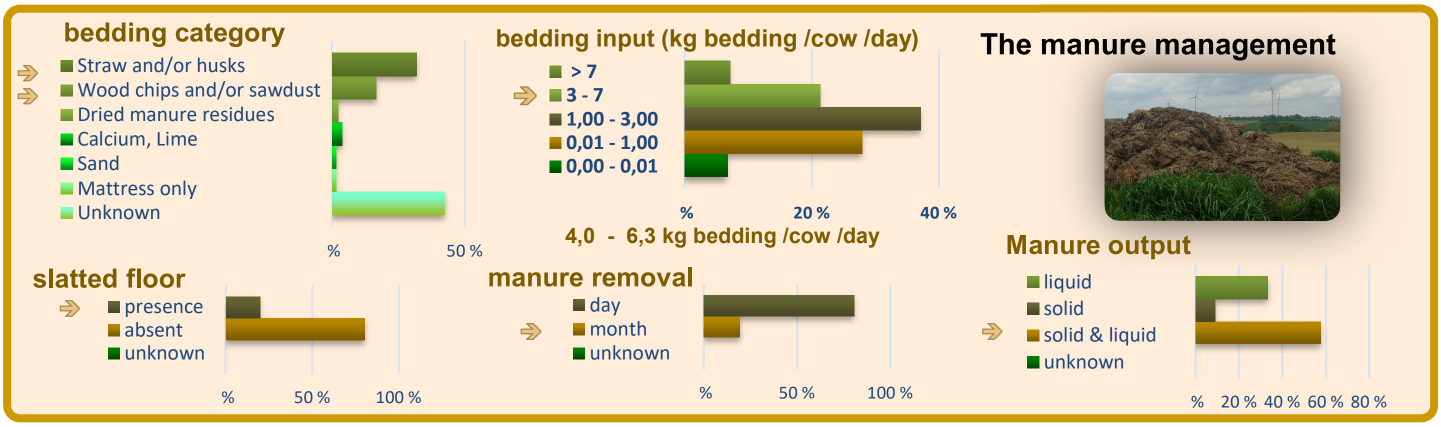
Farm visited by Lena Fehmer (2021 - 2022)

My farm vs the diversity of visited dairy units in all countries

Tier	2b	2a	1	not used	total (3 gases)
nb obs.	0	0	4	8	12





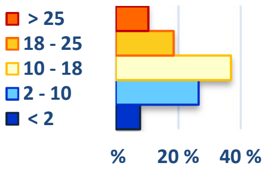


Farm 12 (Germany) JLU

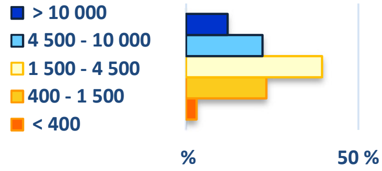
Take-home messages

the "house signature" could not be observed; when high ammonia emissions were repeatedly observed, improvements in manure management could be tested

Outdoor temperature (°C)



Ventilation (m3 /hour /cow)



Observed emissions

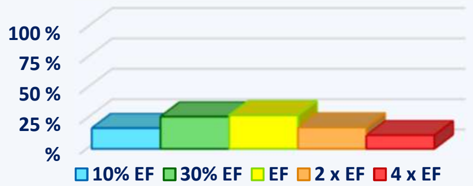
Observations in all countries

Observations in my farm

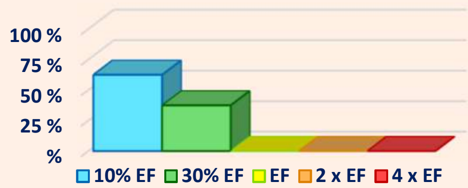
Outdoor temperature 5,0 - 22 °C

Ventilation 790 - 6400 m3 /hour /cow

► ***Ammonia emissions (g NH3 /cow /day)***



Reference emission factor: EF = 30 g NH3 /cow /day



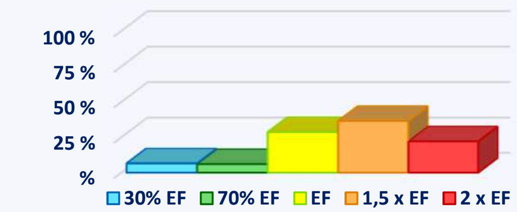
min: 1 g NH3 /cow /day

max: 11 g NH3 /cow /day

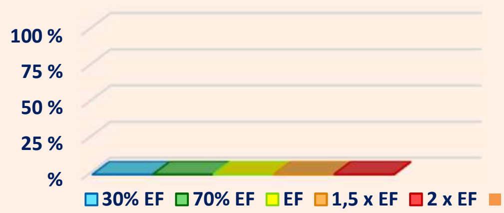
n: 8 emissions

min	max	min	max	min	max	min	max	min
0	4	4	15	15	45	45	101	101

► ***kg CH4 /cow /day (kg CH4 /cow /day)***



Reference emission factor: EF = 0,38 kg CH4 /cow /day



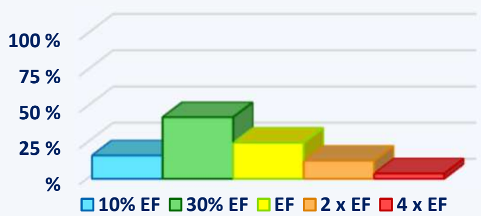
min: 0,00 kg CH4 /cow /day

max: 0,00 kg CH4 /cow /day

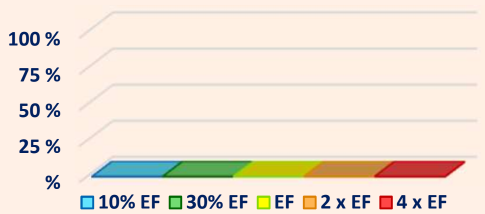
n: 0 emissions

min	max	min	max	min	max	min	max	min
0,00	0,19	0,19	0,30	0,30	0,45	0,45	0,65	0,65

► ***Nitrous oxide emissions (g N2O /cow /day)***



Reference emission factor: EF = 1,8 g N2O /cow /day



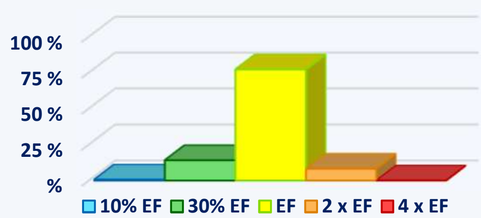
min: 0,00 g N2O /cow /day

max: 0,00 g N2O /cow /day

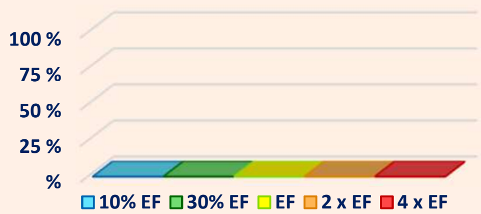
n: 0 emissions

min	max	min	max	min	max	min	max	min
0,00	0,23	0,23	0,91	0,91	2,73	2,73	6,14	6,14

► ***GHG emissions (kg eq CO2 /L milk)***



Reference emission factor: EF = 0,40 kg eq CO2 /L milk



min: 0,00 kg eq CO2 /L milk

max: 0,00 kg eq CO2 /L milk

min	max	min	max	min	max	min	max	min
0,00	0,05	0,05	0,20	0,20	0,61	0,61	1,36	1,36

Farm 13 (Germany)

Survey of housing emissions (2021 - 2023)

JLU

Farm visited by Lena Fehmer (2021)

My farm vs the diversity of visited dairy units in all countries

Tier	2b	2a	1	not used	total (3 gases)
nb obs.	0	0	3	9	12

lactating cows / house

> 600
200 - 600
70 - 200
20 - 70
0 - 20

% 20 % 40 % 60 %

45 - 47 cows

Liter milk / cow /day

> 40
30 - 40
20 - 30
10 - 20
0 - 10

% 20 % 40 % 60 %

31 L milk /cow /day

The monitored dairy cows

Farm 13

kg liveweight / cow

> 800
700 - 800
600 - 700
500 - 600
0 - 500

Kg

% 20 % 40 % 60 %

680 kg /cow

dry matter feed / cow /day

> 30
25 - 30
20 - 25
15 - 20
0 - 15

% 20 % 40 % 60 %

17 kg dry feed /cow /day

concentrate feed

> 11
8 - 11
5 - 8
2 - 5
0 - 2

% 20 % 40 %

4 kg concentrate /cow /day

Housing category

Bedded Pack / Deep litter area
Cubicle housing / Covered walking area
Cubicle housing / Uncovered walking area
Tie stall
other

% 20 % 40 % 60 % 80 %

housing area

> 4 000
2 500 - 4 000
1 500 - 2 500
500 - 1 500
0 - 500

% 20 % 40 %

442 m² /house

The monitored house

feed lactating cows (% feed all animals)

90 - 100 %
75 - 90 %
50 - 75 %
0 - 50 %

% 20 % 40 % 60 %

100 % total house

cow area

> 20
15 - 20
10 - 15
5 - 10
0 - 5

% 20 % 40 % 60 %

8,0 m² /lactating cow

grazing option

Permanent grazing
Permanent housing
Mixed (hours grazing)
Unknown

% 50 % 100 %

0 - 7 hours grazing /day

bedding category

Straw and/or husks
Wood chips and/or sawdust
Dried manure residues
Calcium, Lime
Sand
Mattress only
Unknown

% 50 %

bedding input (kg bedding /cow /day)

> 7
3 - 7
1,00 - 3,00
0,01 - 1,00
0,00 - 0,01

% 20 % 40 %

5,0 - 7,5 kg bedding /cow /day

The manure management

slatted floor

presence
absent
unknown

% 50 % 100 %

manure removal

day
month
unknown

% 50 % 100 %

Manure output

liquid
solid
solid & liquid
unknown

% 20 % 40 % 60 % 80 %

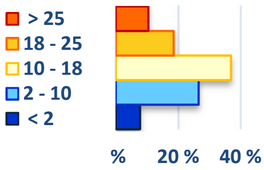
Farm 13 (Germany) JLU

FACCE ERA-GAS | ERA-NET SUSAN | ICT AGRI era-net

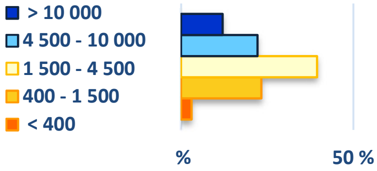
Take-home messages

the "house signature" could not be observed; when high ammonia emissions were repeatedly observed, improvements in manure management could be tested

Outdoor temperature (°C)



Ventilation (m3 /hour /cow)



Observed emissions

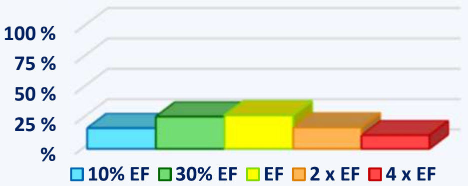
Observations in all countries

Observations in my farm

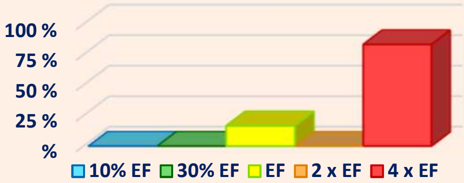
Outdoor temperature 2,0 - 16 °C

Ventilation 3 700 - 89000 m3 /hour /cow

► *Ammonia emissions (g NH3 /cow /day)*



Reference emission factor: EF = 30 g NH3 /cow /day



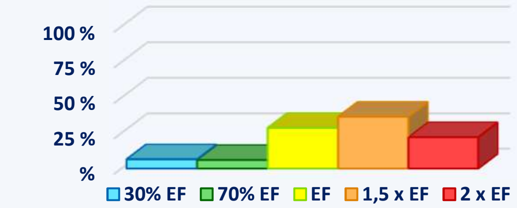
min: 37 g NH3 /cow /day

max: 450 g NH3 /cow /day

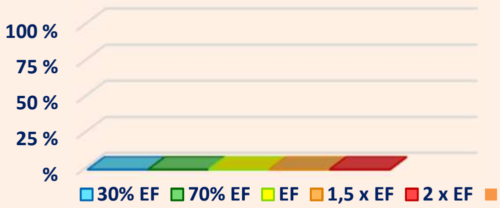
n: 6 emissions

min	max	min	max	min	max	min	max	min
0	4	4	15	15	45	45	101	101

► *kg CH4 /cow /day (kg CH4 /cow /day)*



Reference emission factor: EF = 0,38 kg CH4 /cow /day



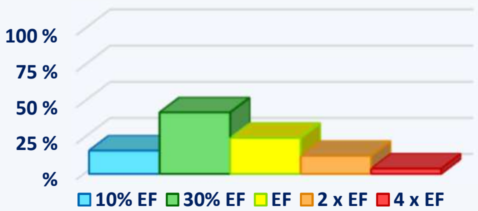
min: 0,00 kg CH4 /cow /day

max: 0,00 kg CH4 /cow /day

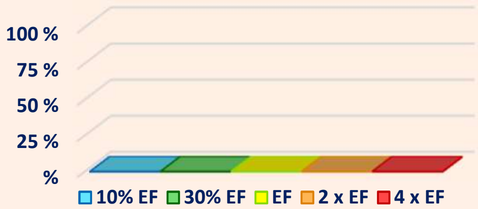
n: 0 emissions

min	max	min	max	min	max	min	max	min
0,00	0,19	0,19	0,30	0,30	0,45	0,45	0,65	0,65

► *Nitrous oxide emissions (g N2O /cow /day)*



Reference emission factor: EF = 1,8 g N2O /cow /day



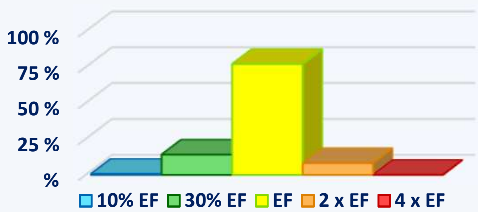
min: 0,00 g N2O /cow /day

max: 0,00 g N2O /cow /day

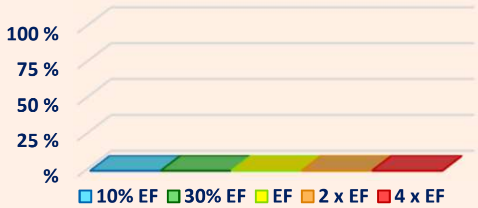
n: 0 emissions

min	max	min	max	min	max	min	max	min
0,00	0,23	0,23	0,91	0,91	2,73	2,73	6,14	6,14

► *GHG emissions (kg eq CO2 /L milk)*



Reference emission factor: EF = 0,40 kg eq CO2 /L milk



min: 0,00 kg eq CO2 /L milk

max: 0,00 kg eq CO2 /L milk

min	max	min	max	min	max	min	max	min
0,00	0,05	0,05	0,20	0,20	0,61	0,61	1,36	1,36

Ferme 1 (France)

évaluation des émissions en élevage (2021 - 2023)

Idele

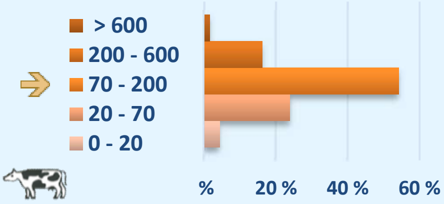
ferme visitée par Xavier Vergé (2021 - 2022)

Ma ferme et la diversité des exploitations enquêtées dans tous les pays

Tier	2b	2a	1	not used	total (3 gases)
nb obs.	5	4	2	1	12

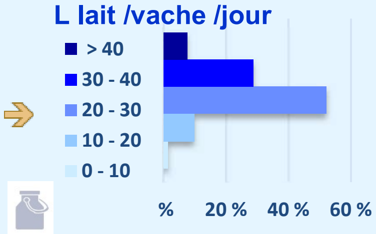
Le troupeau laitier

vaches laitières / bâtiment



72 - 87 vaches

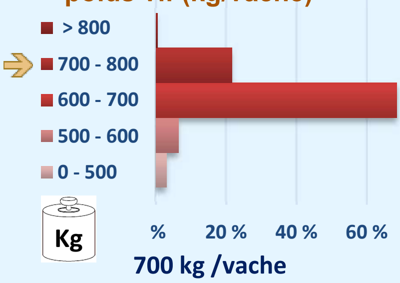
L lait /vache /jour



31 L lait /vache /jour

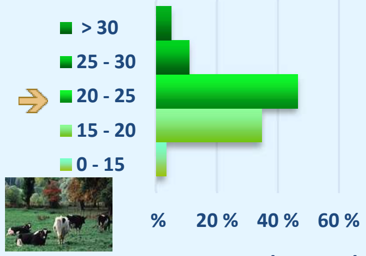
Ferme 1

poids vif (kg/vache)



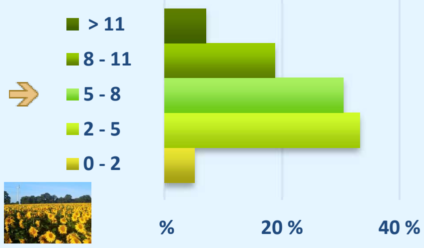
700 kg /vache

MS aliment /vache /jour



23 - 24 kg MS aliment /vache /jour

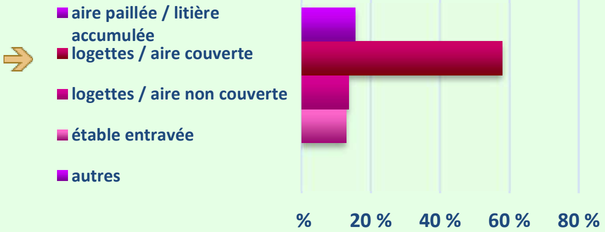
concentré



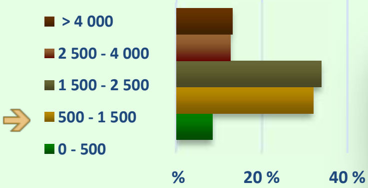
5 - 6 kg concentré /vache /jour

Le bâtiment

type de bâtiment

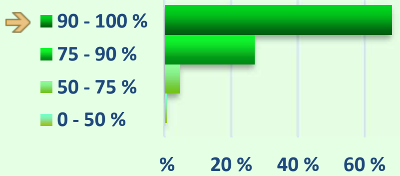


surface du bâtiment



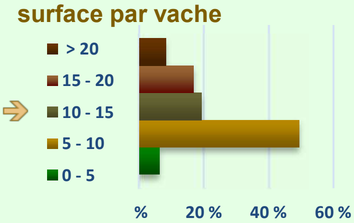
1020 - 1590 m² /bâtiment

part alimentation donnée aux vaches laiti



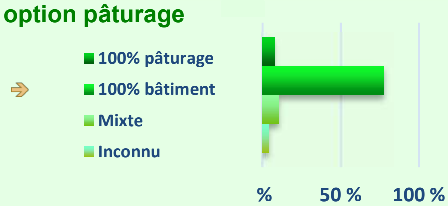
90 - 100 % total bâtiment

surface par vache



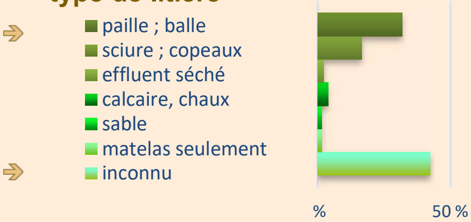
9,8 - 11,8 m² /vache en lactation

option pâturage

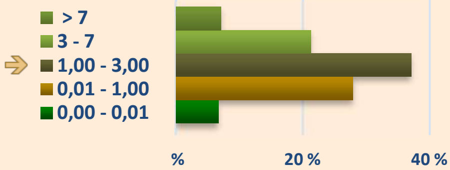


La gestion des effluents

type de litière

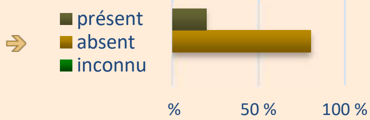


apport de litière (kg litière /vache /jour)

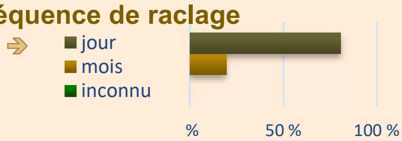


1,9 kg litière /vache /jour

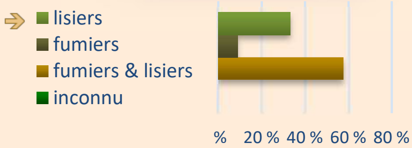
caillebotis



fréquence de raclage



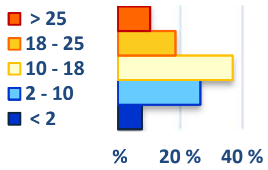
Types d'effluents

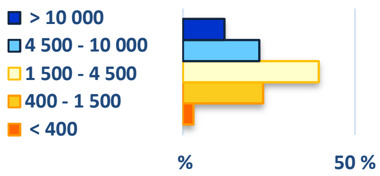


Ferme 1 (France) Idele

à retenir...

- Emissions of ammonia and methane are similar to the population;
- The risk of occasionally high nitrous oxide emission should be further studied





Emissions observées

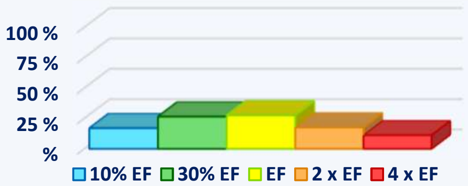
Observations dans tous les pays

Observations dans ma ferme

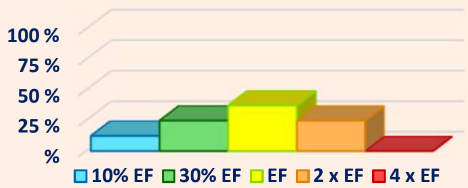
Température extérieure 10 - 29 °C

Débit d'air 1 500 - 29000 m3 /heure /vache

► *Emissions d'ammoniac (g NH3 /vache /jour)*



Facteur d'émission moyen: EF = 30 g NH3 /vache /jour



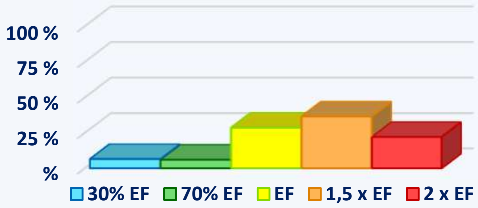
min: 3 g NH3 /vache /jour

max: 63 g NH3 /vache /jour

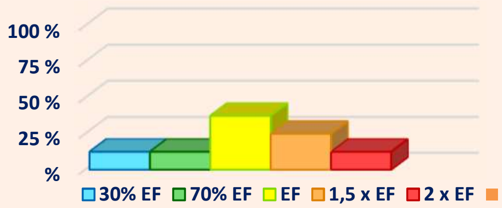
n: 8 emissions

min	max	min	max	min	max	min	max	min
0	4	4	15	15	45	45	101	101

► *kg CH4 /vache /jour (kg CH4 /vache /jour)*



Facteur d'émission moyen: EF = 0,38 kg CH4 /vache /jour



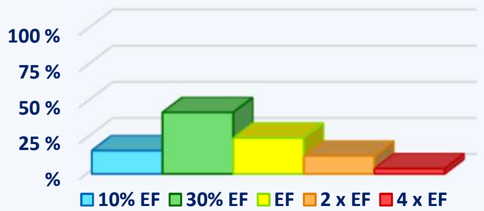
min: 0,2 kg CH4 /vache /jour

max: 0,7 kg CH4 /vache /jour

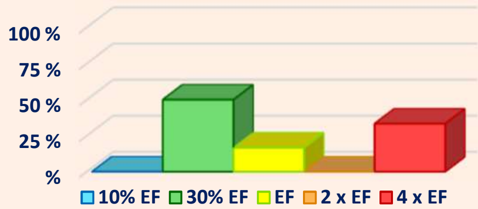
n: 8 emissions

min	max	min	max	min	max	min	max	min
0,00	0,19	0,19	0,30	0,30	0,45	0,45	0,65	0,65

► *Protoxyde d'azote (g N2O /vache /jour)*



Facteur d'émission moyen: EF = 1,8 g N2O /vache /jour



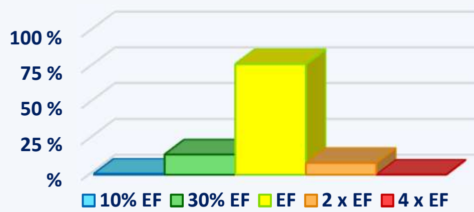
min: 0,3 g N2O /vache /jour

max: 13 g N2O /vache /jour

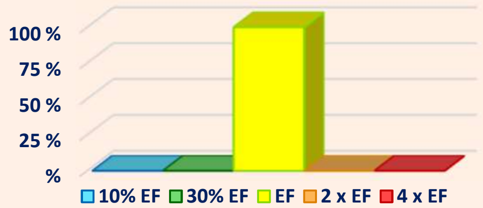
n: 6 emissions

min	max	min	max	min	max	min	max	min
0,00	0,23	0,23	0,91	0,91	2,73	2,73	6,14	6,14

► *Emissions de GES (kg eq CO2 /L lait)*



Facteur d'émission moyen: EF = 0,40 kg eq CO2 /L lait



min: 0,2 kg eq CO2 /L lait

max: 0,5 kg eq CO2 /L lait

min	max	min	max	min	max	min	max	min
0,00	0,05	0,05	0,20	0,20	0,61	0,61	1,36	1,36

Ferme 2 (France)

évaluation des émissions en élevage (2021 - 2023)

Idele

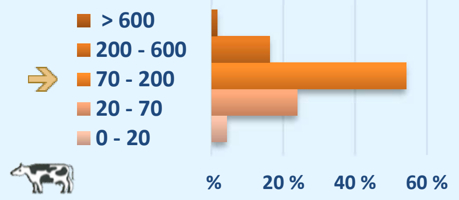
ferme visitée par Xavier Vergé (2021 - 2022)

Ma ferme et la diversité des exploitations enquêtées dans tous les pays

Tier	2b	2a	1	not used	total (3 gases)
nb obs.	6	4	0	2	12

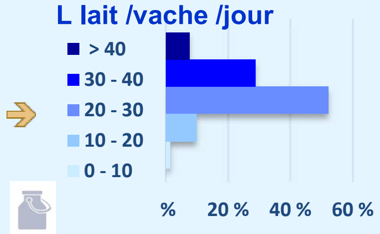
Le troupeau laitier

vaches laitières / bâtiment



87 - 88 vaches

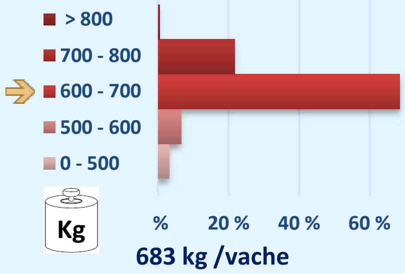
L lait /vache /jour



23 L lait /vache /jour

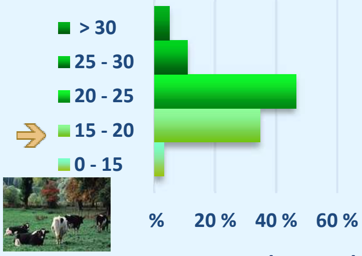
Ferme 2

poids vif (kg/vache)



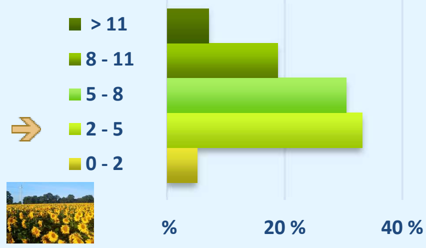
683 kg /vache

MS aliment /vache /jour



17 - 19 kg MS aliment /vache /jour

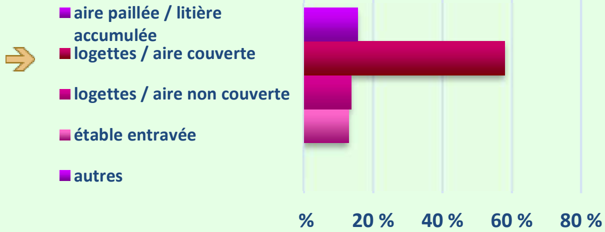
concentré



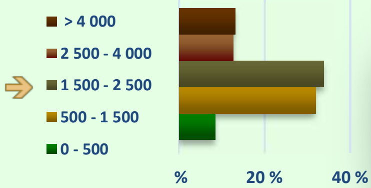
0 - 5 kg concentré /vache /jour

Le bâtiment

type de bâtiment

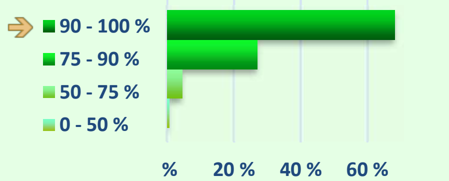


surface du bâtiment



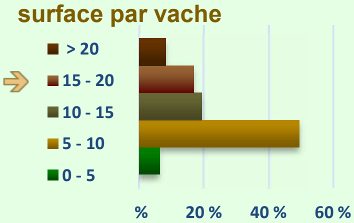
1860 m² /bâtiment

part alimentation donnée aux vaches laiti



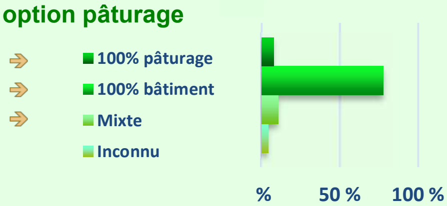
97 - 98 % total bâtiment

surface par vache



16,5 m² /vache en lactation

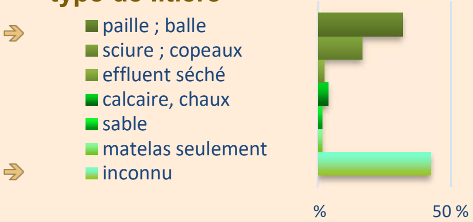
option pâturage



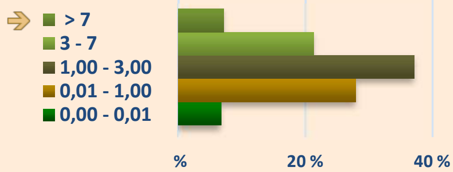
0 - 10 heures pâturage /jour

La gestion des effluents

type de litière

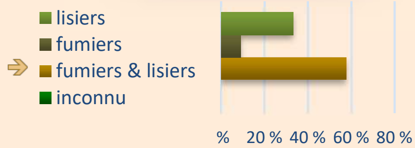


apport de litière (kg litière /vache /jour)

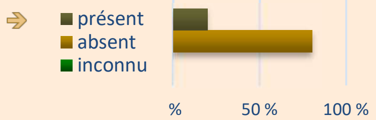


8,0 kg litière /vache /jour

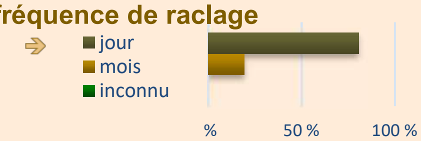
Types d'effluents



caillebotis



fréquence de raclage

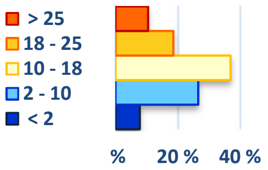


Ferme 2 (France) Idele

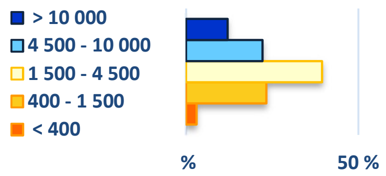
à retenir...

- Emissions of ammonia are lower than in most farms;
- However, high methane and nitrous oxide are observed which can be due to the manure management (e.g. 1: reusing dried manure with moist litter; e.g. 2: moist litter for methane; e.g. 3: frequent tu

Température extérieure (°C)



Débit d'air (m3 /heure /vache)



Emissions observées

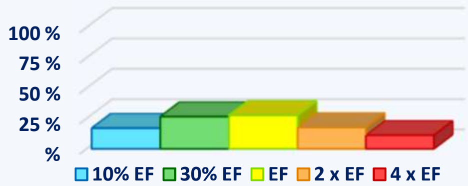
Observations dans tous les pays

Observations dans ma ferme

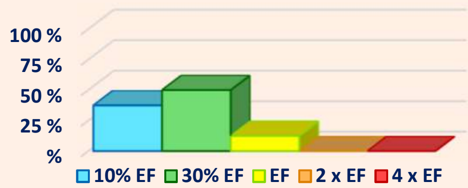
Température extérieure 10 - 18 °C

Débit d'air 580 - 10000 m3 /heure /vache

► *Emissions d'ammoniac (g NH3 /vache /jour)*



Facteur d'émission moyen: EF = 30 g NH3 /vache /jour



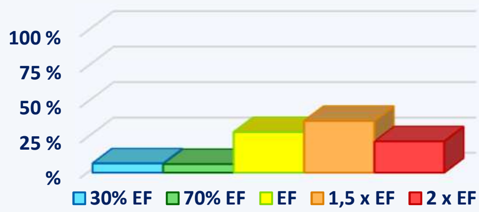
min: 3 g NH3 /vache /jour

max: 42 g NH3 /vache /jour

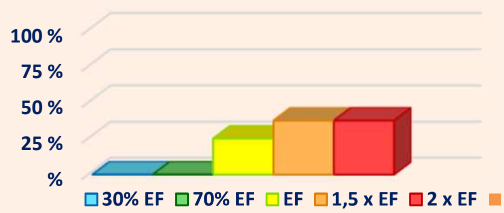
n: 8 emissions

min	max	min	max	min	max	min	max	min
0	4	4	15	15	45	45	101	101

► *kg CH4 /vache /jour (kg CH4 /vache /jour)*



Facteur d'émission moyen: EF = 0,38 kg CH4 /vache /jour



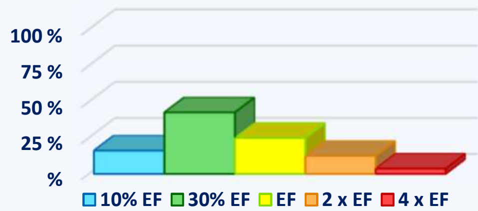
min: 0,4 kg CH4 /vache /jour

max: 1 kg CH4 /vache /jour

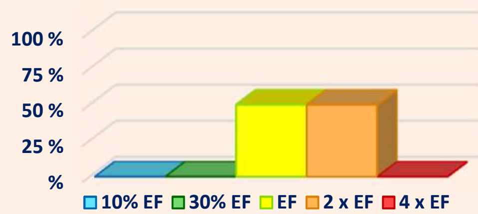
n: 8 emissions

min	max	min	max	min	max	min	max	min
0,00	0,19	0,19	0,30	0,30	0,45	0,45	0,65	0,65

► *Protoxyde d'azote (g N2O /vache /jour)*



Facteur d'émission moyen: EF = 1,8 g N2O /vache /jour



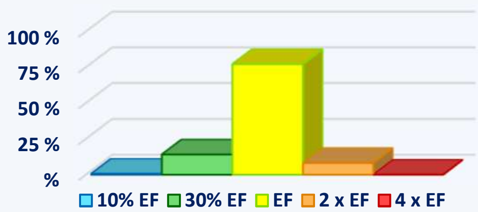
min: 1 g N2O /vache /jour

max: 4 g N2O /vache /jour

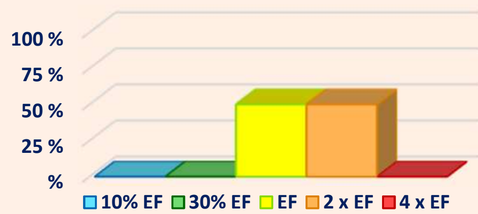
n: 4 emissions

min	max	min	max	min	max	min	max	min
0,00	0,23	0,23	0,91	0,91	2,73	2,73	6,14	6,14

► *Emissions de GES (kg eq CO2 /L lait)*



Facteur d'émission moyen: EF = 0,40 kg eq CO2 /L lait



min: 0,4 kg eq CO2 /L lait

max: 0,9 kg eq CO2 /L lait

min	max	min	max	min	max	min	max	min
0,00	0,05	0,05	0,20	0,20	0,61	0,61	1,36	1,36

Ferme 3 (France)

évaluation des émissions en élevage (2021 - 2023)

Idele

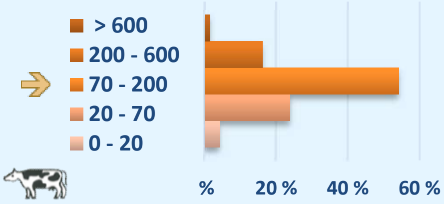
ferme visitée par Xavier Vergé (2021 - 2022)

Ma ferme et la diversité des exploitations enquêtées dans tous les pays

Tier	2b	2a	1	not used	total (3 gases)
nb obs.	6	0	1	5	12

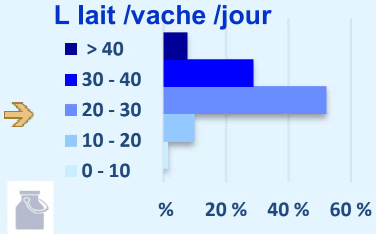
Le troupeau laitier

vaches laitières / bâtiment



20 - 120 vaches

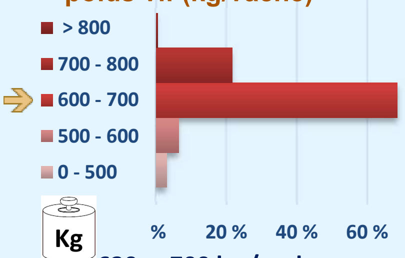
L lait /vache /jour



27 L lait /vache /jour

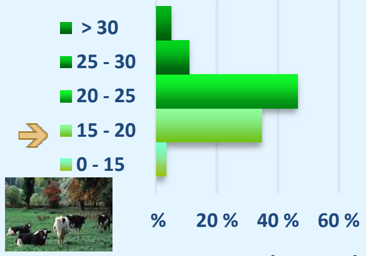
Ferme 3

poids vif (kg/vache)



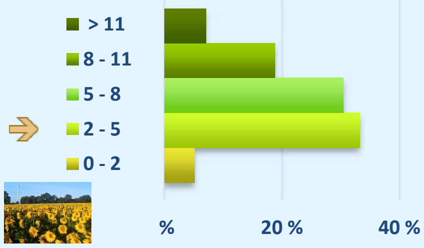
630 - 700 kg /vache

MS aliment /vache /jour



15 - 22 kg MS aliment /vache /jour

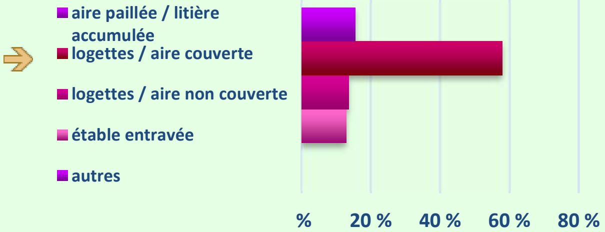
concentré



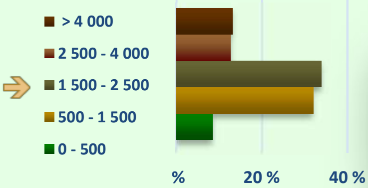
0 - 4 kg concentré /vache /jour

Le bâtiment

type de bâtiment

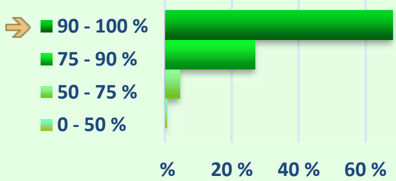


surface du bâtiment



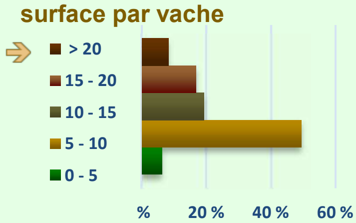
1700 m² /bâtiment

part alimentation donnée aux vaches laiti



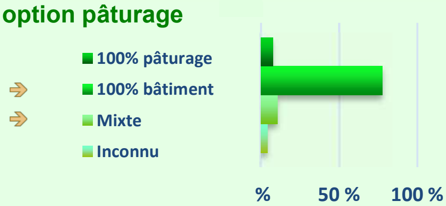
100 % total bâtiment

surface par vache



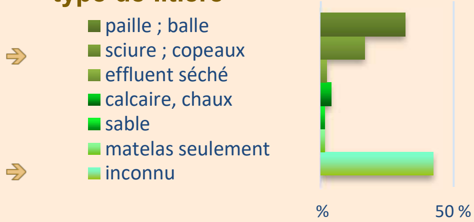
11,3 - 68,0 m² /vache en lactation

option pâturage

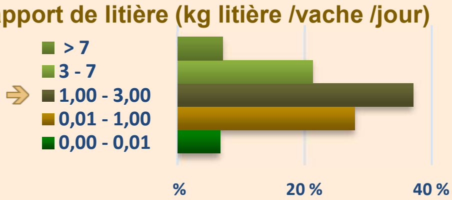


La gestion des effluents

type de litière

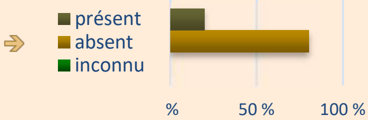


apport de litière (kg litière /vache /jour)

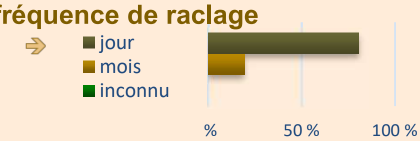


1,5 - 3,5 kg litière /vache /jour

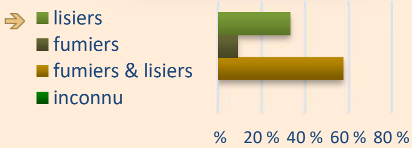
caillebotis



fréquence de raclage



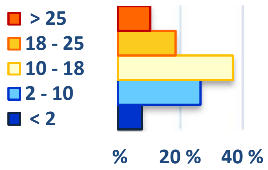
Types d'effluents

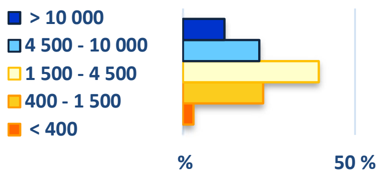


Ferme 3 (France) Idele

à retenir...

- Emissions of ammonia are lower than in most farms;
- However, high methane and nitrous oxide are observed which can be due to the manure management (e.g. 1: reusing dried manure with moist litter; e.g. 2: moist litter for methane; e.g. 3: frequent tu





Emissions observées

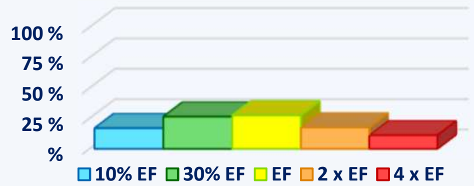
Observations dans tous les pays

Observations dans ma ferme

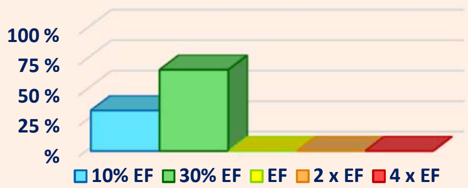
Température extérieure 3,0 - 21 °C

Débit d'air 1 200 - 11000 m3 /heure /vache

► *Emissions d'ammoniac (g NH3 /vache /jour)*



Facteur d'émission moyen: EF = 30 g NH3 /vache /jour



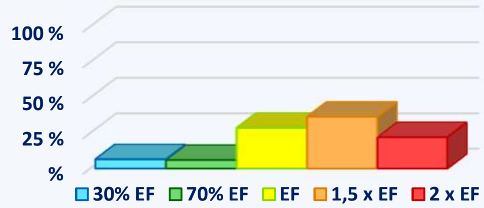
min: 1 g NH3 /vache /jour

max: 7 g NH3 /vache /jour

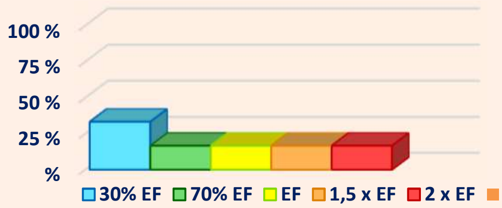
n: 6 emissions

min	max	min	max	min	max	min	max	min
0	4	4	15	15	45	45	101	101

► *kg CH4 /vache /jour (kg CH4 /vache /jour)*



Facteur d'émission moyen: EF = 0,38 kg CH4 /vache /jour



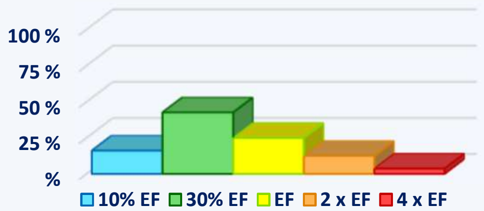
min: 0,09 kg CH4 /vache /jour

max: 0,7 kg CH4 /vache /jour

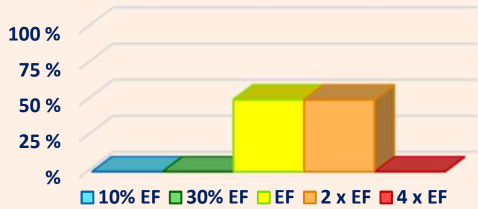
n: 6 emissions

min	max	min	max	min	max	min	max	min
0,00	0,19	0,19	0,30	0,30	0,45	0,45	0,65	0,65

► *Protoxyde d'azote (g N2O /vache /jour)*



Facteur d'émission moyen: EF = 1,8 g N2O /vache /jour



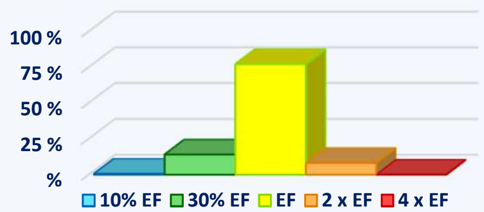
min: 1 g N2O /vache /jour

max: 4 g N2O /vache /jour

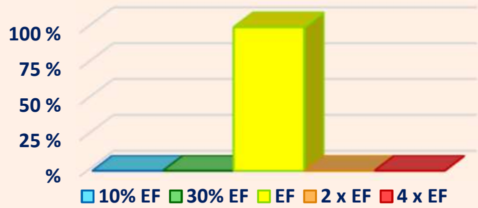
n: 2 emissions

min	max	min	max	min	max	min	max	min
0,00	0,23	0,23	0,91	0,91	2,73	2,73	6,14	6,14

► *Emissions de GES (kg eq CO2 /L lait)*



Facteur d'émission moyen: EF = 0,40 kg eq CO2 /L lait



min: 0,3 kg eq CO2 /L lait

max: 0,5 kg eq CO2 /L lait

min	max	min	max	min	max	min	max	min
0,00	0,05	0,05	0,20	0,20	0,61	0,61	1,36	1,36

Ferme 4 (France)

évaluation des émissions en élevage (2021 - 2023)

Idele

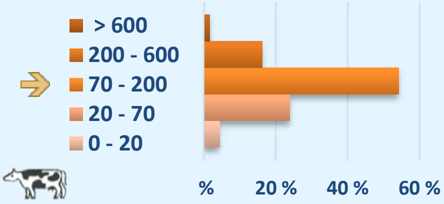
ferme visitée par Xavier Vergé (2022)

Ma ferme et la diversité des exploitations enquêtées dans tous les pays

Tier	2b	2a	1	not used	total (3 gases)
nb obs.	9	0	1	2	12

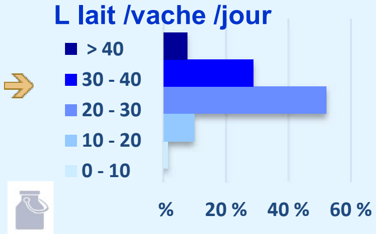
Le troupeau laitier

vaches laitières / bâtiment



62 - 134 vaches

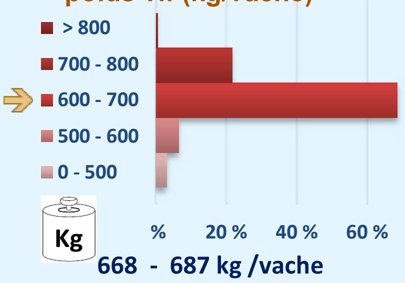
L lait /vache /jour



39 L lait /vache /jour

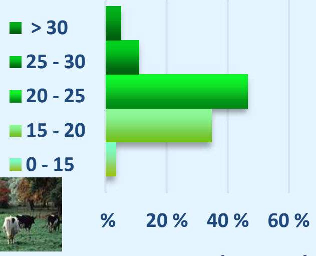
Ferme 4

poids vif (kg/vache)



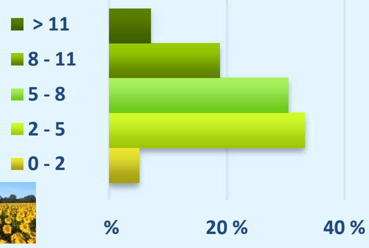
668 - 687 kg /vache

MS aliment /vache /jour



22 - 30 kg MS aliment /vache /jour

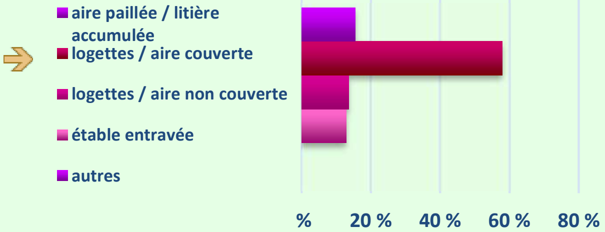
concentré



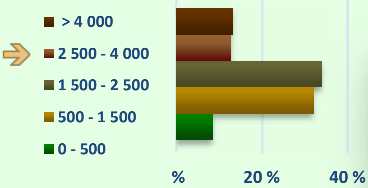
5 - 7 kg concentré /vache /jour

Le bâtiment

type de bâtiment

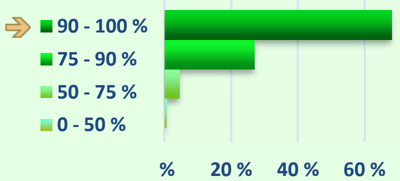


surface du bâtiment



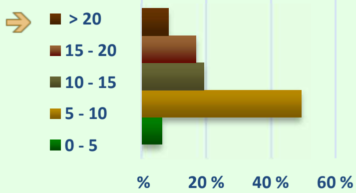
3000 m² /bâtiment

part alimentation donnée aux vaches laiti



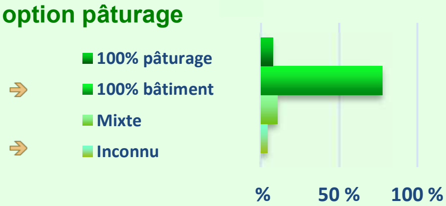
100 % total bâtiment

surface par vache



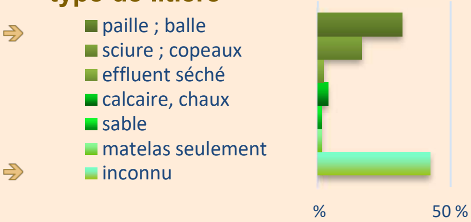
16,7 - 36,0 m² /vache en lactation

option pâturage

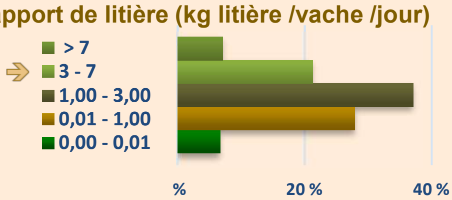


La gestion des effluents

type de litière

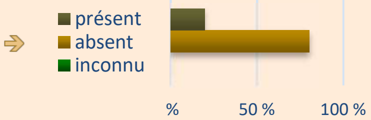


apport de litière (kg litière /vache /jour)

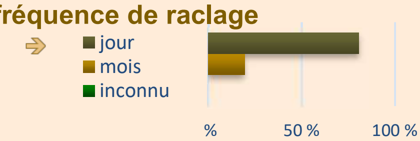


4,0 kg litière /vache /jour

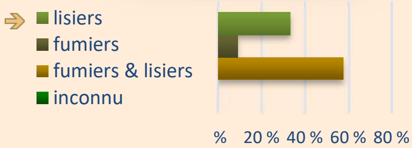
caillebotis



fréquence de raclage



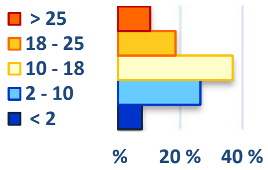
Types d'effluents



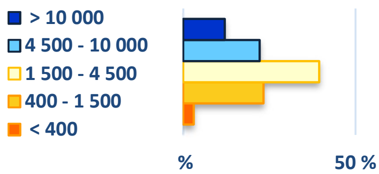
à retenir...

- Emissions of ammonia are higher than the population;
- Emissions of methane are lower than the population and nitrous oxide emissions similar;
- Manure management could be tuned to decrease ammonia emissions

Température extérieure (°C)



Débit d'air (m3 /heure /vache)



Emissions observées

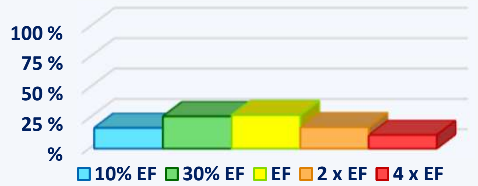
Observations dans tous les pays

Observations dans ma ferme

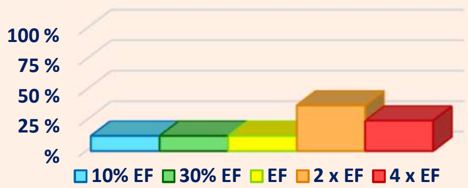
Température extérieure 9,3 - 22 °C

Débit d'air 410 - 13000 m3 /heure /vache

► *Emissions d'ammoniac (g NH3 /vache /jour)*



Facteur d'émission moyen: EF = 30 g NH3 /vache /jour



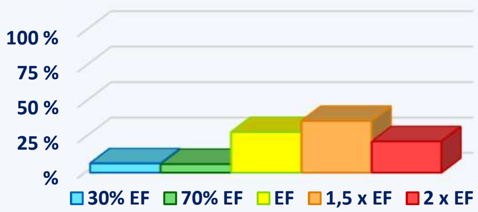
min: 3 g NH3 /vache /jour

max: 170 g NH3 /vache /jour

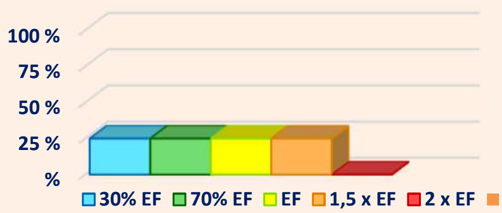
n: 8 emissions

min	max	min	max	min	max	min	max	min
0	4	4	15	15	45	45	101	101

► *kg CH4 /vache /jour (kg CH4 /vache /jour)*



Facteur d'émission moyen: EF = 0,38 kg CH4 /vache /jour



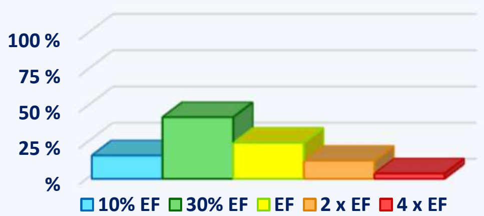
min: 0,02 kg CH4 /vache /jour

max: 0,6 kg CH4 /vache /jour

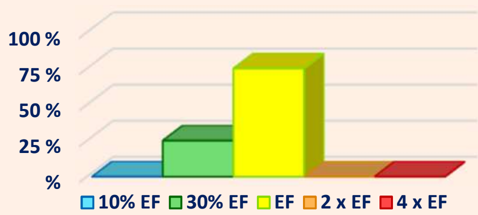
n: 8 emissions

min	max	min	max	min	max	min	max	min
0,00	0,19	0,19	0,30	0,30	0,45	0,45	0,65	0,65

► *Protoxyde d'azote (g N2O /vache /jour)*



Facteur d'émission moyen: EF = 1,8 g N2O /vache /jour



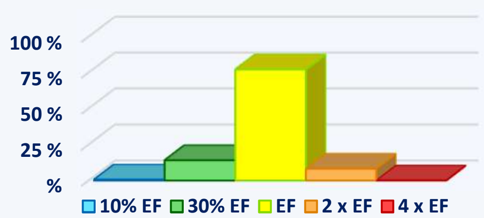
min: 0,5 g N2O /vache /jour

max: 1 g N2O /vache /jour

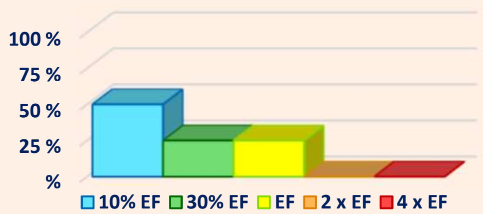
n: 4 emissions

min	max	min	max	min	max	min	max	min
0,00	0,23	0,23	0,91	0,91	2,73	2,73	6,14	6,14

► *Emissions de GES (kg eq CO2 /L lait)*



Facteur d'émission moyen: EF = 0,40 kg eq CO2 /L lait



min: 0,02 kg eq CO2 /L lait

max: 0,3 kg eq CO2 /L lait

min	max	min	max	min	max	min	max	min
0,00	0,05	0,05	0,20	0,20	0,61	0,61	1,36	1,36

Ferme 5 (France)

évaluation des émissions en élevage (2021 - 2023)

Idele

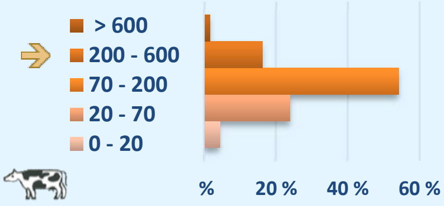
ferme visitée par Xavier Vergé (2021 - 2022)

Ma ferme et la diversité des exploitations enquêtées dans tous les pays

Tier	2b	2a	1	not used	total (3 gases)
nb obs.	8	0	0	4	12

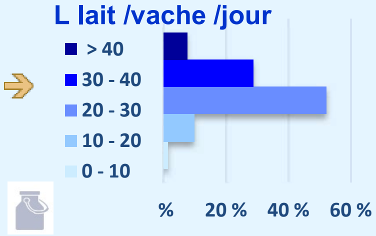
Le troupeau laitier

vaches laitières / bâtiment



198 - 230 vaches

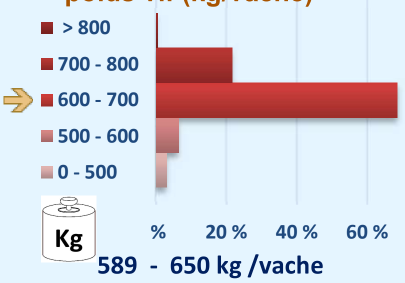
L lait /vache /jour



34 L lait /vache /jour

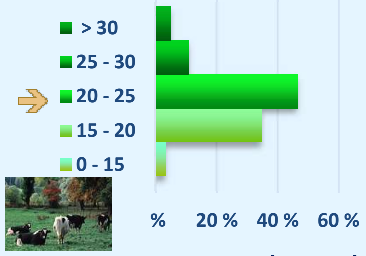
Ferme 5

poids vif (kg/vache)



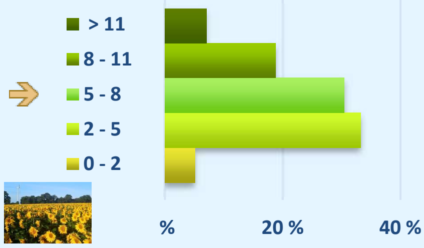
589 - 650 kg /vache

MS aliment /vache /jour



23 - 24 kg MS aliment /vache /jour

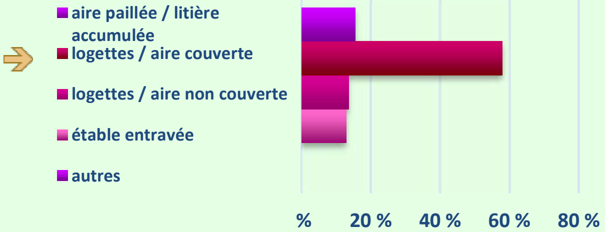
concentré



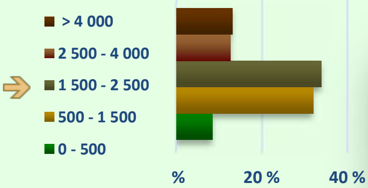
5 - 5 kg concentré /vache /jour

Le bâtiment

type de bâtiment

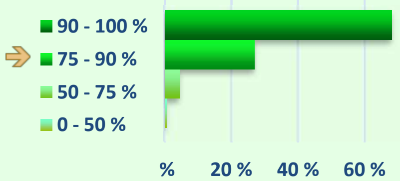


surface du bâtiment



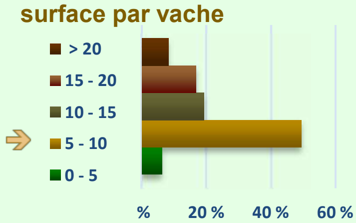
1695 m² /bâtiment

part alimentation donnée aux vaches laiti



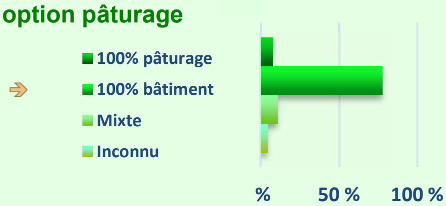
89 - 90 % total bâtiment

surface par vache



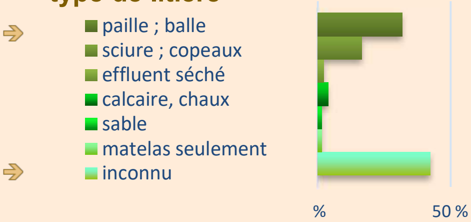
6,3 - 7,3 m² /vache en lactation

option pâturage

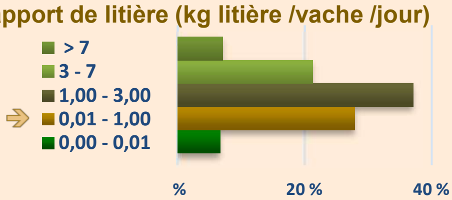


La gestion des effluents

type de litière

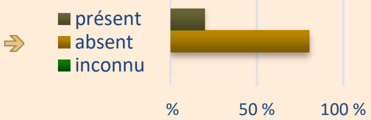


apport de litière (kg litière /vache /jour)

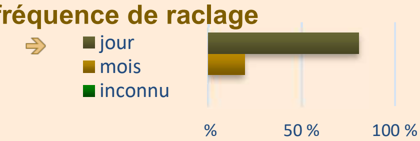


0,5 - 0,6 kg litière /vache /jour

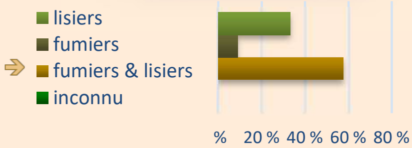
caillebotis



fréquence de raclage



Types d'effluents

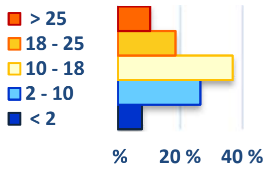


Ferme 5 (France) Idele

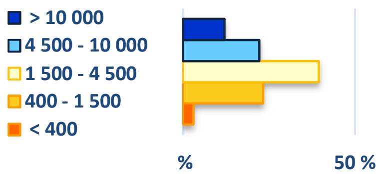
à retenir...

- Emissions of ammonia and nitrous oxide are similar to the population;
- Methane emissions higher than emission factor can be due to the manure management

Température extérieure (°C)



Débit d'air (m3 /heure /vache)



Emissions observées

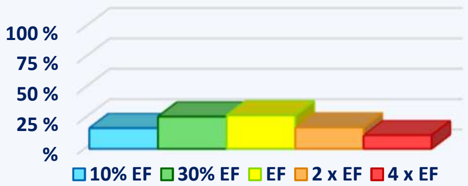
Observations dans tous les pays

Observations dans ma ferme

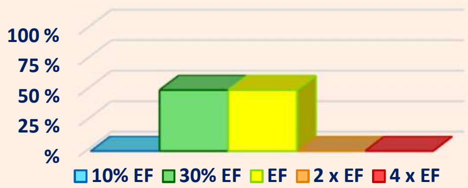
Température extérieure 0,0 - 22 °C

Débit d'air 950 - 3500 m3 /heure /vache

► ***Emissions d'ammoniac (g NH3 /vache /jour)***



Facteur d'émission moyen: EF = 30 g NH3 /vache /jour



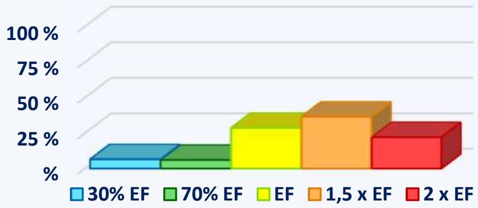
min: 6 g NH3 /vache /jour

max: 39 g NH3 /vache /jour

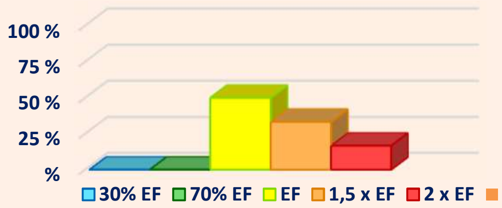
n: 6 emissions

min	max	min	max	min	max	min	max	min
0	4	4	15	15	45	45	101	101

► ***kg CH4 /vache /jour (kg CH4 /vache /jour)***



Facteur d'émission moyen: EF = 0,38 kg CH4 /vache /jour



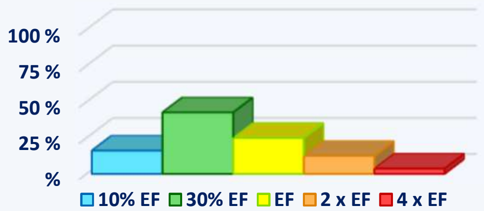
min: 0,3 kg CH4 /vache /jour

max: 0,7 kg CH4 /vache /jour

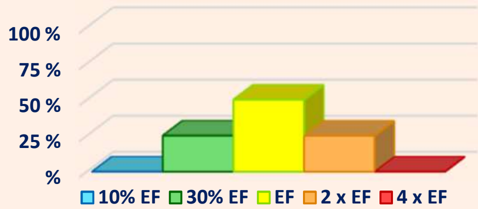
n: 6 emissions

min	max	min	max	min	max	min	max	min
0,00	0,19	0,19	0,30	0,30	0,45	0,45	0,65	0,65

► ***Protoxyde d'azote (g N2O /vache /jour)***



Facteur d'émission moyen: EF = 1,8 g N2O /vache /jour



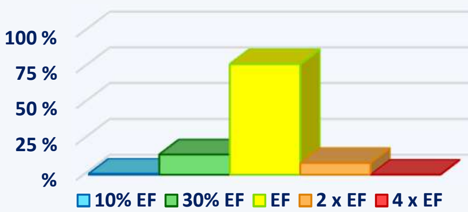
min: 0,5 g N2O /vache /jour

max: 5 g N2O /vache /jour

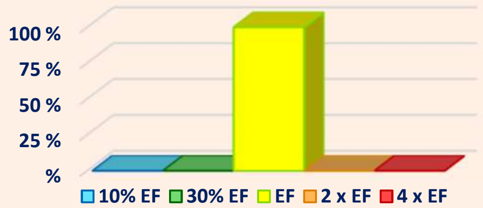
n: 4 emissions

min	max	min	max	min	max	min	max	min
0,00	0,23	0,23	0,91	0,91	2,73	2,73	6,14	6,14

► ***Emissions de GES (kg eq CO2 /L lait)***



Facteur d'émission moyen: EF = 0,40 kg eq CO2 /L lait



min: 0,2 kg eq CO2 /L lait

max: 0,4 kg eq CO2 /L lait

min	max	min	max	min	max	min	max	min
0,00	0,05	0,05	0,20	0,20	0,61	0,61	1,36	1,36

farming

Ferme 6 (France)

évaluation des émissions en élevage (2021 - 2023)

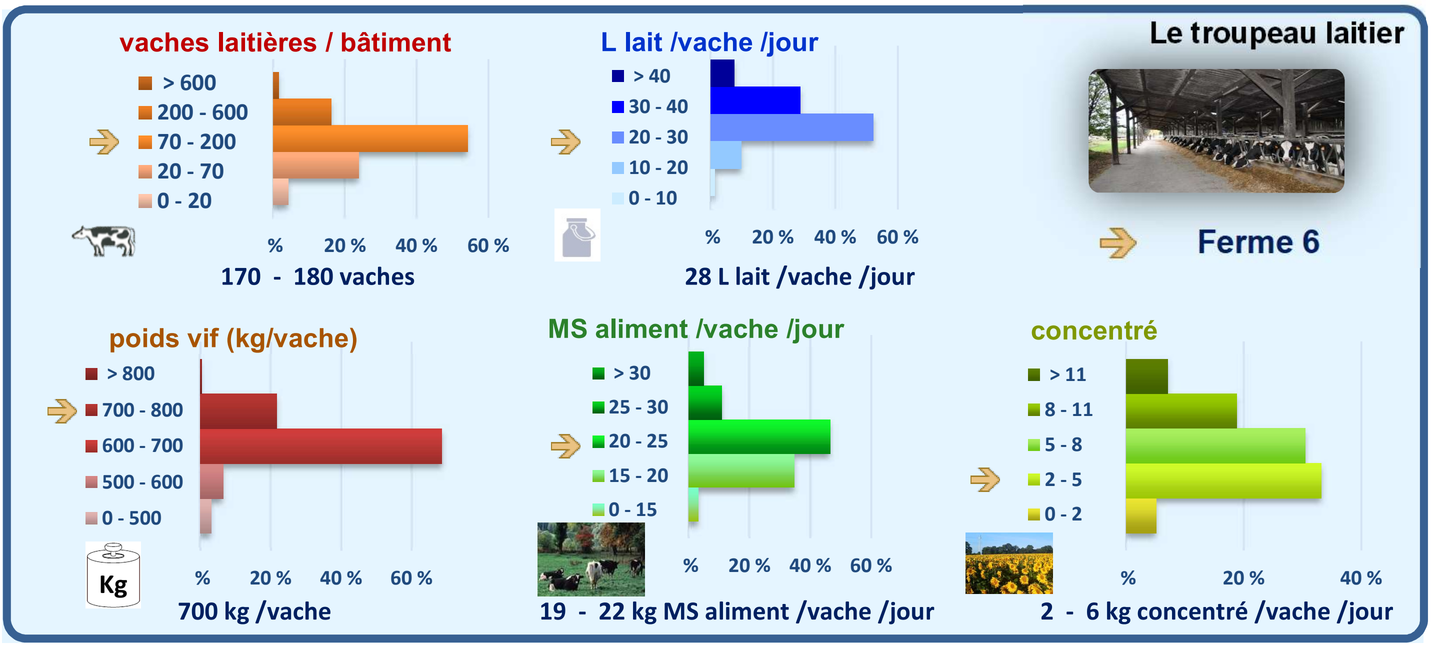
Idele

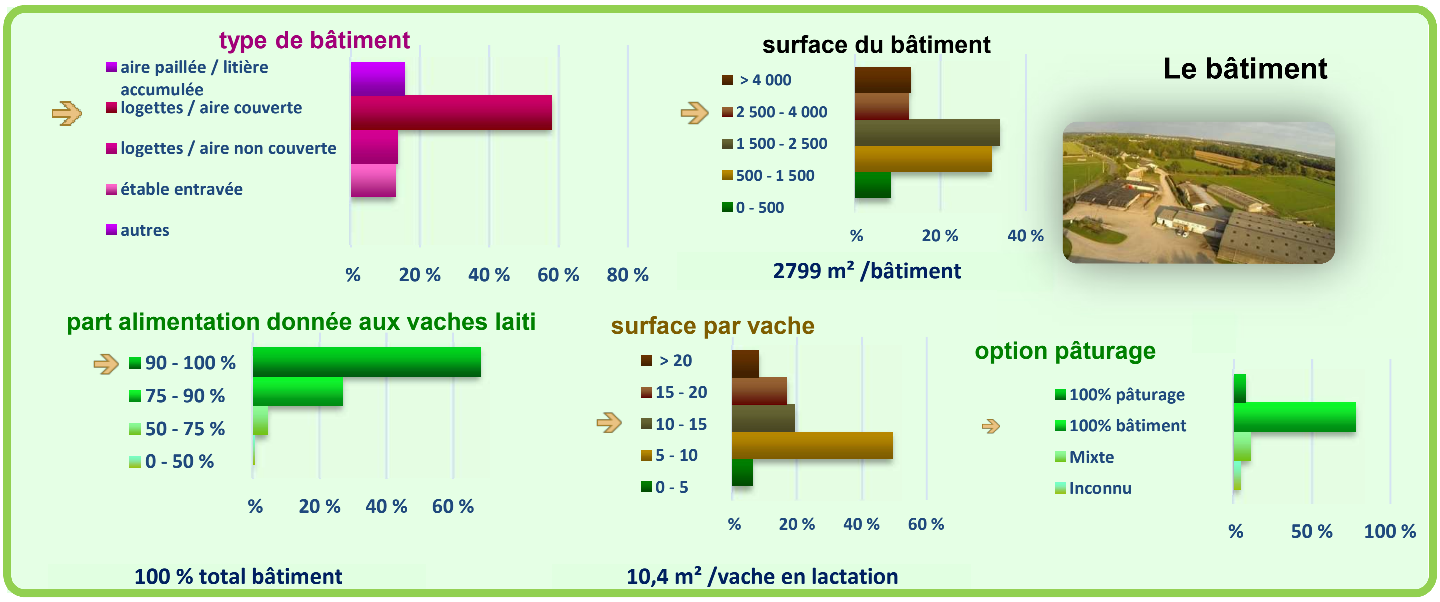
ferme visitée par Xavier Vergé (2021 - 2022)

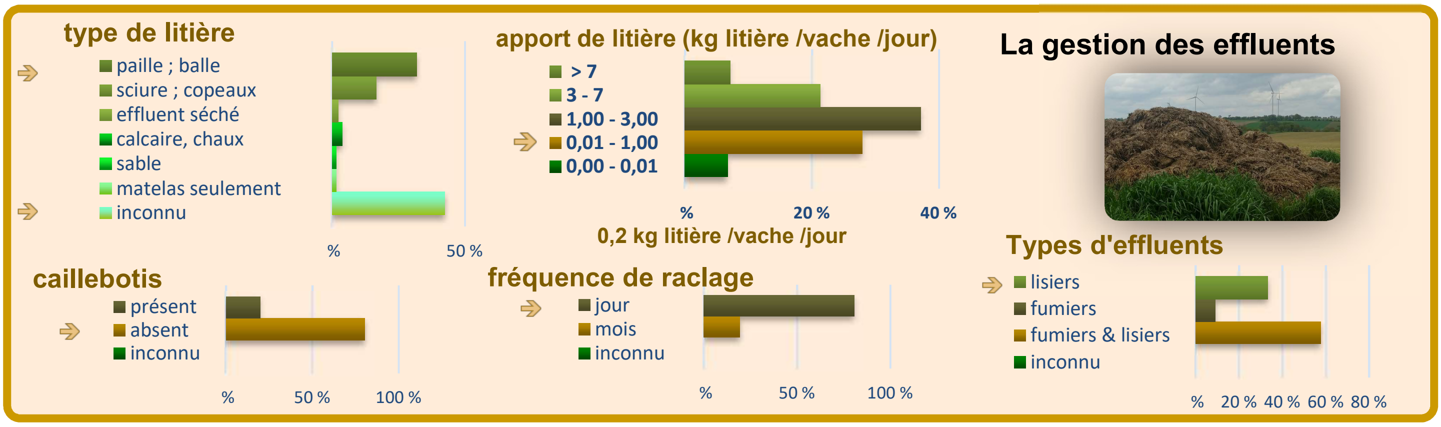
FACCE ERA-GAS ERA-NET SUSAN ICT AGRI era-net

Ma ferme et la diversité des exploitations enquêtées dans tous les pays

Tier	2b	2a	1	not used	total (3 gases)
nb obs.	6	0	3	3	12







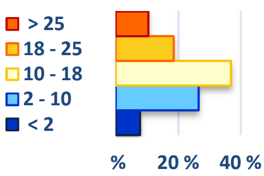
Ferme 6 (France)

Idele

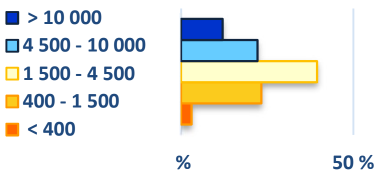
à retenir...

- Emissions of ammonia, methane and nitrous oxide are higher than the population;
- Changes in manure management should be studied to decrease these emissions

Température extérieure (°C)



Débit d'air (m3 /heure /vache)



Emissions observées

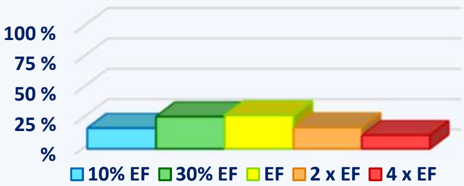
Observations dans tous les pays

Observations dans ma ferme

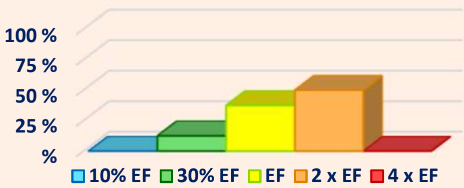
Température extérieure 9,2 - 23 °C

Débit d'air 3 300 - 29000 m3 /heure /vache

► *Emissions d'ammoniac (g NH3 /vache /jour)*



Facteur d'émission moyen: EF = 30 g NH3 /vache /jour



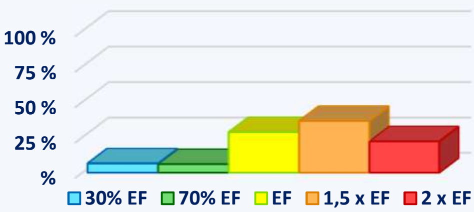
min: 5 g NH3 /vache /jour

max: 95 g NH3 /vache /jour

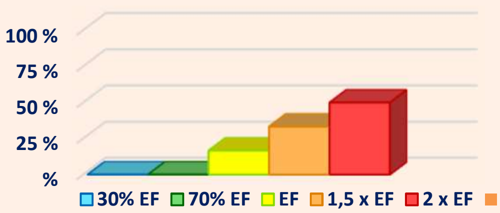
n: 8 emissions

min	max	min	max	min	max	min	max	min
0	4	4	15	15	45	45	101	101

► *kg CH4 /vache /jour (kg CH4 /vache /jour)*



Facteur d'émission moyen: EF = 0,38 kg CH4 /vache /jour



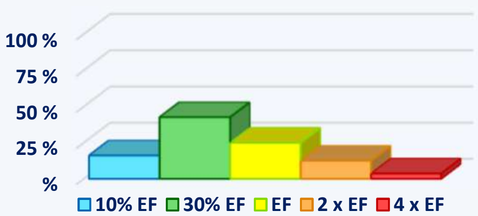
min: 0,4 kg CH4 /vache /jour

max: 1 kg CH4 /vache /jour

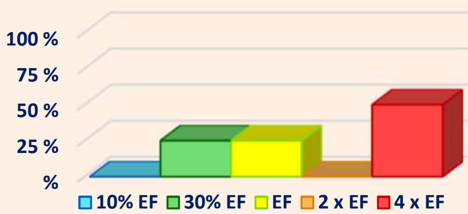
n: 6 emissions

min	max	min	max	min	max	min	max	min
0,00	0,19	0,19	0,30	0,30	0,45	0,45	0,65	0,65

► *Protoxyde d'azote (g N2O /vache /jour)*



Facteur d'émission moyen: EF = 1,8 g N2O /vache /jour



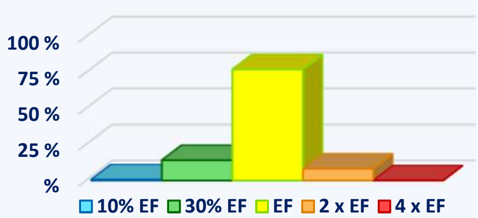
min: 0,6 g N2O /vache /jour

max: 13 g N2O /vache /jour

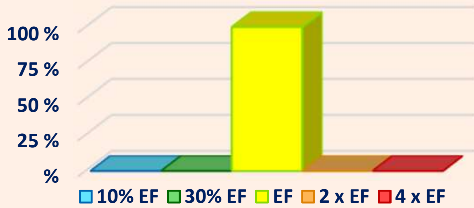
n: 4 emissions

min	max	min	max	min	max	min	max	min
0,00	0,23	0,23	0,91	0,91	2,73	2,73	6,14	6,14

► *Emissions de GES (kg eq CO2 /L lait)*



Facteur d'émission moyen: EF = 0,40 kg eq CO2 /L lait



min: 0,3 kg eq CO2 /L lait

max: 0,5 kg eq CO2 /L lait

min	max	min	max	min	max	min	max	min
0,00	0,05	0,05	0,20	0,20	0,61	0,61	1,36	1,36

Ferme 7 (France)

évaluation des émissions en élevage (2021 - 2023)

Idele

ferme visitée par Xavier Vergé (2021 - 2022)

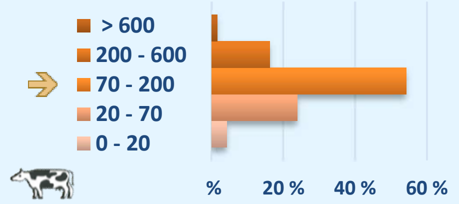
Ma ferme et la diversité des exploitations enquêtées dans tous les pays

Tier	2b	2a	1	not used	total (3 gases)
nb obs.	6	0	3	3	12

Le troupeau laitier

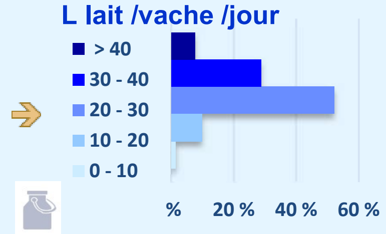
Ferme 7

vaches laitières / bâtiment



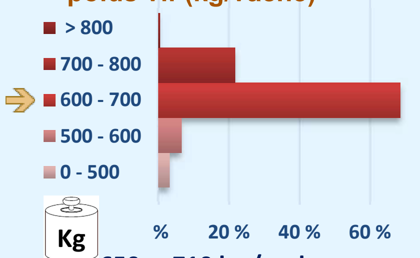
96 - 108 vaches

L lait /vache /jour



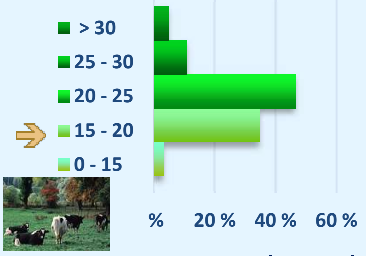
26 L lait /vache /jour

poids vif (kg/vache)



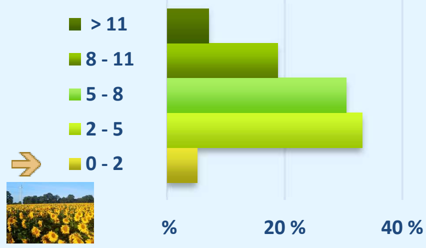
650 - 710 kg /vache

MS aliment /vache /jour



16 - 19 kg MS aliment /vache /jour

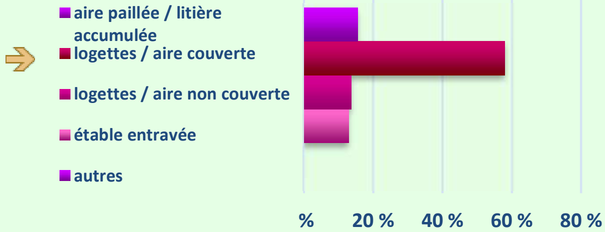
concentré



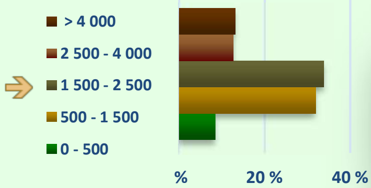
0 - 3 kg concentré /vache /jour

Le bâtiment

type de bâtiment

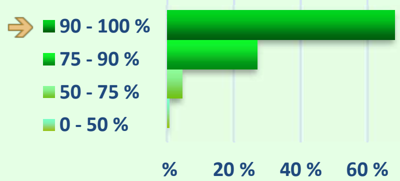


surface du bâtiment



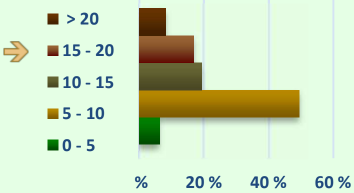
2222,36 m² /bâtiment

part alimentation donnée aux vaches laiti



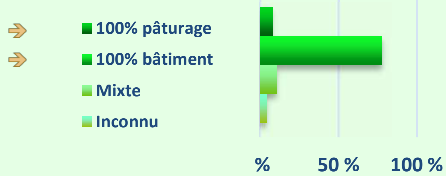
100 % total bâtiment

surface par vache



16,7 - 18,8 m² /vache en lactation

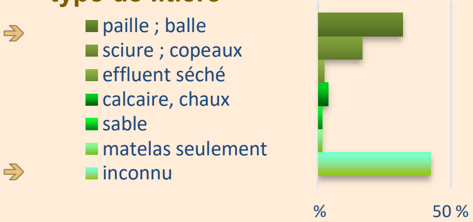
option pâturage



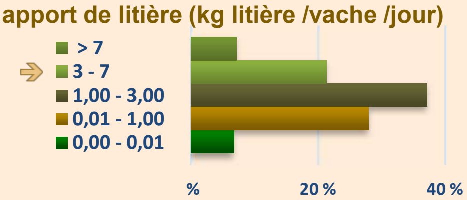
0 - 20 heures pâturage /jour

La gestion des effluents

type de litière

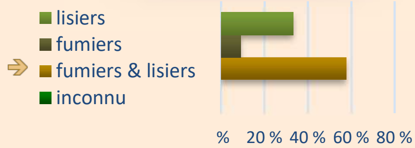


apport de litière (kg litière /vache /jour)

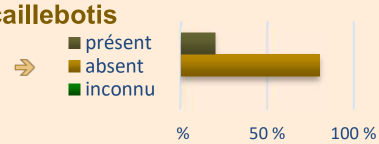


5,8 kg litière /vache /jour

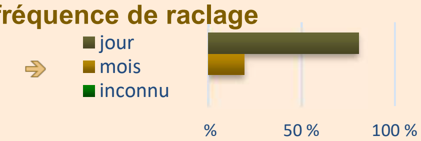
Types d'effluents



caillebotis



fréquence de raclage

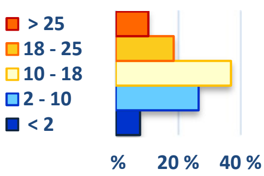


Ferme 7 (France)   Idele

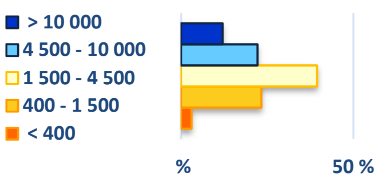
à retenir...

- Emissions of ammonia, methane and nitrous oxide higher than the population are repeatedly observed;
- Changes in manure or cow management can induce significant decrease in polluting emissions

Température extérieure (°C)



Débit d'air (m3 /heure /vache)



Emissions observées

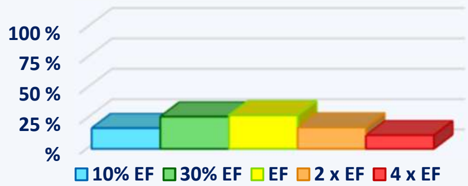
Observations dans tous les pays

Observations dans ma ferme

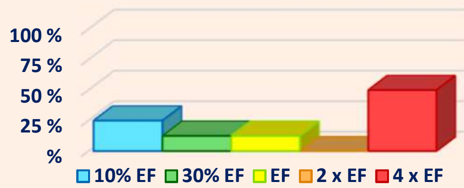
Température extérieure 4,9 - 29 °C

Débit d'air 910 - 39000 m3 /heure /vache

► *Emissions d'ammoniac (g NH3 /vache /jour)*



Facteur d'émission moyen: EF = 30 g NH3 /vache /jour



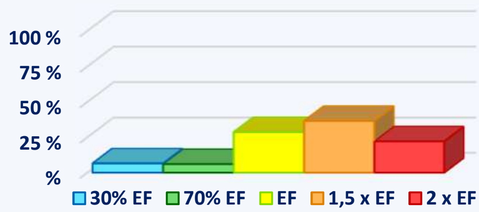
min: 1 g NH3 /vache /jour

max: 460 g NH3 /vache /jour

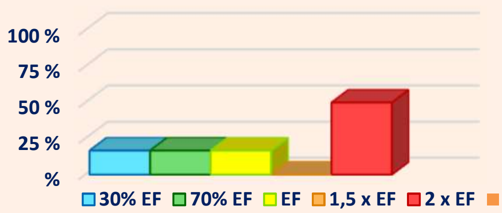
n: 8 emissions

min	max	min	max	min	max	min	max	min
0	4	4	15	15	45	45	101	101

► *kg CH4 /vache /jour (kg CH4 /vache /jour)*



Facteur d'émission moyen: EF = 0,38 kg CH4 /vache /jour



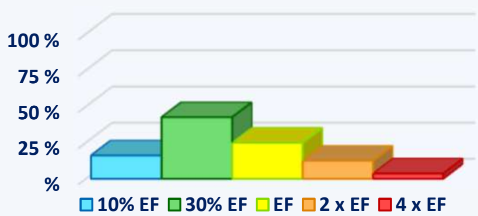
min: 0,1 kg CH4 /vache /jour

max: 1 kg CH4 /vache /jour

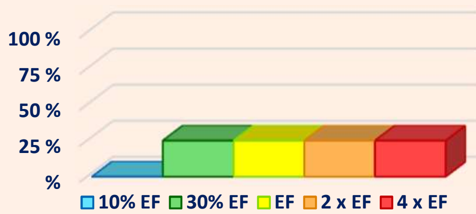
n: 6 emissions

min	max	min	max	min	max	min	max	min
0,00	0,19	0,19	0,30	0,30	0,45	0,45	0,65	0,65

► *Protoxyde d'azote (g N2O /vache /jour)*



Facteur d'émission moyen: EF = 1,8 g N2O /vache /jour



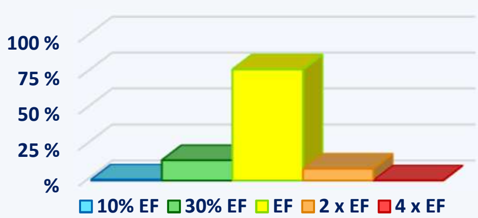
min: 0,8 g N2O /vache /jour

max: 9 g N2O /vache /jour

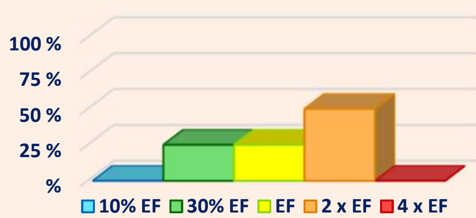
n: 4 emissions

min	max	min	max	min	max	min	max	min
0,00	0,23	0,23	0,91	0,91	2,73	2,73	6,14	6,14

► *Emissions de GES (kg eq CO2 /L lait)*



Facteur d'émission moyen: EF = 0,40 kg eq CO2 /L lait



min: 0,1 kg eq CO2 /L lait

max: 1,0 kg eq CO2 /L lait

min	max	min	max	min	max	min	max	min
0,00	0,05	0,05	0,20	0,20	0,61	0,61	1,36	1,36

farming

Ferme 8 (France)

évaluation des émissions en élevage (2021 - 2023)

Idele

ferme visitée par Xavier Vergé (2021 - 2022)

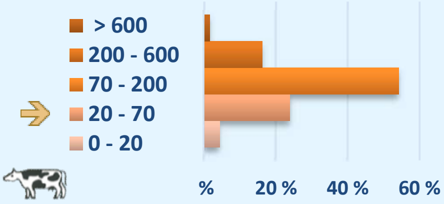
FACCE ERA-GAS ERA-NETSUSAN ICT AGRI era-net

Ma ferme et la diversité des exploitations enquêtées dans tous les pays

Tier	2b	2a	1	not used	total (3 gases)
nb obs.	7	0	4	1	12

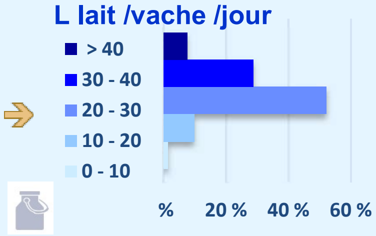
Le troupeau laitier

vaches laitières / bâtiment



52 - 70 vaches

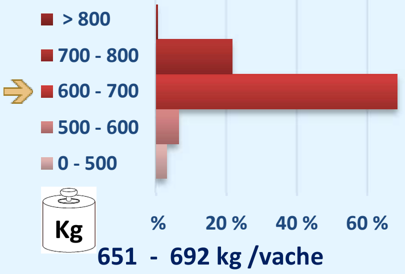
L lait /vache /jour



29 L lait /vache /jour

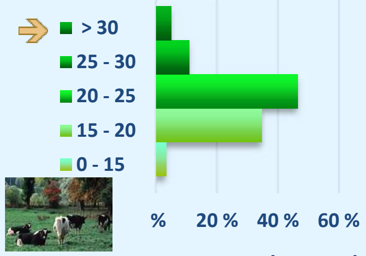
Ferme 8

poids vif (kg/vache)



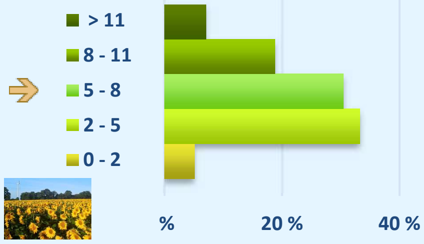
651 - 692 kg /vache

MS aliment /vache /jour



22 - 51 kg MS aliment /vache /jour

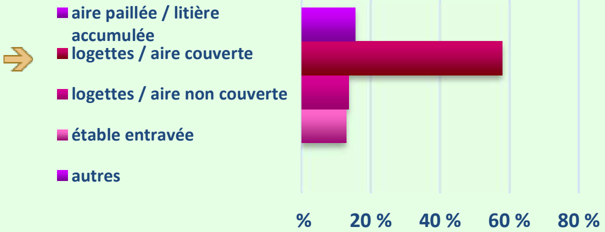
concentré



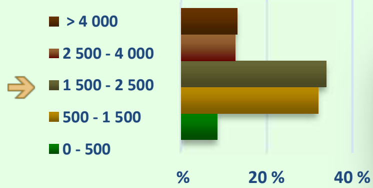
5 - 8 kg concentré /vache /jour

Le bâtiment

type de bâtiment

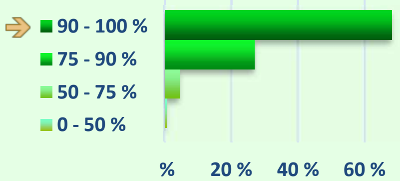


surface du bâtiment



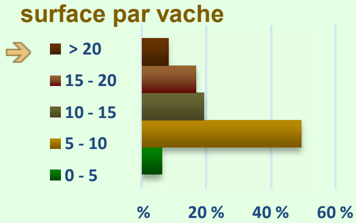
1700 m² /bâtiment

part alimentation donnée aux vaches laiti



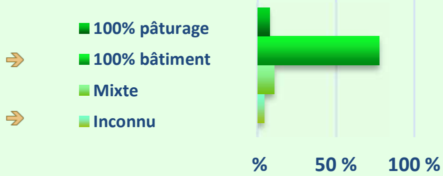
100 % total bâtiment

surface par vache



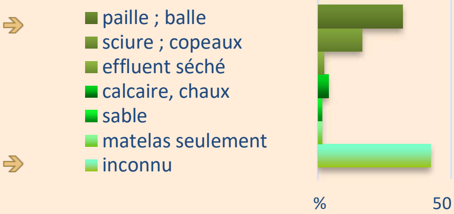
19,6 - 26,3 m² /vache en lactation

option pâturage

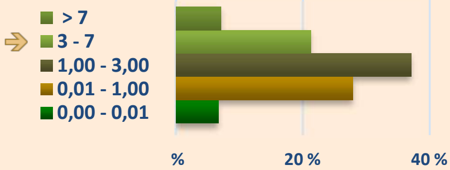


La gestion des effluents

type de litière

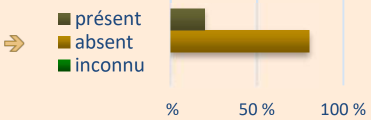


apport de litière (kg litière /vache /jour)

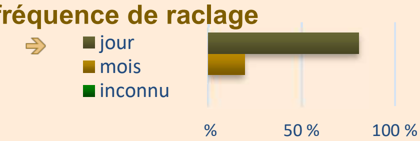


4,2 - 5,2 kg litière /vache /jour

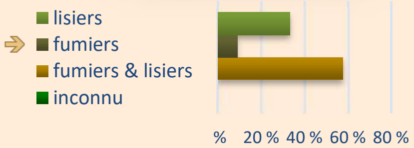
caillebotis



fréquence de raclage



Types d'effluents

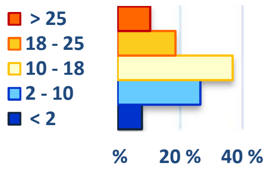


Ferme 8 (France) Idele

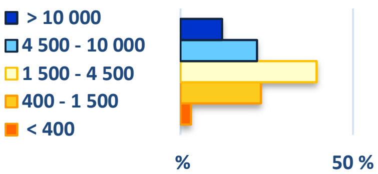
à retenir...

- Emissions of ammonia and nitrous oxide are smaller than the population while methane emissions are normal for dairy cows;
- The farmer practices should serve as an example of “low emitting system” to improve similar farms in the same region

Température extérieure (°C)



Débit d'air (m3 /heure /vache)



Emissions observées

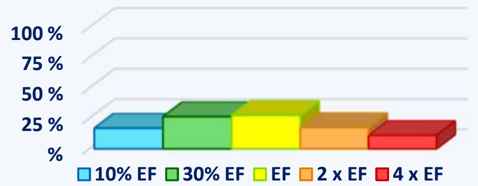
Observations dans tous les pays

Observations dans ma ferme

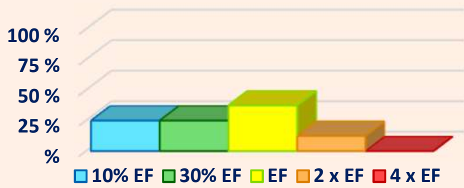
Température extérieure 11 - 23 °C

Débit d'air 730 - 4400 m3 /heure /vache

► *Emissions d'ammoniac (g NH3 /vache /jour)*



Facteur d'émission moyen: EF = 30 g NH3 /vache /jour



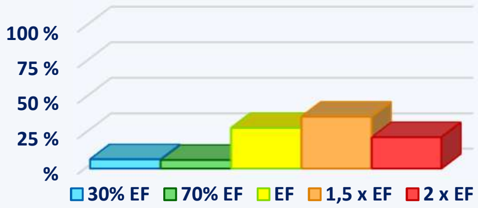
min: 2 g NH3 /vache /jour

max: 46 g NH3 /vache /jour

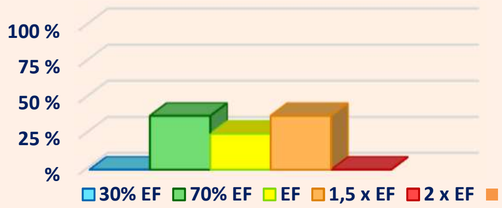
n: 8 emissions

min	max	min	max	min	max	min	max	min
0	4	4	15	15	45	45	101	101

► *kg CH4 /vache /jour (kg CH4 /vache /jour)*



Facteur d'émission moyen: EF = 0,38 kg CH4 /vache /jour



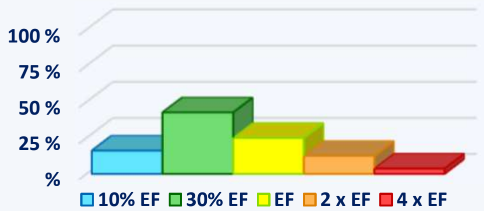
min: 0,2 kg CH4 /vache /jour

max: 0,6 kg CH4 /vache /jour

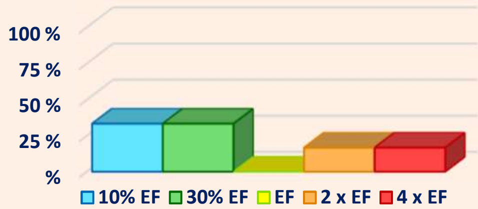
n: 8 emissions

min	max	min	max	min	max	min	max	min
0,00	0,19	0,19	0,30	0,30	0,45	0,45	0,65	0,65

► *Protoxyde d'azote (g N2O /vache /jour)*



Facteur d'émission moyen: EF = 1,8 g N2O /vache /jour



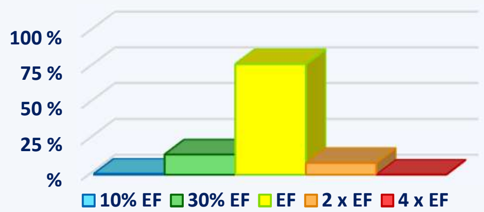
min: 0,1 g N2O /vache /jour

max: 12 g N2O /vache /jour

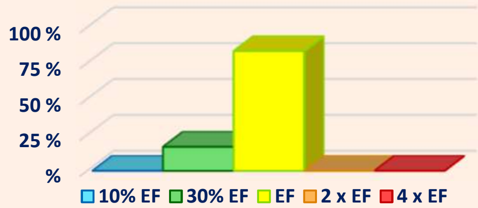
n: 6 emissions

min	max	min	max	min	max	min	max	min
0,00	0,23	0,23	0,91	0,91	2,73	2,73	6,14	6,14

► *Emissions de GES (kg eq CO2 /L lait)*



Facteur d'émission moyen: EF = 0,40 kg eq CO2 /L lait



min: 0,2 kg eq CO2 /L lait

max: 0,5 kg eq CO2 /L lait

min	max	min	max	min	max	min	max	min
0,00	0,05	0,05	0,20	0,20	0,61	0,61	1,36	1,36

Farm 1 (Italy)

Survey of housing emissions
(2021 - 2023)

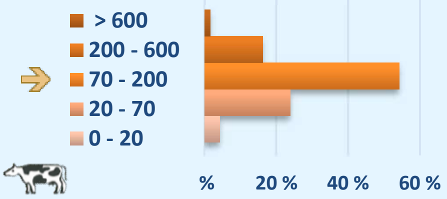
UNIFI

Farm visited by
Valentina Becciolini

My farm vs the diversity of visited dairy units in all countries

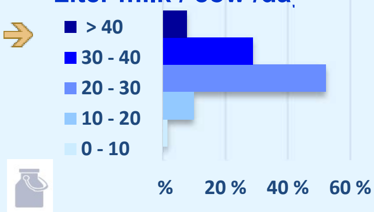
Tier	2b	2a	1	not used	total (3 gases)
nb obs.	8	0	1	3	12

lactating cows / house



80 - 88 cows

Liter milk / cow /day

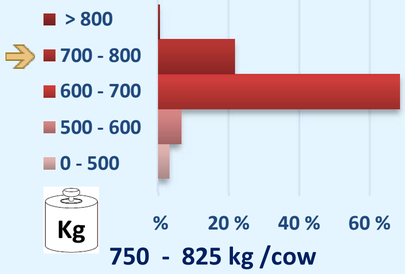


42 L milk /cow /day

The monitored dairy cows

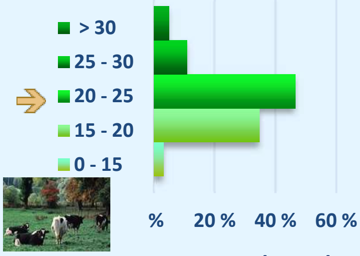
Farm 1

kg liveweight / cow



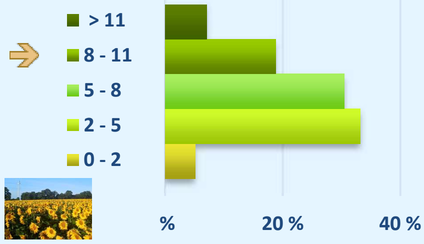
750 - 825 kg /cow

dry matter feed / cow /day



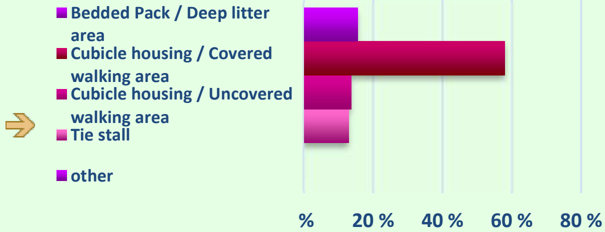
23 - 25 kg dry feed /cow /day

concentrate feed

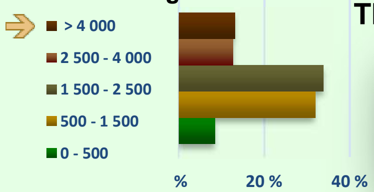


8 - 10 kg concentrate /cow /day

Housing category



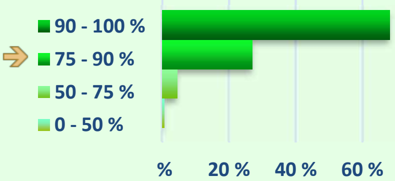
housing area



4087,324 - 4212,324 m² /house

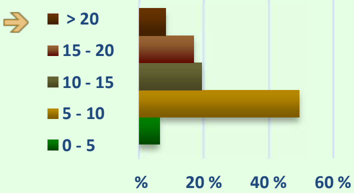
The monitored house

feed lactating cows (% feed all animals)



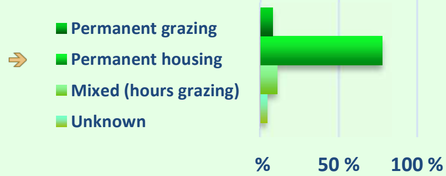
83 - 90 % total house

cow area

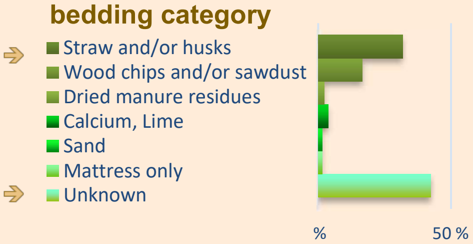


23,8 - 26,2 m² /lactating cow

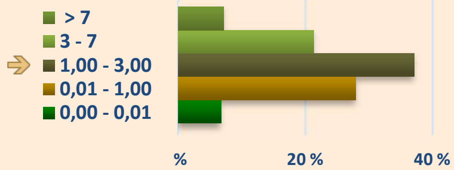
grazing option



bedding category



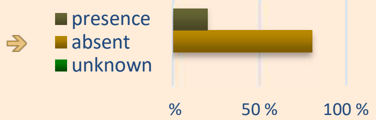
bedding input (kg bedding /cow /day)



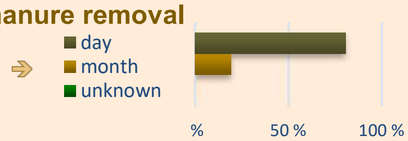
1,5 - 1,8 kg bedding /cow /day

The manure management

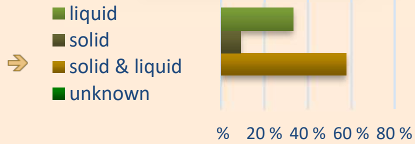
slatted floor



manure removal



Manure output



Farm 1 (Italy) UNIFI

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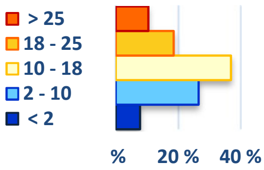
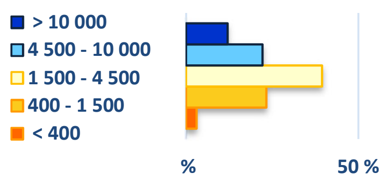
Take-home messages

- Emissions of ammonia, methane and nitrous oxide higher than the population are repeatedly observed;
- Changes in manure or cow management can induce significant decrease in polluting emissions

Outdoor temperature (°C)



Ventilation (m3 /hour /cow)



Observed emissions

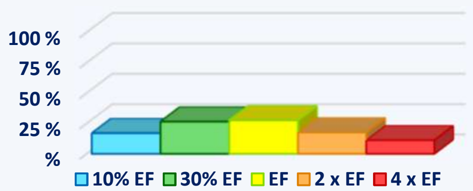
Observations in all countries

Observations in my farm

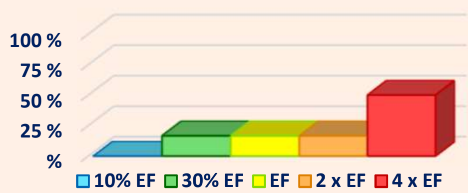
Outdoor temperature 4,4 - 31 °C

Ventilation 3 300 - 18000 m3 /hour /cow

► *Ammonia emissions (g NH3 /cow /day)*



Reference emission factor: EF = 30 g NH3 /cow /day



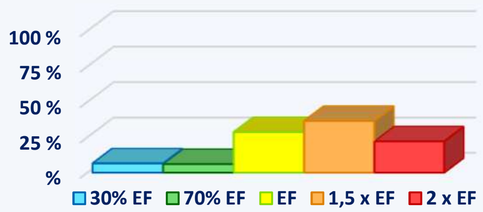
min: 14 g NH3 /cow /day

max: 350 g NH3 /cow /day

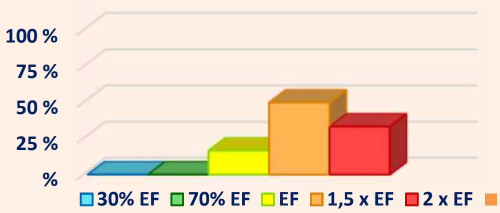
n: 6 emissions

min	max	min	max	min	max	min	max	min
0	4	4	15	15	45	45	101	101

► *kg CH4 /cow /day (kg CH4 /cow /day)*



Reference emission factor: EF = 0,38 kg CH4 /cow /day



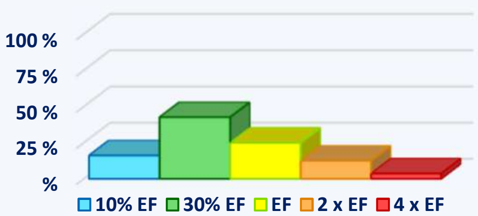
min: 0,3 kg CH4 /cow /day

max: 0,8 kg CH4 /cow /day

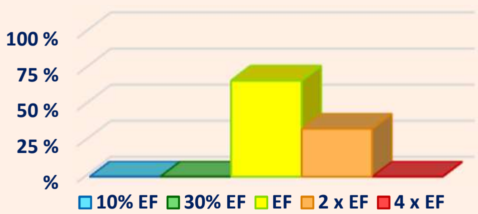
n: 6 emissions

min	max	min	max	min	max	min	max	min
0,00	0,19	0,19	0,30	0,30	0,45	0,45	0,65	0,65

► *Nitrous oxide emissions (g N2O /cow /day)*



Reference emission factor: EF = 1,8 g N2O /cow /day



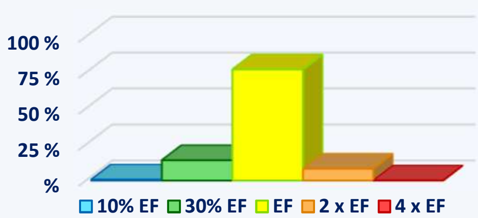
min: 1 g N2O /cow /day

max: 5 g N2O /cow /day

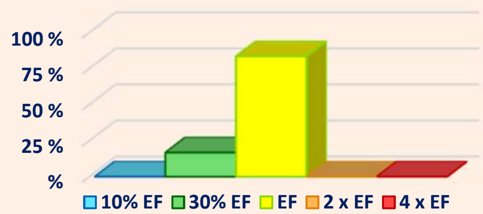
n: 6 emissions

min	max	min	max	min	max	min	max	min
0,00	0,23	0,23	0,91	0,91	2,73	2,73	6,14	6,14

► *GHG emissions (kg eq CO2 /L milk)*



Reference emission factor: EF = 0,40 kg eq CO2 /L milk



min: 0,2 kg eq CO2 /L milk

max: 0,4 kg eq CO2 /L milk

min	max	min	max	min	max	min	max	min
0,00	0,05	0,05	0,20	0,20	0,61	0,61	1,36	1,36

Farm 2 (Italy)

Survey of housing emissions (2021 - 2023)

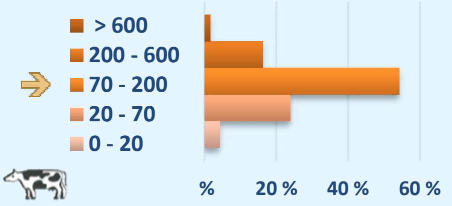
UNIFI

Farm visited by Valentina Becciolini

My farm vs the diversity of visited dairy units in all countries

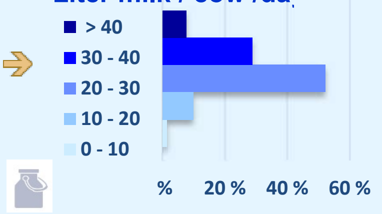
Tier	2b	2a	1	not used	total (3 gases)
nb obs.	10	0	2	0	12

lactating cows / house



180 cows

Liter milk / cow /day

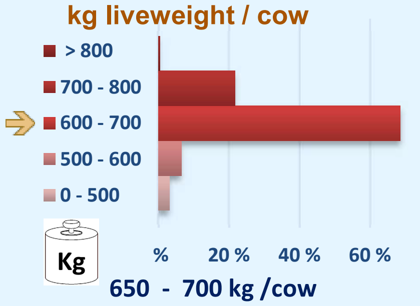


39 L milk /cow /day

The monitored dairy cows

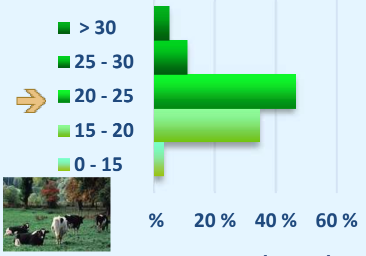
Farm 2

kg liveweight / cow



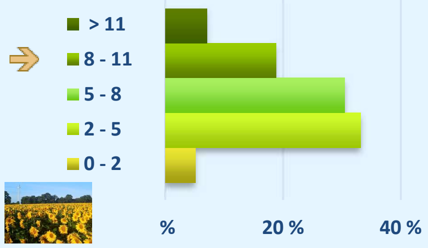
650 - 700 kg /cow

dry matter feed / cow /day



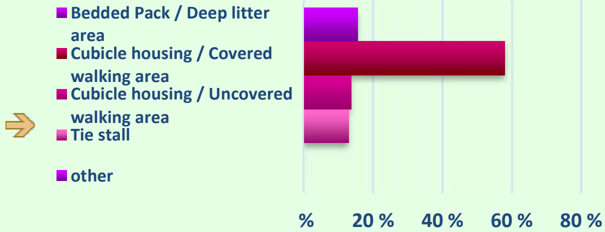
22 - 23 kg dry feed /cow /day

concentrate feed

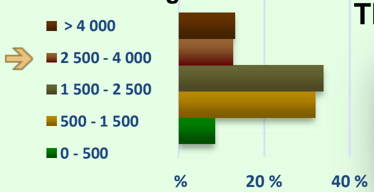


9 - 10 kg concentrate /cow /day

Housing category



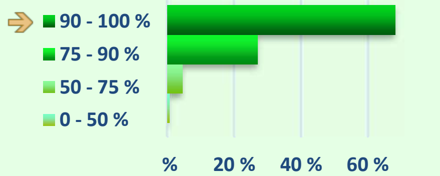
housing area



3108,61 m² /house

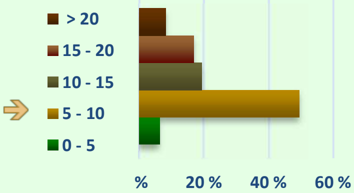
The monitored house

feed lactating cows (% feed all animals)



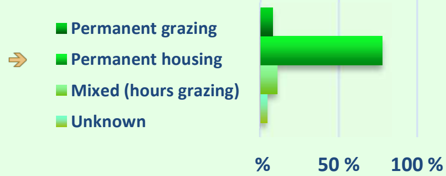
86 - 92 % total house

cow area

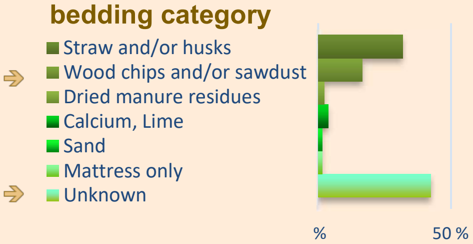


9,0 m² /lactating cow

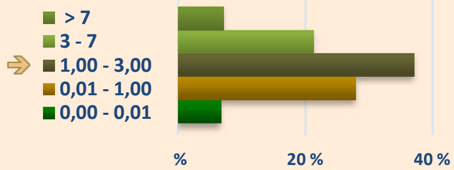
grazing option



bedding category



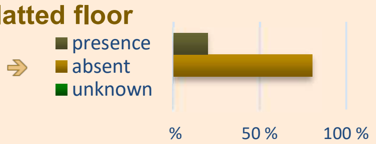
bedding input (kg bedding /cow /day)



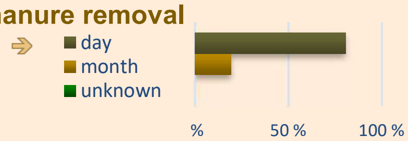
2,4 kg bedding /cow /day

The manure management

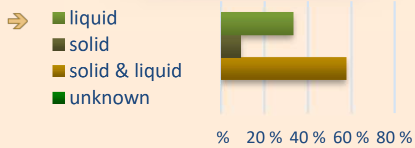
slatted floor



manure removal



Manure output

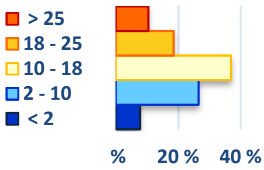


Farm 2 (Italy) UNIFI

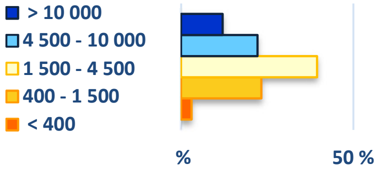
Take-home messages

- Emissions of ammonia and nitrous oxide are similar to the population;
- Manure management could be tuned to decrease the occurrence of methane (or ammonia) emissions higher than the emission factor

Outdoor temperature (°C)



Ventilation (m3 /hour /cow)



Observed emissions

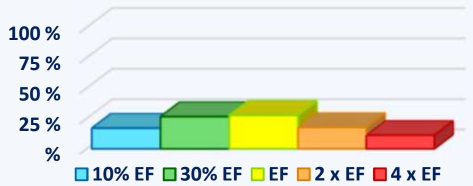
Observations in all countries

Observations in my farm

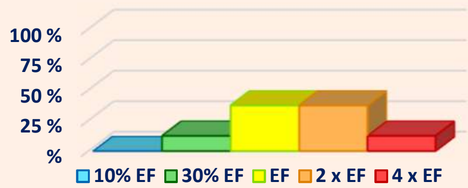
Outdoor temperature 10 - 31 °C

Ventilation 2 900 - 7800 m3 /hour /cow

► *Ammonia emissions (g NH_3 /cow /day)*



Reference emission factor: EF = 30 g NH_3 /cow /day



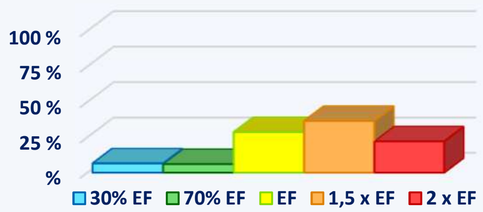
min: 8 g NH_3 /cow /day

max: 120 g NH_3 /cow /day

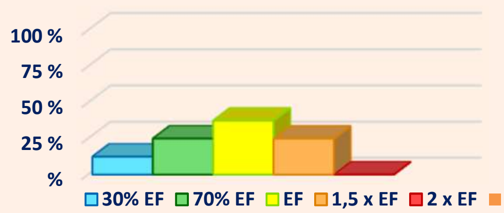
n: 8 emissions

min	max	min	max	min	max	min	max	min
0	4	4	15	15	45	45	101	101

► *kg CH_4 /cow /day (kg CH_4 /cow /day)*



Reference emission factor: EF = 0,38 kg CH_4 /cow /day



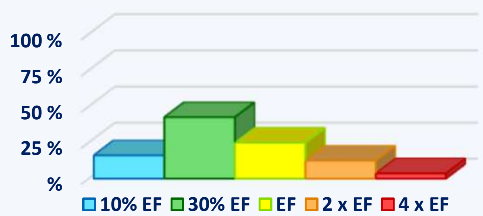
min: 0,2 kg CH_4 /cow /day

max: 0,6 kg CH_4 /cow /day

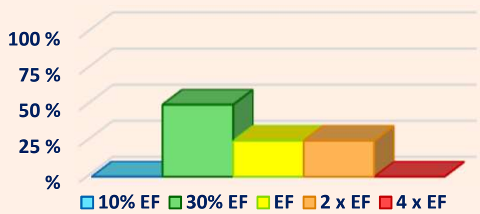
n: 8 emissions

min	max	min	max	min	max	min	max	min
0,00	0,19	0,19	0,30	0,30	0,45	0,45	0,65	0,65

► *Nitrous oxide emissions (g N_2O /cow /day)*



Reference emission factor: EF = 1,8 g N_2O /cow /day



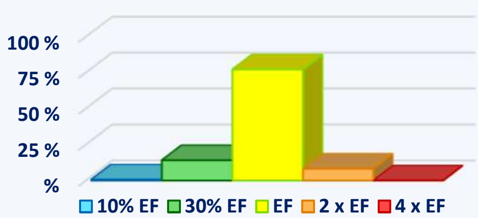
min: 0,6 g N_2O /cow /day

max: 4 g N_2O /cow /day

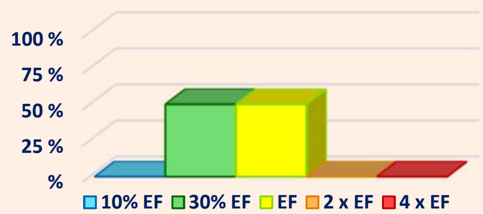
n: 8 emissions

min	max	min	max	min	max	min	max	min
0,00	0,23	0,23	0,91	0,91	2,73	2,73	6,14	6,14

► *GHG emissions (kg eq CO_2 /L milk)*



Reference emission factor: EF = 0,40 kg eq CO_2 /L milk



min: 0,1 kg eq CO_2 /L milk

max: 0,3 kg eq CO_2 /L milk

min	max	min	max	min	max	min	max	min
0,00	0,05	0,05	0,20	0,20	0,61	0,61	1,36	1,36

Farm 3 (Italy)

Survey of housing emissions
(2021 - 2023)

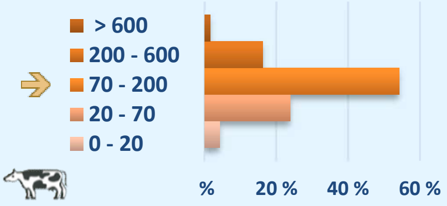
UNIFI

Farm visited by
Valentina Becciolini

My farm vs the diversity of visited dairy units in all countries

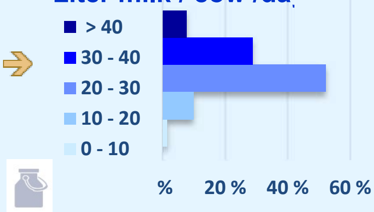
Tier	2b	2a	1	not used	total (3 gases)
nb obs.	5	0	5	2	12

lactating cows / house



110 - 120 cows

Liter milk / cow /day

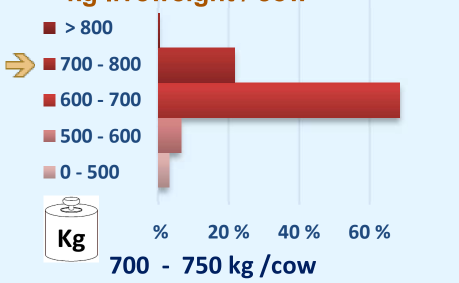


37 L milk /cow /day

The monitored dairy cows

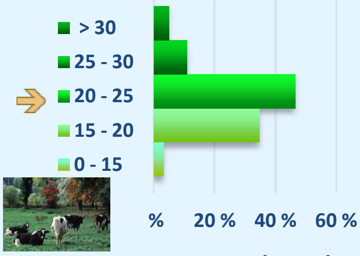
Farm 3

kg liveweight / cow



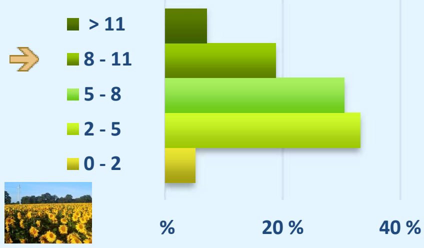
700 - 750 kg /cow

dry matter feed / cow /day



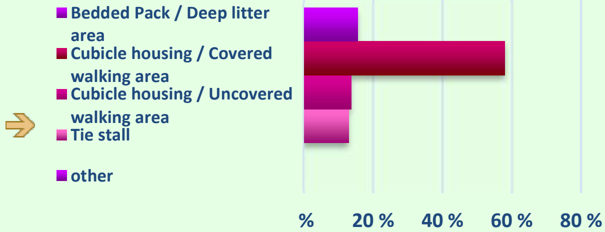
23 - 24 kg dry feed /cow /day

concentrate feed

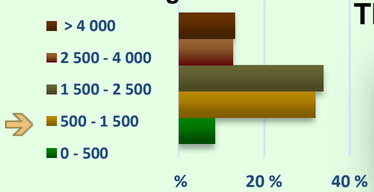


9 - 11 kg concentrate /cow /day

Housing category



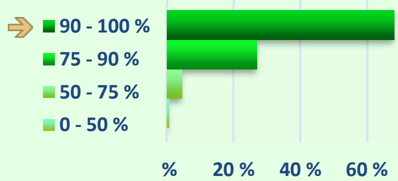
housing area



1280 m² /house

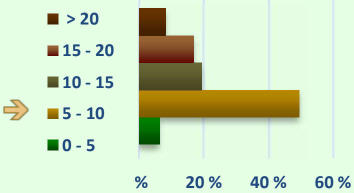
The monitored house

feed lactating cows (% feed all animals)



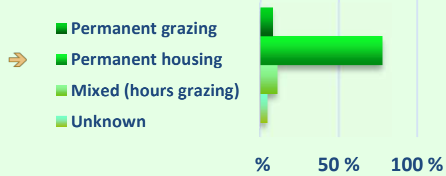
100 % total house

cow area

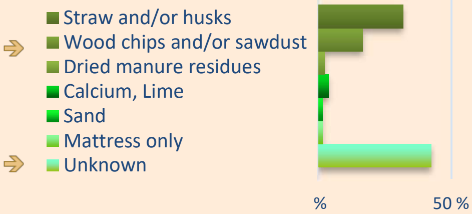


9,0 m² /lactating cow

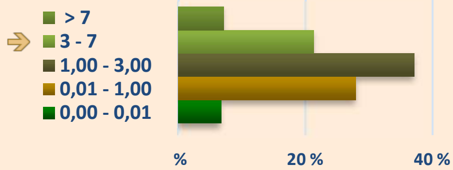
grazing option



bedding category



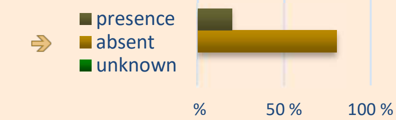
bedding input (kg bedding /cow /day)



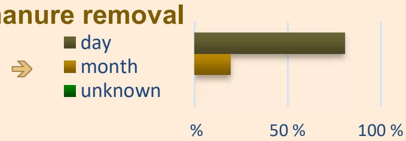
2,5 - 3,5 kg bedding /cow /day

The manure management

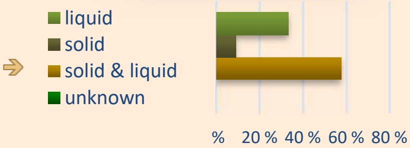
slatted floor



manure removal



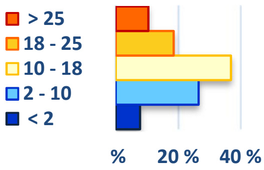
Manure output

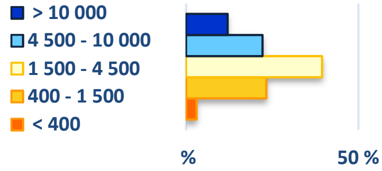


Farm 3 (Italy) UNIFI

Take-home messages

- Emissions of ammonia, methane and nitrous oxide higher than the population are repeatedly observed;
- Changes in manure or cow management can induce significant decrease in polluting emissions





Observed emissions

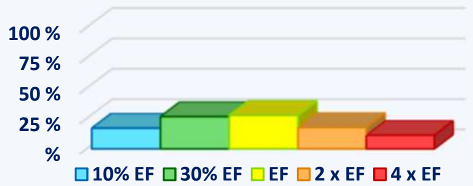
Observations in all countries

Observations in my farm

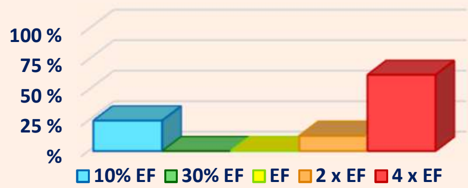
Outdoor temperature 8,3 - 29 °C

Ventilation 2 000 - 33000 m3 /hour /cow

► *Ammonia emissions (g NH3 /cow /day)*



Reference emission factor: EF = 30 g NH3 /cow /day



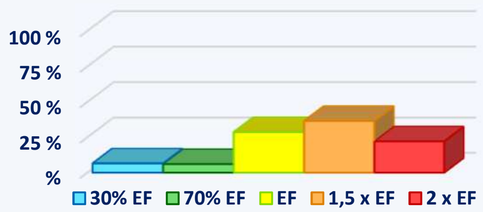
min: 2 g NH3 /cow /day

max: 730 g NH3 /cow /day

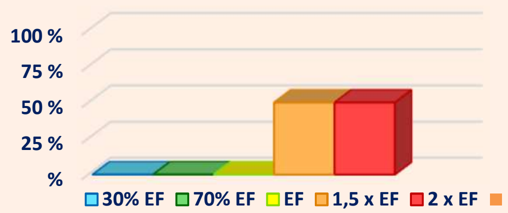
n: 8 emissions

min	max	min	max	min	max	min	max	min
0	4	4	15	15	45	45	101	101

► *kg CH4 /cow /day (kg CH4 /cow /day)*



Reference emission factor: EF = 0,38 kg CH4 /cow /day



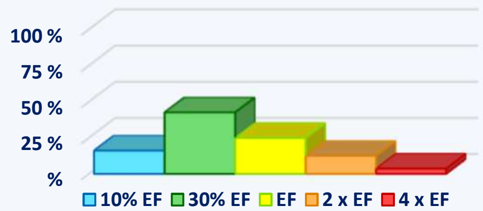
min: 0,5 kg CH4 /cow /day

max: 0,8 kg CH4 /cow /day

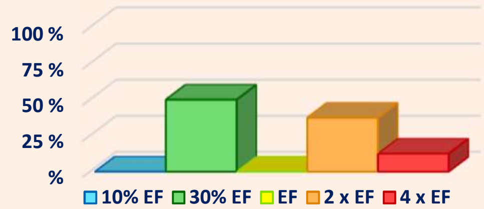
n: 4 emissions

min	max	min	max	min	max	min	max	min
0,00	0,19	0,19	0,30	0,30	0,45	0,45	0,65	0,65

► *Nitrous oxide emissions (g N2O /cow /day)*



Reference emission factor: EF = 1,8 g N2O /cow /day



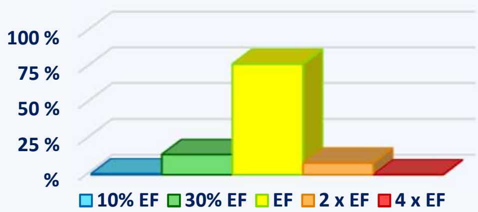
min: 0,4 g N2O /cow /day

max: 8 g N2O /cow /day

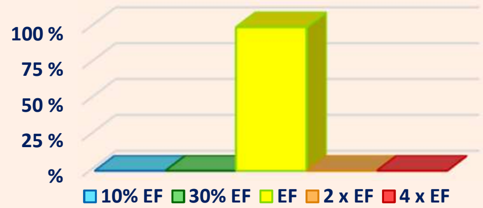
n: 8 emissions

min	max	min	max	min	max	min	max	min
0,00	0,23	0,23	0,91	0,91	2,73	2,73	6,14	6,14

► *GHG emissions (kg eq CO2 /L milk)*



Reference emission factor: EF = 0,40 kg eq CO2 /L milk



min: 0,3 kg eq CO2 /L milk

max: 0,5 kg eq CO2 /L milk

min	max	min	max	min	max	min	max	min
0,00	0,05	0,05	0,20	0,20	0,61	0,61	1,36	1,36

Farm 4 (Italy)

Survey of housing emissions (2021 - 2023)

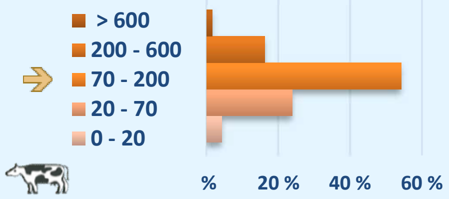
UNIFI

Farm visited by Valentina Becciolini

My farm vs the diversity of visited dairy units in all countries

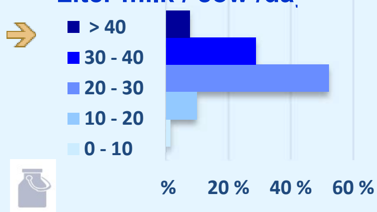
Tier	2b	2a	1	not used	total (3 gases)
nb obs.	11	0	1	0	12

lactating cows / house



180 - 211 cows

Liter milk / cow /day

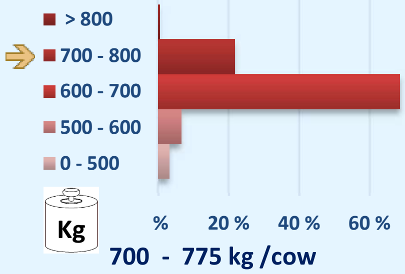


43 L milk /cow /day

The monitored dairy cows

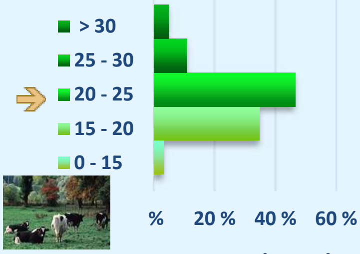
Farm 4

kg liveweight / cow



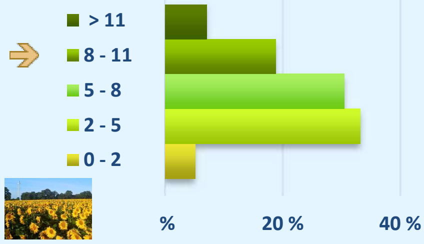
700 - 775 kg /cow

dry matter feed / cow /day



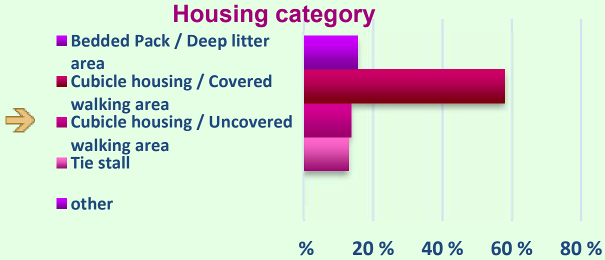
23 - 25 kg dry feed /cow /day

concentrate feed

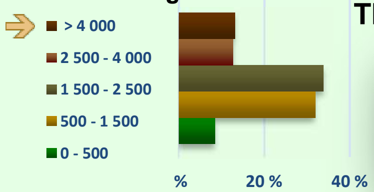


7 - 13 kg concentrate /cow /day

Housing category



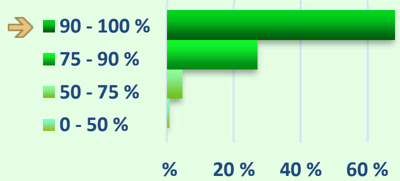
housing area



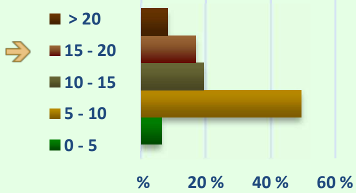
4378 m² /house

The monitored house

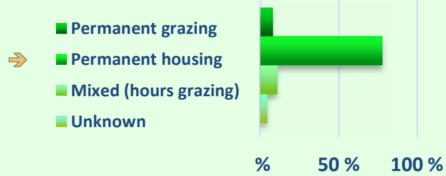
feed lactating cows (% feed all animals)



cow area



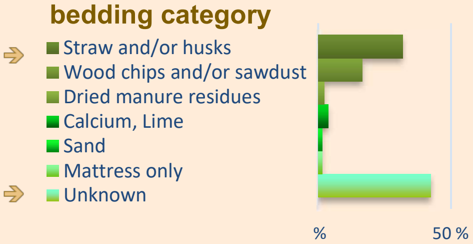
grazing option



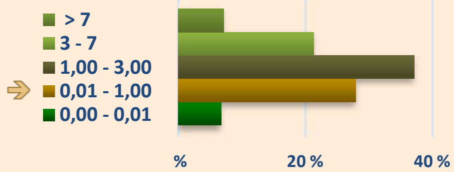
98 - 100 % total house

15,0 - 17,6 m² /lactating cow

bedding category



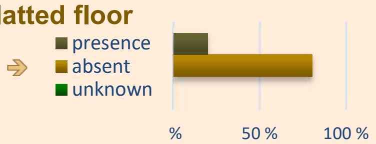
bedding input (kg bedding /cow /day)



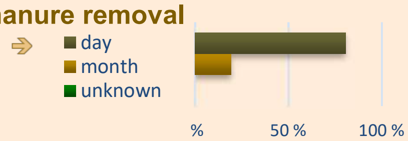
0,7 - 1,4 kg bedding /cow /day

The manure management

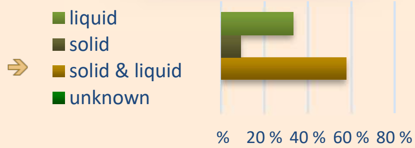
slatted floor



manure removal



Manure output

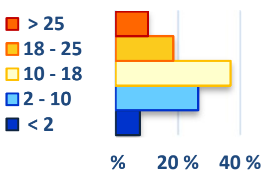


Farm 4 (Italy) UNIFI

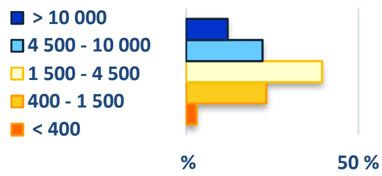
Take-home messages

- Emissions of ammonia, methane and nitrous oxide are similar to the population;
- Methane emissions higher than emission factor can be due to the manure management

Outdoor temperature (°C)



Ventilation (m3 /hour /cow)



Observed emissions

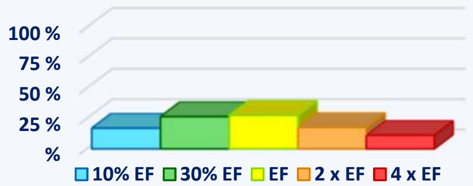
Observations in all countries

Observations in my farm

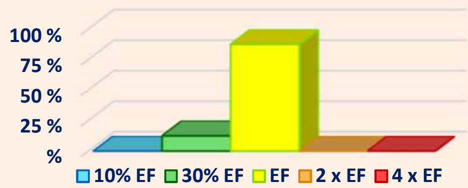
Outdoor temperature 9,2 - 33 °C

Ventilation 2 100 - 9300 m3 /hour /cow

► *Ammonia emissions (g NH3 /cow /day)*



Reference emission factor: EF = 30 g NH3 /cow /day



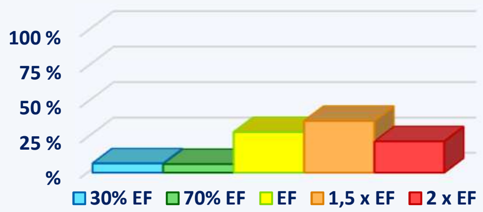
min: 6 g NH3 /cow /day

max: 44 g NH3 /cow /day

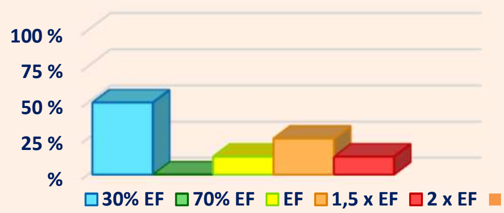
n: 8 emissions

min	max	min	max	min	max	min	max	min
0	4	4	15	15	45	45	101	101

► *kg CH4 /cow /day (kg CH4 /cow /day)*



Reference emission factor: EF = 0,38 kg CH4 /cow /day



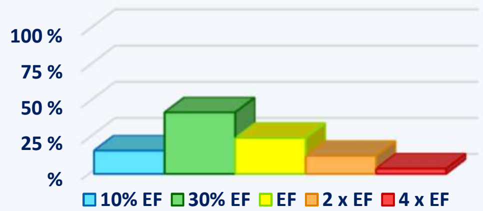
min: 0,09 kg CH4 /cow /day

max: 0,7 kg CH4 /cow /day

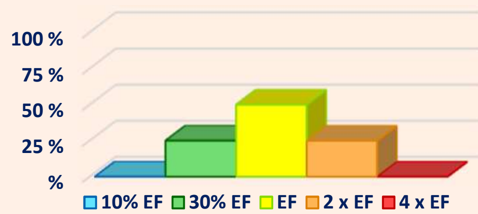
n: 8 emissions

min	max	min	max	min	max	min	max	min
0,00	0,19	0,19	0,30	0,30	0,45	0,45	0,65	0,65

► *Nitrous oxide emissions (g N2O /cow /day)*



Reference emission factor: EF = 1,8 g N2O /cow /day



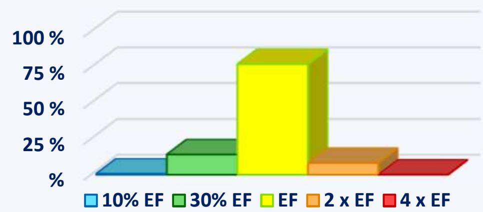
min: 0,5 g N2O /cow /day

max: 3 g N2O /cow /day

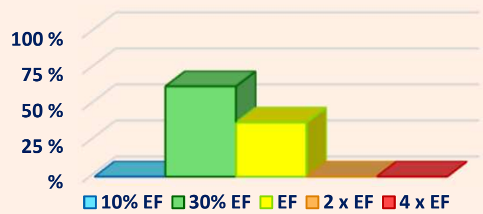
n: 8 emissions

min	max	min	max	min	max	min	max	min
0,00	0,23	0,23	0,91	0,91	2,73	2,73	6,14	6,14

► *GHG emissions (kg eq CO2 /L milk)*



Reference emission factor: EF = 0,40 kg eq CO2 /L milk



min: 0,05 kg eq CO2 /L milk

max: 0,3 kg eq CO2 /L milk

min	max	min	max	min	max	min	max	min
0,00	0,05	0,05	0,20	0,20	0,61	0,61	1,36	1,36

Farm 5 (Italy)

Survey of housing emissions
(2021 - 2023)

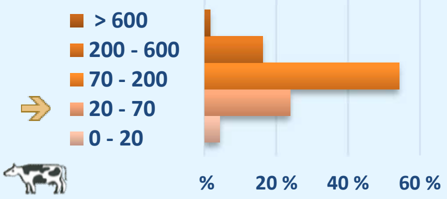
UNIFI

Farm visited by
Valentina Becciolini

My farm vs the diversity of visited dairy units in all countries

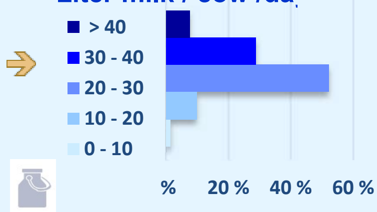
Tier	2b	2a	1	not used	total (3 gases)
nb obs.	6	5	1	0	12

lactating cows / house



57 - 72 cows

Liter milk / cow /day

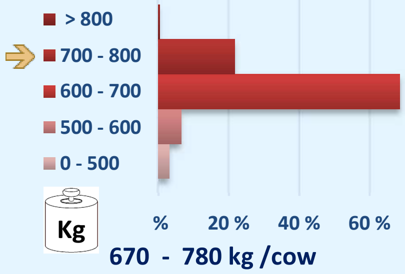


38 L milk /cow /day

The monitored dairy cows

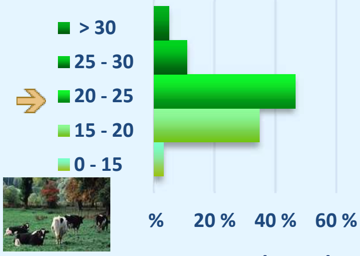
Farm 5

kg liveweight / cow



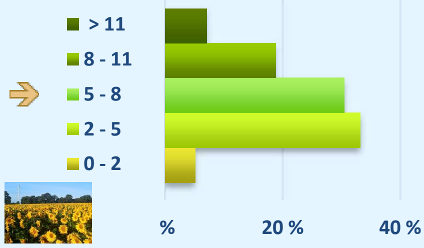
670 - 780 kg /cow

dry matter feed / cow /day



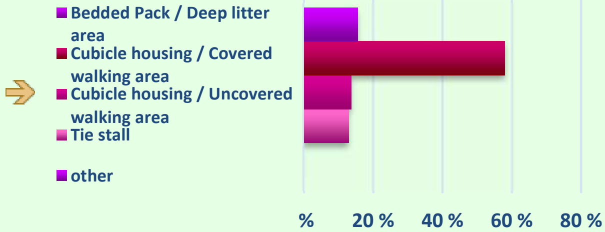
18 - 24 kg dry feed /cow /day

concentrate feed

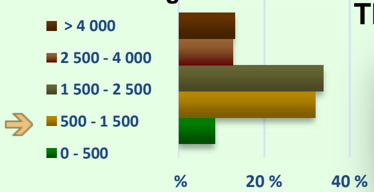


5 - 10 kg concentrate /cow /day

Housing category



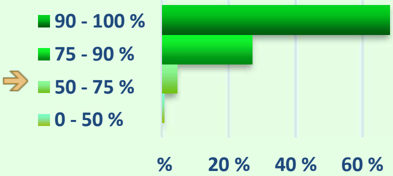
housing area



1205 m² /house

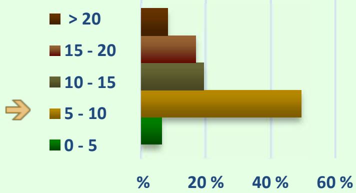
The monitored house

feed lactating cows (% feed all animals)



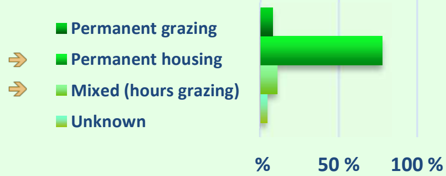
49 - 75 % total house

cow area



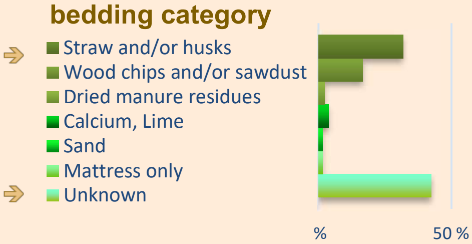
6,2 - 7,8 m² /lactating cow

grazing option

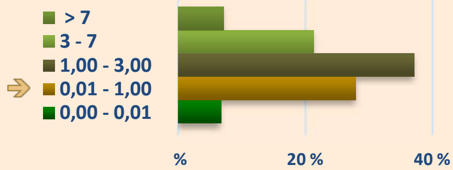


0 - 10 hours grazing /day

bedding category



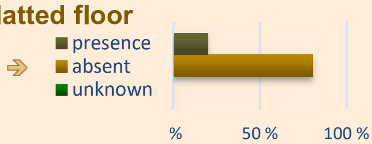
bedding input (kg bedding /cow /day)



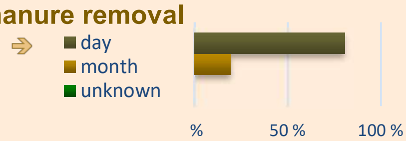
0,5 kg bedding /cow /day

The manure management

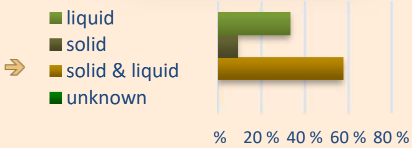
slatted floor



manure removal



Manure output

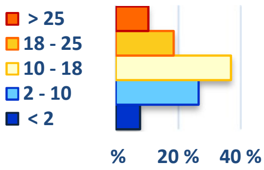


Farm 5 (Italy) UNIFI

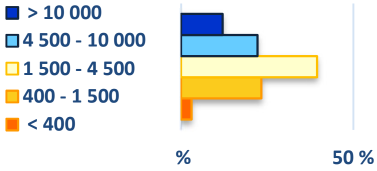
Take-home messages

- Emissions of ammonia and nitrous oxide are similar to the population;
- Manure management could be tuned to decrease the occurrence of methane (or ammonia) emissions higher than the emission factor

Outdoor temperature (°C)



Ventilation (m3 /hour /cow)



Observed emissions

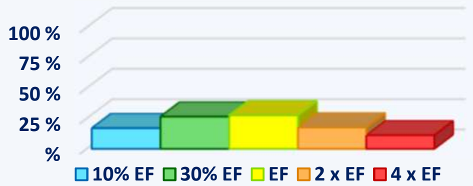
Observations in all countries

Observations in my farm

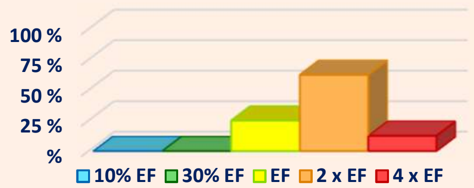
Outdoor temperature 4,6 - 30 °C

Ventilation 2 500 - 9200 m3 /hour /cow

► *Ammonia emissions (g NH3 /cow /day)*



Reference emission factor: EF = 30 g NH3 /cow /day



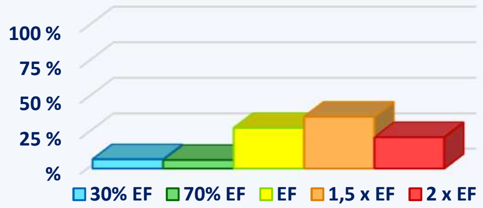
min: 25 g NH3 /cow /day

max: 140 g NH3 /cow /day

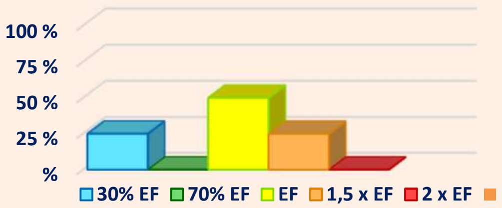
n: 8 emissions

min	max	min	max	min	max	min	max	min
0	4	4	15	15	45	45	101	101

► *kg CH4 /cow /day (kg CH4 /cow /day)*



Reference emission factor: EF = 0,38 kg CH4 /cow /day



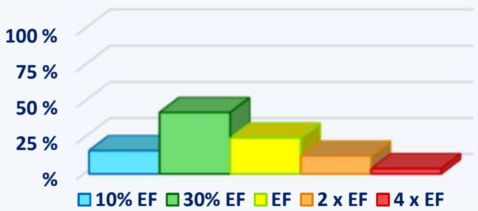
min: 0,1 kg CH4 /cow /day

max: 0,5 kg CH4 /cow /day

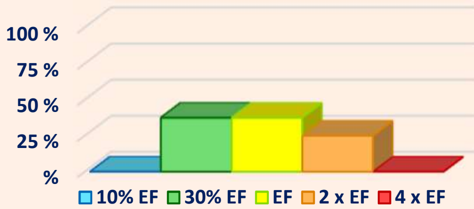
n: 8 emissions

min	max	min	max	min	max	min	max	min
0,00	0,19	0,19	0,30	0,30	0,45	0,45	0,65	0,65

► *Nitrous oxide emissions (g N2O /cow /day)*



Reference emission factor: EF = 1,8 g N2O /cow /day



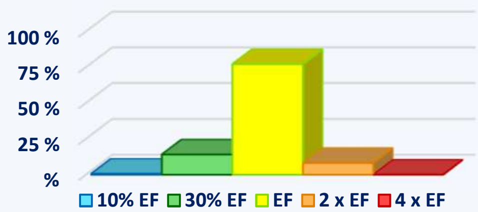
min: 0,4 g N2O /cow /day

max: 3 g N2O /cow /day

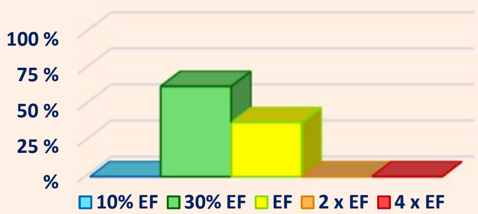
n: 8 emissions

min	max	min	max	min	max	min	max	min
0,00	0,23	0,23	0,91	0,91	2,73	2,73	6,14	6,14

► *GHG emissions (kg eq CO2 /L milk)*



Reference emission factor: EF = 0,40 kg eq CO2 /L milk



min: 0,07 kg eq CO2 /L milk

max: 0,3 kg eq CO2 /L milk

min	max	min	max	min	max	min	max	min
0,00	0,05	0,05	0,20	0,20	0,61	0,61	1,36	1,36

Farm 6 (Italy)

Survey of housing emissions
(2021 - 2023)

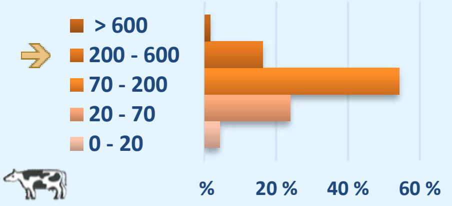
UNIFI

Farm visited by
Valentina Becciolini

My farm vs the diversity of visited dairy units in all countries

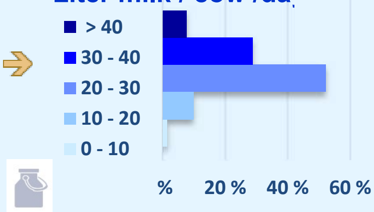
Tier	2b	2a	1	not used	total (3 gases)
nb obs.	0	0	9	3	12

lactating cows / house



196 - 206 cows

Liter milk / cow /day

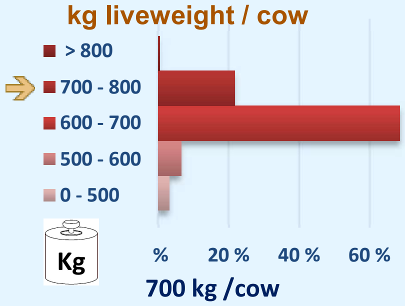


31 L milk /cow /day

The monitored dairy cows

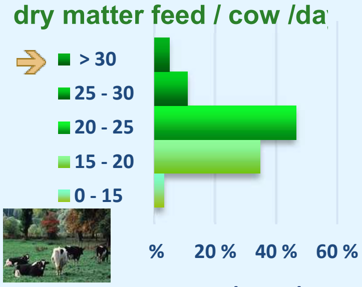
Farm 6

kg liveweight / cow



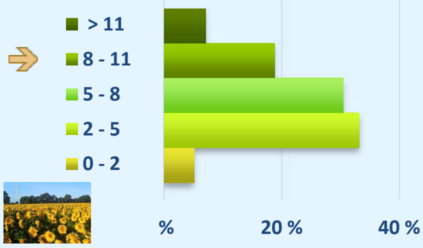
700 kg /cow

dry matter feed / cow /day



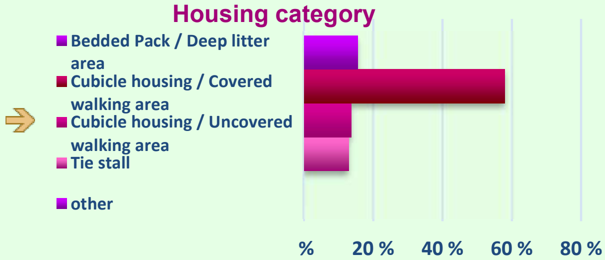
45 kg dry feed /cow /day

concentrate feed

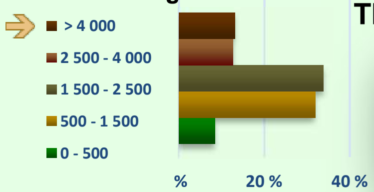


10 - 11 kg concentrate /cow /day

Housing category



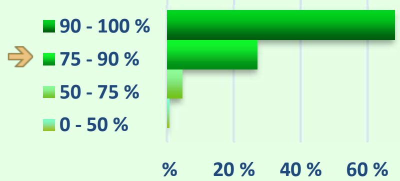
housing area



4086,01 m² /house

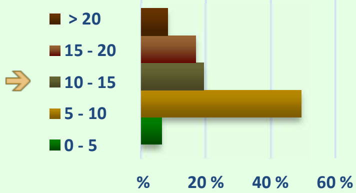
The monitored house

feed lactating cows (% feed all animals)



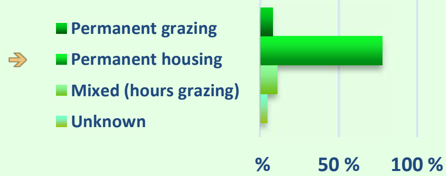
87 - 89 % total house

cow area

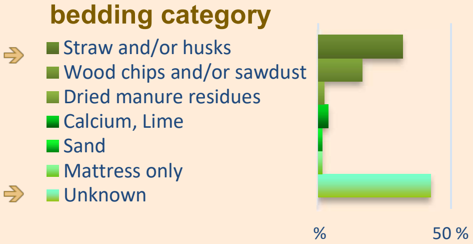


11,2 m² /lactating cow

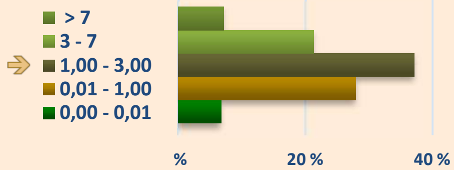
grazing option



bedding category



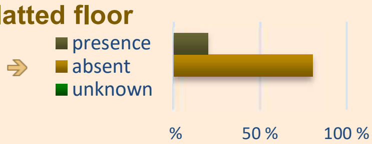
bedding input (kg bedding /cow /day)



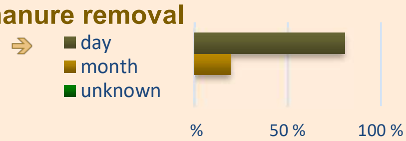
2,9 kg bedding /cow /day

The manure management

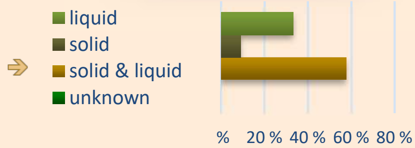
slatted floor



manure removal



Manure output



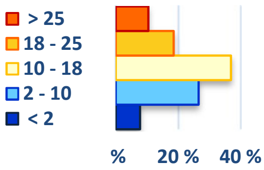
Farm 6 (Italy)

UNIFI

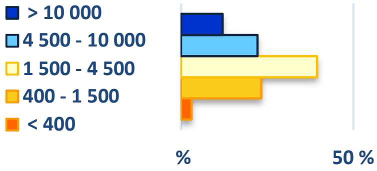
Take-home messages

- Emissions of ammonia and nitrous oxide are similar to the population;
- Manure management could be tuned to decrease the occurrence of methane (or ammonia) emissions higher than the emission factor

Outdoor temperature (°C)



Ventilation (m3 /hour /cow)



Observed emissions

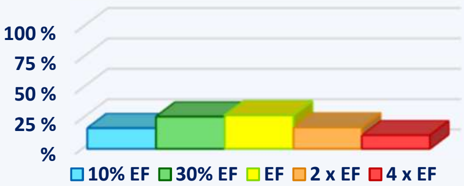
Observations in all countries

Observations in my farm

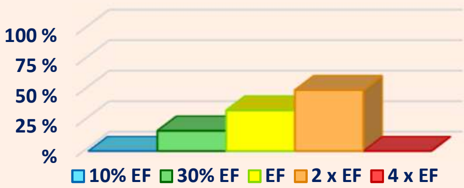
Outdoor temperature 13 - 32 °C

Ventilation 2 200 - 15000 m3 /hour /cow

► *Ammonia emissions (g NH_3 /cow /day)*



Reference emission factor: EF = 30 g NH_3 /cow /day



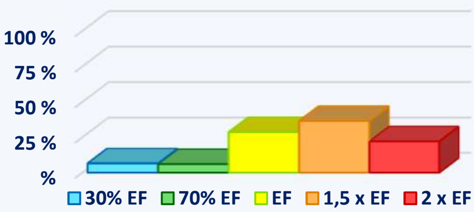
min: 10 g NH_3 /cow /day

max: 88 g NH_3 /cow /day

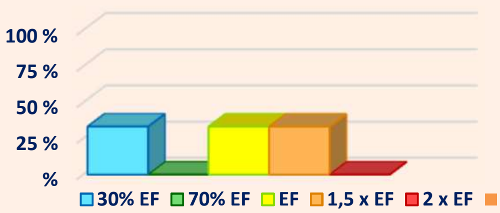
n: 6 emissions

min	max	min	max	min	max	min	max	min
0	4	4	15	15	45	45	101	101

► *kg CH_4 /cow /day (kg CH_4 /cow /day)*



Reference emission factor: EF = 0,38 kg CH_4 /cow /day



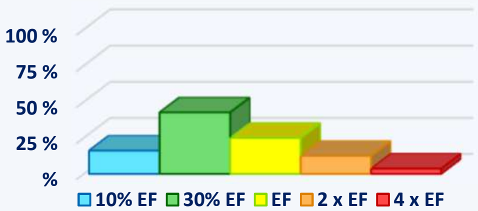
min: 0,1 kg CH_4 /cow /day

max: 0,5 kg CH_4 /cow /day

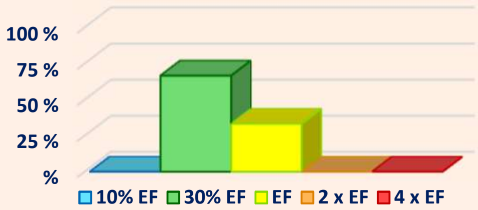
n: 6 emissions

min	max	min	max	min	max	min	max	min
0,00	0,19	0,19	0,30	0,30	0,45	0,45	0,65	0,65

► *Nitrous oxide emissions (g N_2O /cow /day)*



Reference emission factor: EF = 1,8 g N_2O /cow /day



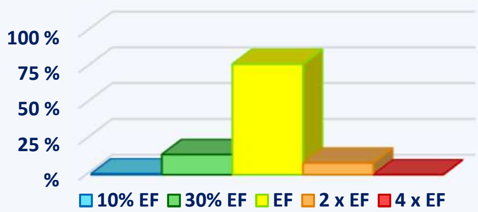
min: 0,4 g N_2O /cow /day

max: 2 g N_2O /cow /day

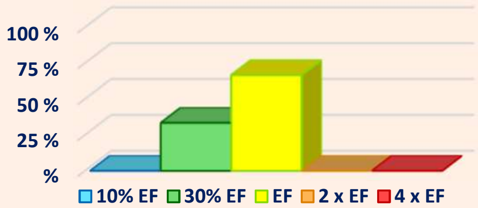
n: 6 emissions

min	max	min	max	min	max	min	max	min
0,00	0,23	0,23	0,91	0,91	2,73	2,73	6,14	6,14

► *GHG emissions (kg eq CO_2 /L milk)*



Reference emission factor: EF = 0,40 kg eq CO_2 /L milk



min: 0,08 kg eq CO_2 /L milk

max: 0,3 kg eq CO_2 /L milk

min	max	min	max	min	max	min	max	min
0,00	0,05	0,05	0,20	0,20	0,61	0,61	1,36	1,36

Farm 7 (Italy)

Survey of housing emissions
(2021 - 2023)

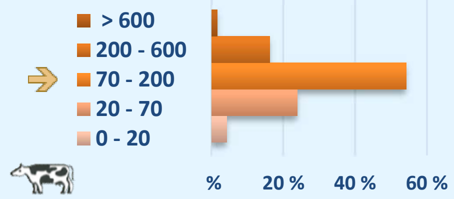
UNIFI

Farm visited by
Valentina Becciolini

My farm vs the diversity of visited dairy units in all countries

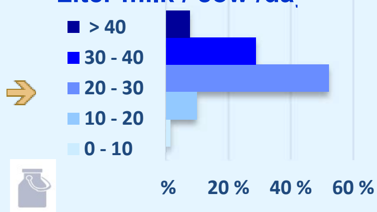
Tier	2b	2a	1	not used	total (3 gases)
nb obs.	0	0	9	3	12

lactating cows / house



139 - 181 cows

Liter milk / cow /day

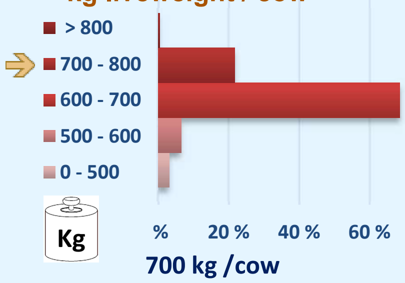


29 L milk /cow /day

The monitored dairy cows

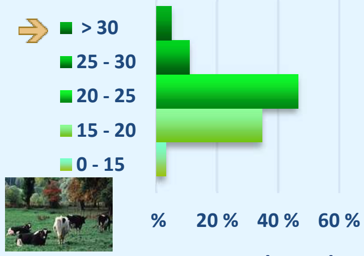
Farm 7

kg liveweight / cow



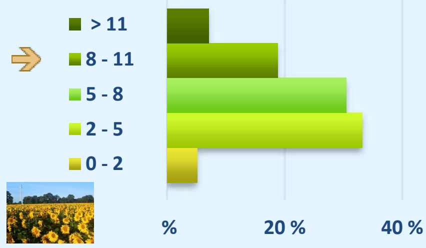
700 kg /cow

dry matter feed / cow /day



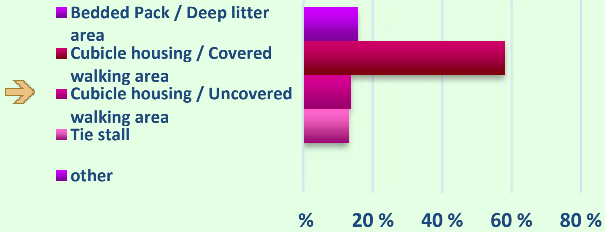
41 - 42 kg dry feed /cow /day

concentrate feed

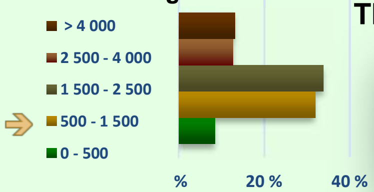


10 - 12 kg concentrate /cow /day

Housing category



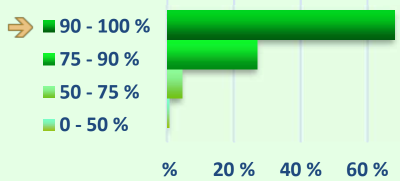
housing area



1168,59 m² /house

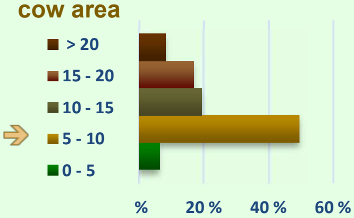
The monitored house

feed lactating cows (% feed all animals)



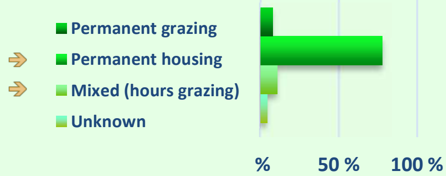
100 % total house

cow area

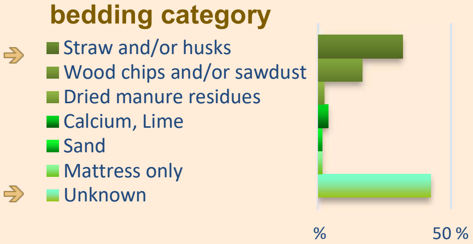


5,1 - 6,6 m² /lactating cow

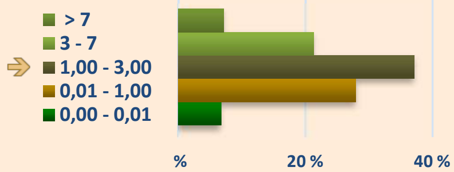
grazing option



bedding category



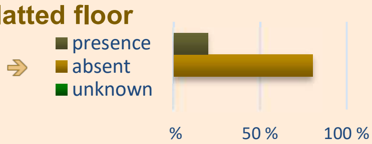
bedding input (kg bedding /cow /day)



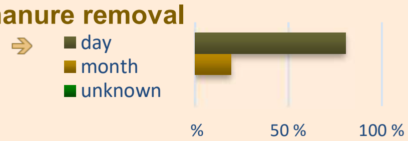
2,5 kg bedding /cow /day

The manure management

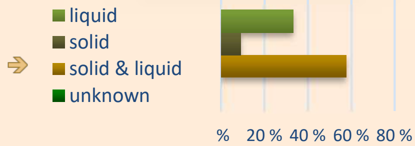
slatted floor



manure removal



Manure output

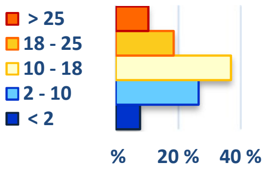


Farm 7 (Italy) UNIFI

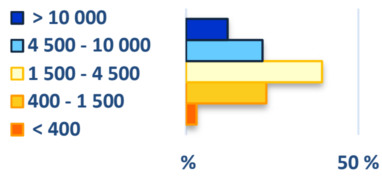
Take-home messages

- Emissions of ammonia and nitrous oxide are lower than the population;
- The reasons of occasional higher methane emissions should be understood to further improve the overall good quality of emissions

Outdoor temperature (°C)



Ventilation (m3 /hour /cow)



Observed emissions

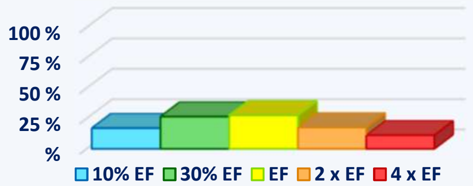
Observations in all countries

Observations in my farm

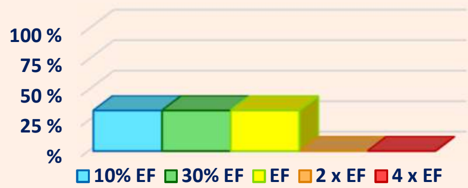
Outdoor temperature 7,3 - 36 °C

Ventilation 830 - 11000 m3 /hour /cow

► *Ammonia emissions (g NH3 /cow /day)*



Reference emission factor: EF = 30 g NH3 /cow /day



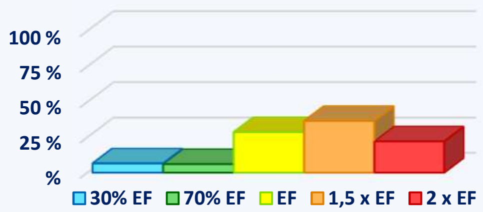
min: 1 g NH3 /cow /day

max: 28 g NH3 /cow /day

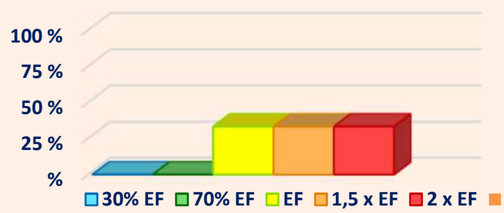
n: 6 emissions

min	max	min	max	min	max	min	max	min
0	4	4	15	15	45	45	101	101

► *kg CH4 /cow /day (kg CH4 /cow /day)*



Reference emission factor: EF = 0,38 kg CH4 /cow /day



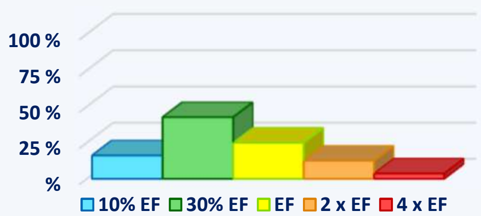
min: 0,4 kg CH4 /cow /day

max: 1 kg CH4 /cow /day

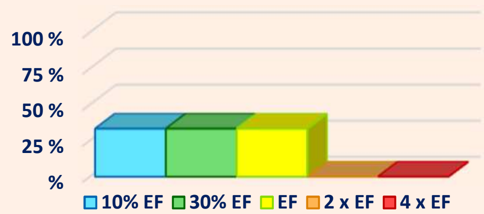
n: 6 emissions

min	max	min	max	min	max	min	max	min
0,00	0,19	0,19	0,30	0,30	0,45	0,45	0,65	0,65

► *Nitrous oxide emissions (g N2O /cow /day)*



Reference emission factor: EF = 1,8 g N2O /cow /day



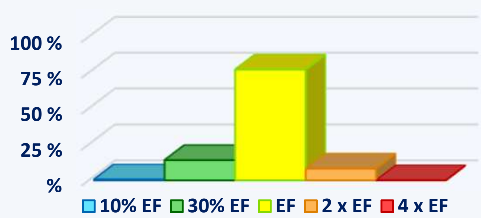
min: 0,1 g N2O /cow /day

max: 1 g N2O /cow /day

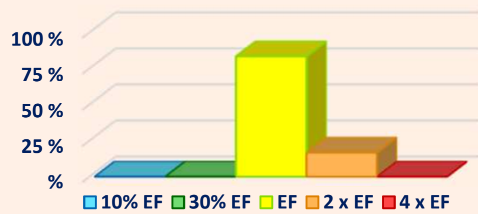
n: 6 emissions

min	max	min	max	min	max	min	max	min
0,00	0,23	0,23	0,91	0,91	2,73	2,73	6,14	6,14

► *GHG emissions (kg eq CO2 /L milk)*



Reference emission factor: EF = 0,40 kg eq CO2 /L milk



min: 0,3 kg eq CO2 /L milk

max: 0,7 kg eq CO2 /L milk

min	max	min	max	min	max	min	max	min
0,00	0,05	0,05	0,20	0,20	0,61	0,61	1,36	1,36

Farm 8 (Italy)

Survey of housing emissions
(2021 - 2023)

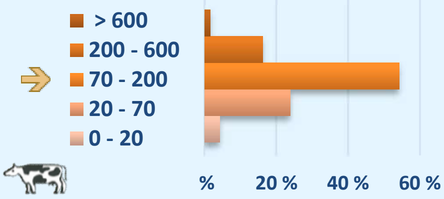
UNIFI

Farm visited by
Valentina Becciolini

My farm vs the diversity of visited dairy units in all countries

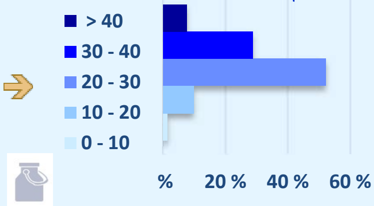
Tier	2b	2a	1	not used	total (3 gases)
nb obs.	7	0	2	3	12

lactating cows / house



79 - 92 cows

Liter milk / cow /day

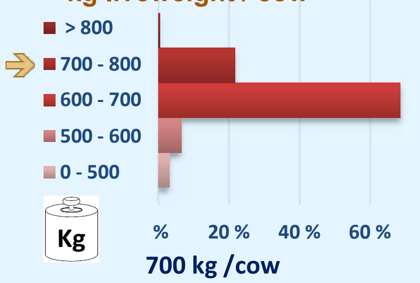


30 L milk /cow /day

The monitored dairy cows

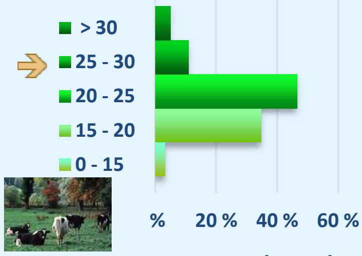
Farm 8

kg liveweight / cow



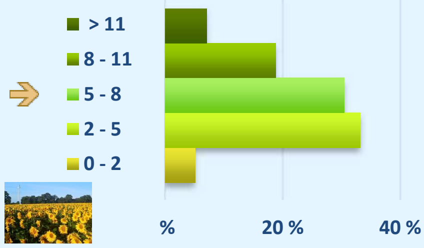
700 kg /cow

dry matter feed / cow /day



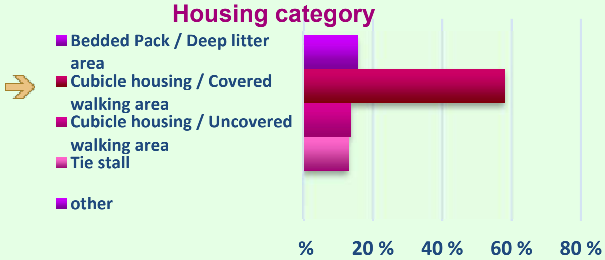
23 - 26 kg dry feed /cow /day

concentrate feed

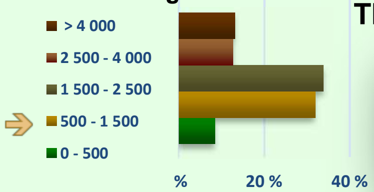


6 - 6 kg concentrate /cow /day

Housing category



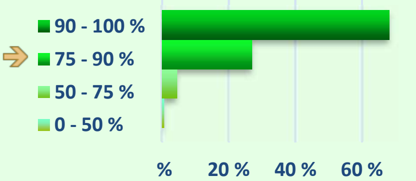
housing area



1153,5 m² /house

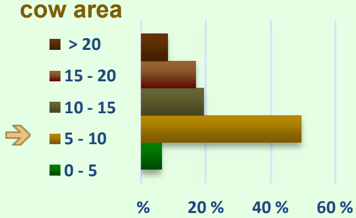
The monitored house

feed lactating cows (% feed all animals)



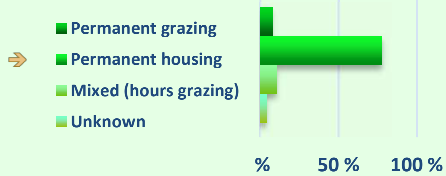
80 - 88 % total house

cow area

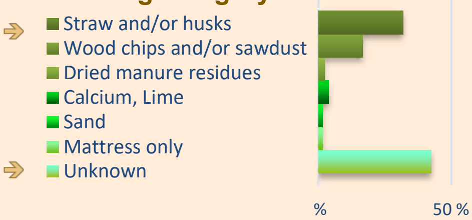


8,3 - 9,6 m² /lactating cow

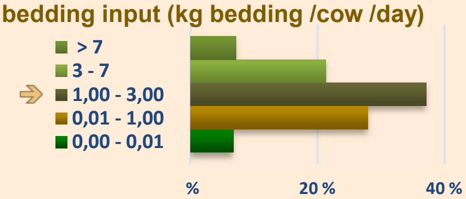
grazing option



bedding category



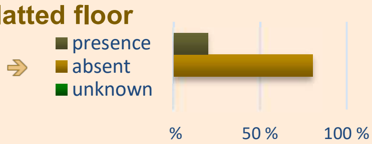
bedding input (kg bedding /cow /day)



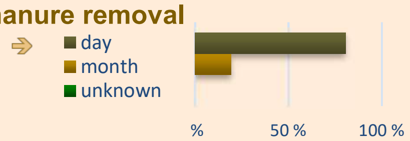
1,6 kg bedding /cow /day

The manure management

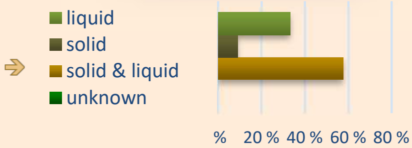
slatted floor



manure removal



Manure output

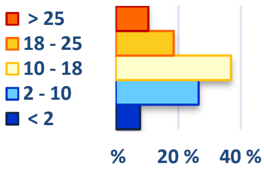


Farm 8 (Italy) UNIFI

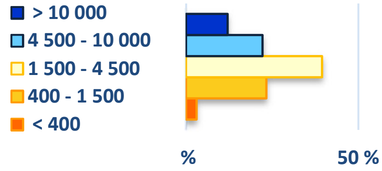
Take-home messages

- Emissions of ammonia and nitrous oxide are smaller than the population while methane emissions are normal for dairy cows;
- The farmer practices should serve as an example of "low emitting system" to improve similar farms in the same region

Outdoor temperature (°C)



Ventilation (m3 /hour /cow)



Observed emissions

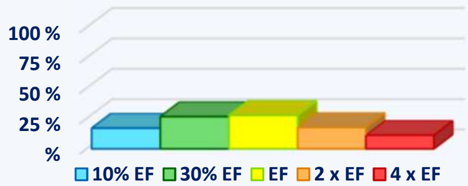
Observations in all countries

Observations in my farm

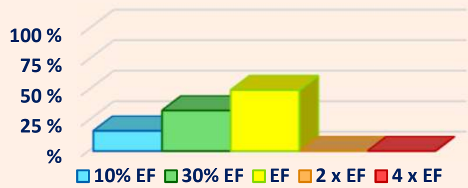
Outdoor temperature 9,9 - 26 °C

Ventilation 1 600 - 4600 m3 /hour /cow

► *Ammonia emissions (g NH3 /cow /day)*



Reference emission factor: EF = 30 g NH3 /cow /day



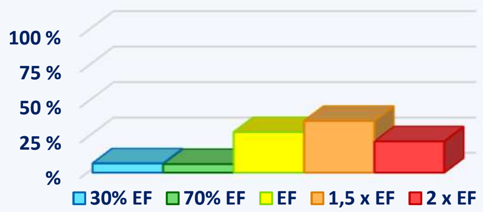
min: 3 g NH3 /cow /day

max: 35 g NH3 /cow /day

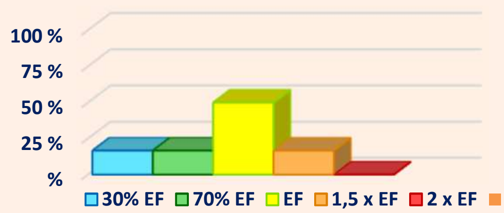
n: 6 emissions

min	max	min	max	min	max	min	max	min
0	4	4	15	15	45	45	101	101

► *kg CH4 /cow /day (kg CH4 /cow /day)*



Reference emission factor: EF = 0,38 kg CH4 /cow /day



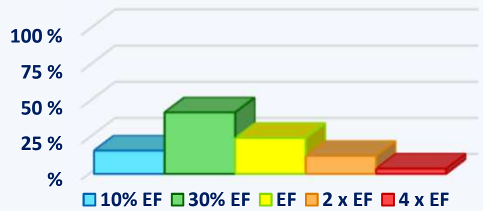
min: 0,2 kg CH4 /cow /day

max: 0,6 kg CH4 /cow /day

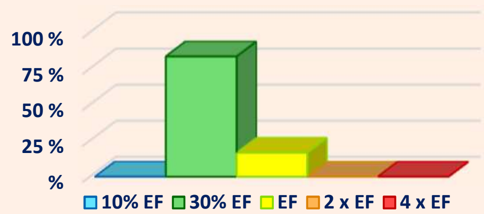
n: 6 emissions

min	max	min	max	min	max	min	max	min
0,00	0,19	0,19	0,30	0,30	0,45	0,45	0,65	0,65

► *Nitrous oxide emissions (g N2O /cow /day)*



Reference emission factor: EF = 1,8 g N2O /cow /day



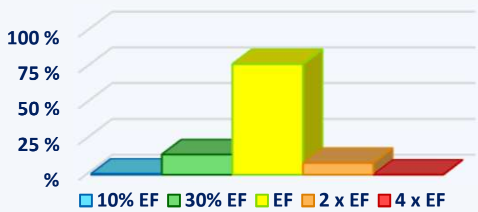
min: 0,3 g N2O /cow /day

max: 2 g N2O /cow /day

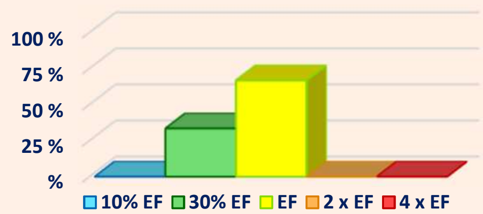
n: 6 emissions

min	max	min	max	min	max	min	max	min
0,00	0,23	0,23	0,91	0,91	2,73	2,73	6,14	6,14

► *GHG emissions (kg eq CO2 /L milk)*



Reference emission factor: EF = 0,40 kg eq CO2 /L milk



min: 0,1 kg eq CO2 /L milk

max: 0,4 kg eq CO2 /L milk

min	max	min	max	min	max	min	max	min
0,00	0,05	0,05	0,20	0,20	0,61	0,61	1,36	1,36

Farm 1 (Lithuania)

Survey of housing emissions (2021 - 2023)

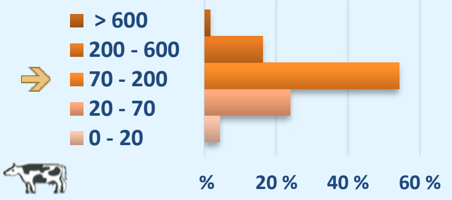
LUHS

Farm visited by Violeta Juškienė (2021 - 2022)

My farm vs the diversity of visited dairy units in all countries

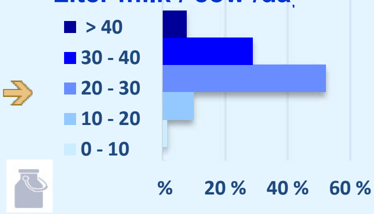
Tier	2b	2a	1	not used	total (3 gases)
nb obs.	11	0	1	0	12

lactating cows / house



96 - 118 cows

Liter milk / cow /day

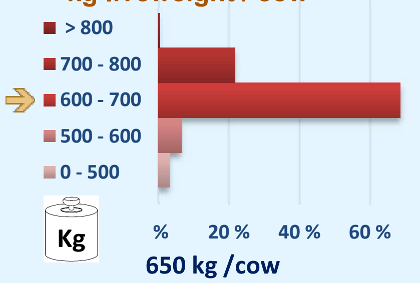


28 L milk /cow /day

The monitored dairy cows

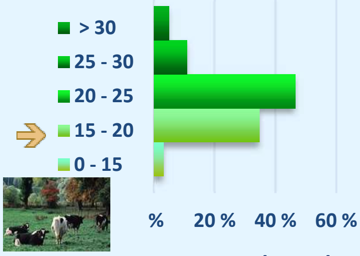
Farm 1

kg liveweight / cow



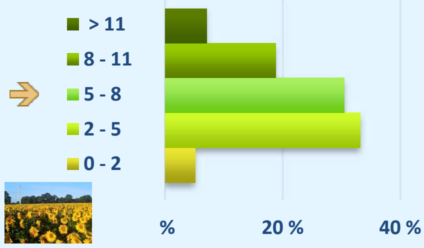
650 kg /cow

dry matter feed / cow /day



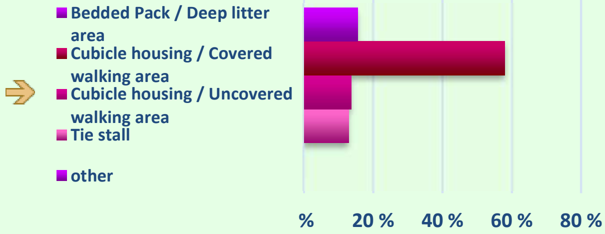
19 - 20 kg dry feed /cow /day

concentrate feed

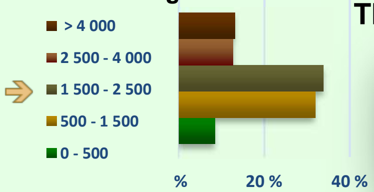


5 - 6 kg concentrate /cow /day

Housing category



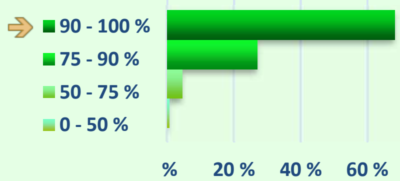
housing area



1566,47 - 1581,47 m² /house

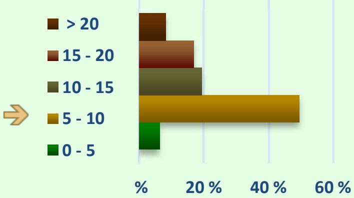
The monitored house

feed lactating cows (% feed all animals)



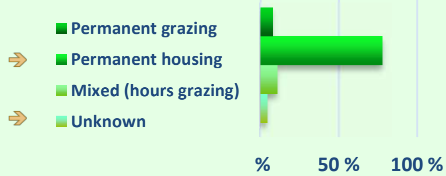
81 - 93 % total house

cow area

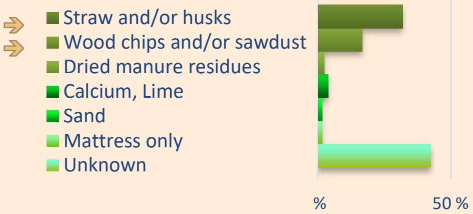


6,7 - 8,3 m² /lactating cow

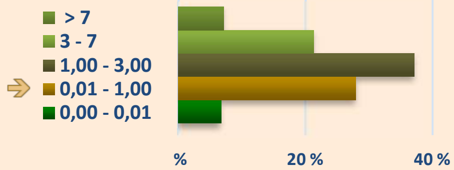
grazing option



bedding category



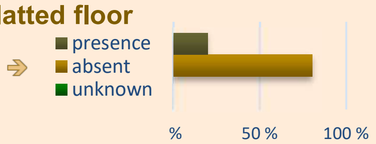
bedding input (kg bedding /cow /day)



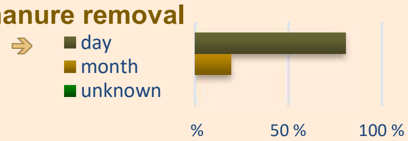
0,6 kg bedding /cow /day

The manure management

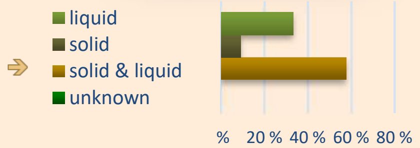
slatted floor



manure removal



Manure output

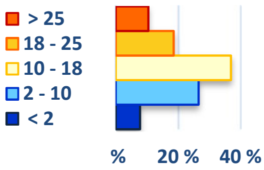


Farm 1 (Lithuania) LUHS

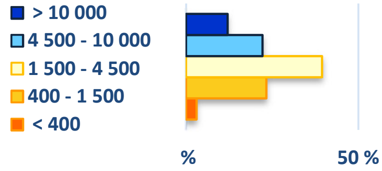
Take-home messages

- Emissions of ammonia and nitrous oxide are smaller than the population while methane emissions are normal for dairy cows;
- The farmer practices should serve as an example of "low emitting system" to improve similar farms in the same region

Outdoor temperature (°C)



Ventilation (m3 /hour /cow)



Observed emissions

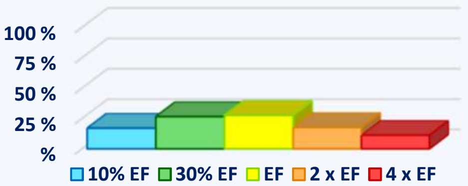
Observations in all countries

Observations in my farm

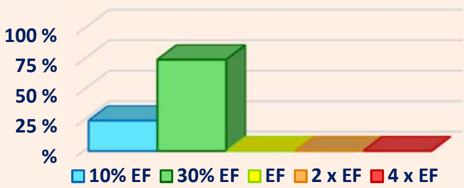
Outdoor temperature -1,4 - 16 °C

Ventilation 280 - 780 m3 /hour /cow

► Ammonia emissions (g NH3 /cow /day)



Reference emission factor: EF = 30 g NH3 /cow /day



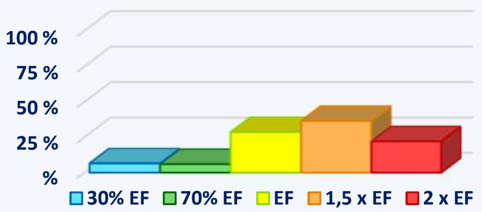
min: 3 g NH3 /cow /day

max: 13 g NH3 /cow /day

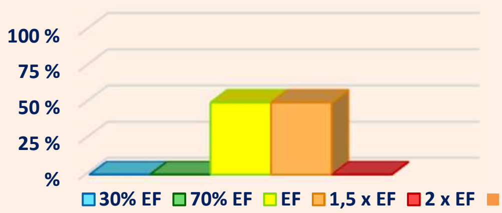
n: 8 emissions

min	max	min	max	min	max	min	max	min
0	4	4	15	15	45	45	101	101

► kg CH4 /cow /day (kg CH4 /cow /day)



Reference emission factor: EF = 0,38 kg CH4 /cow /day



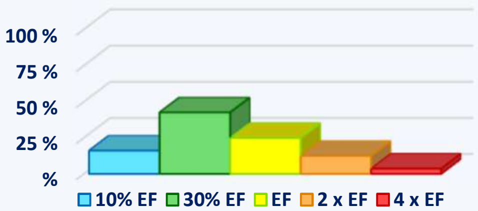
min: 0,4 kg CH4 /cow /day

max: 0,6 kg CH4 /cow /day

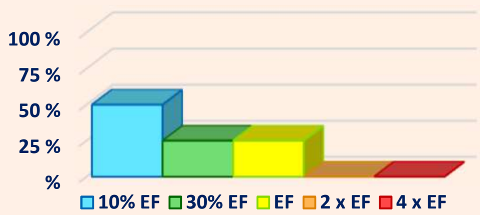
n: 8 emissions

min	max	min	max	min	max	min	max	min
0,00	0,19	0,19	0,30	0,30	0,45	0,45	0,65	0,65

► Nitrous oxide emissions (g N2O /cow /day)



Reference emission factor: EF = 1,8 g N2O /cow /day



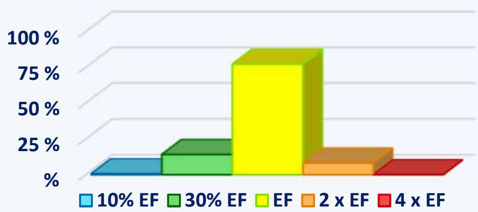
min: 0,04 g N2O /cow /day

max: 2 g N2O /cow /day

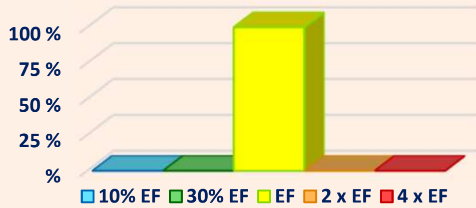
n: 8 emissions

min	max	min	max	min	max	min	max	min
0,00	0,23	0,23	0,91	0,91	2,73	2,73	6,14	6,14

► GHG emissions (kg eq CO2 /L milk)



Reference emission factor: EF = 0,40 kg eq CO2 /L milk



min: 0,3 kg eq CO2 /L milk

max: 0,4 kg eq CO2 /L milk

min	max	min	max	min	max	min	max	min
0,00	0,05	0,05	0,20	0,20	0,61	0,61	1,36	1,36

Farm 2 (Lithuania)

Survey of housing emissions (2021 - 2023)

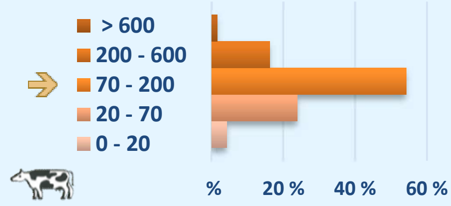
LUHS

Farm visited by Violeta Juškienė (2021 - 2022)

My farm vs the diversity of visited dairy units in all countries

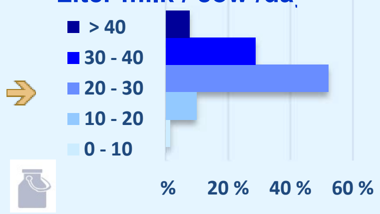
Tier	2b	2a	1	not used	total (3 gases)
nb obs.	11	0	1	0	12

lactating cows / house



105 - 142 cows

Liter milk / cow /day

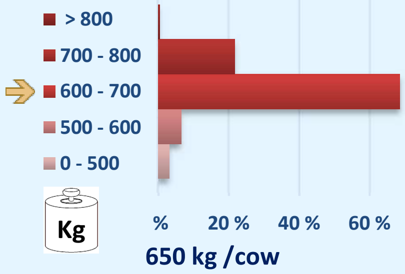


25 L milk /cow /day

The monitored dairy cows

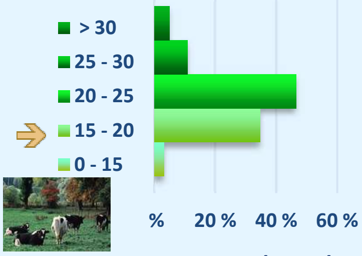
Farm 2

kg liveweight / cow



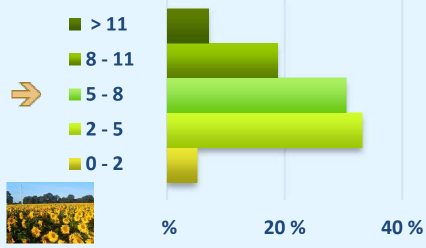
650 kg /cow

dry matter feed / cow /day



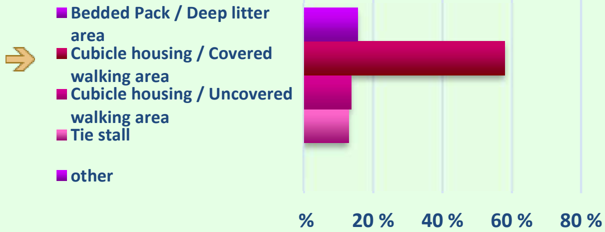
20 - 20 kg dry feed /cow /day

concentrate feed

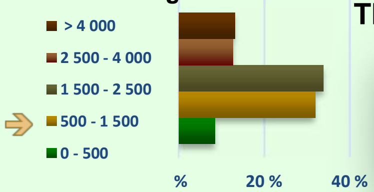


5 kg concentrate /cow /day

Housing category



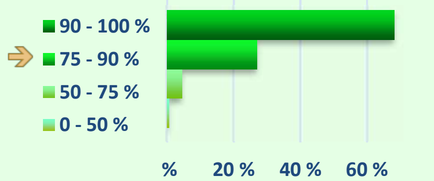
housing area



$1454\ m^2$ /house

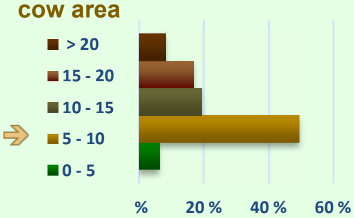
The monitored house

feed lactating cows (% feed all animals)



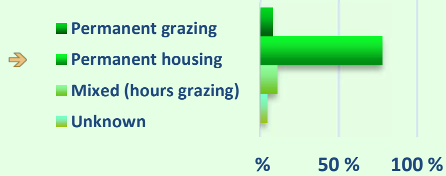
75 - 84 % total house

cow area

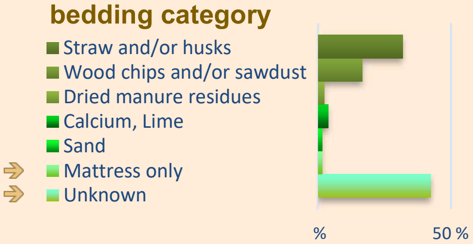


5,7 - 7,7 m^2 /lactating cow

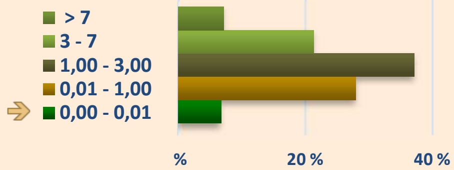
grazing option



bedding category



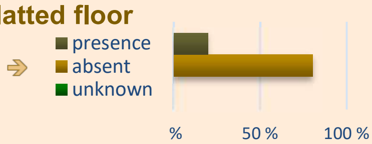
bedding input (kg bedding /cow /day)



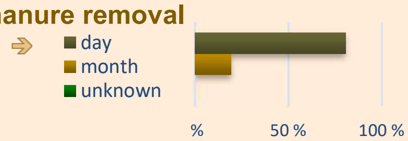
0 kg bedding /cow /day

The manure management

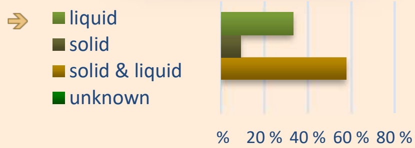
slatted floor



manure removal



Manure output



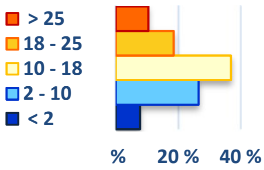
Farm 2 (Lithuania) LUHS

FACCE ERA-GAS · ERA-NET SUSAN · ICT-AGRI era-net

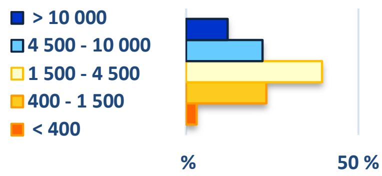
Take-home messages

- Emissions of ammonia and nitrous oxide are smaller than the population while methane emissions are normal for dairy cows;
- The farmer practices should serve as an example of "low emitting system" to improve similar farms in the same region

Outdoor temperature (°C)



Ventilation (m3 /hour /cow)



Observed emissions

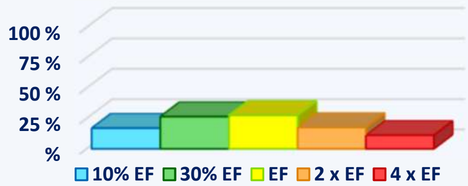
Observations in all countries

Observations in my farm

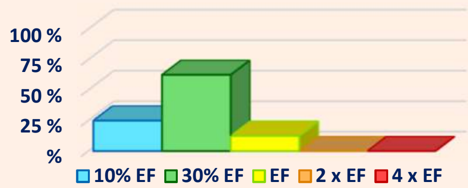
Outdoor temperature -0,1 - 23 °C

Ventilation 510 - 1900 m3 /hour /cow

► *Ammonia emissions (g NH3 /cow /day)*



Reference emission factor: EF = 30 g NH3 /cow /day



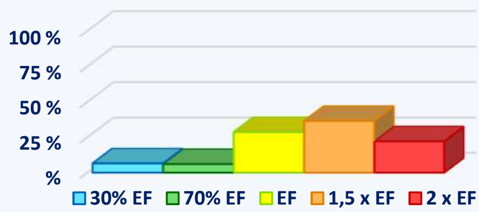
min: 2 g NH3 /cow /day

max: 16 g NH3 /cow /day

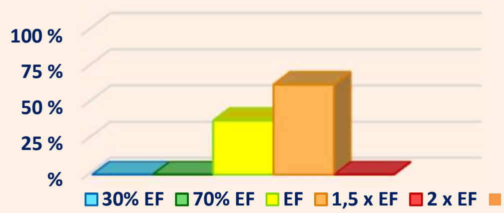
n: 8 emissions

min	max	min	max	min	max	min	max	min
0	4	4	15	15	45	45	101	101

► *kg CH4 /cow /day (kg CH4 /cow /day)*



Reference emission factor: EF = 0,38 kg CH4 /cow /day



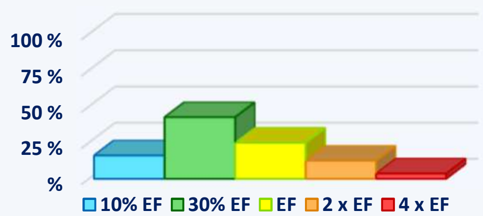
min: 0,4 kg CH4 /cow /day

max: 0,6 kg CH4 /cow /day

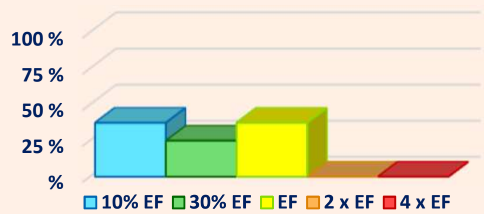
n: 8 emissions

min	max	min	max	min	max	min	max	min
0,00	0,19	0,19	0,30	0,30	0,45	0,45	0,65	0,65

► *Nitrous oxide emissions (g N2O /cow /day)*



Reference emission factor: EF = 1,8 g N2O /cow /day



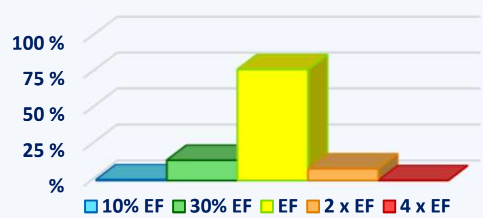
min: 0,09 g N2O /cow /day

max: 2 g N2O /cow /day

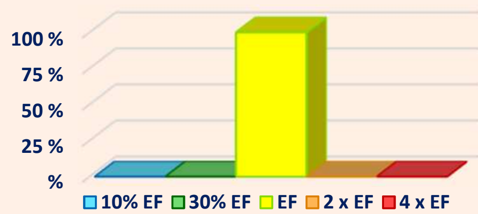
n: 8 emissions

min	max	min	max	min	max	min	max	min
0,00	0,23	0,23	0,91	0,91	2,73	2,73	6,14	6,14

► *GHG emissions (kg eq CO2 /L milk)*



Reference emission factor: EF = 0,40 kg eq CO2 /L milk



min: 0,3 kg eq CO2 /L milk

max: 0,6 kg eq CO2 /L milk

min	max	min	max	min	max	min	max	min
0,00	0,05	0,05	0,20	0,20	0,61	0,61	1,36	1,36

Farm 3 (Lithuania)

Survey of housing emissions
(2021 - 2023)

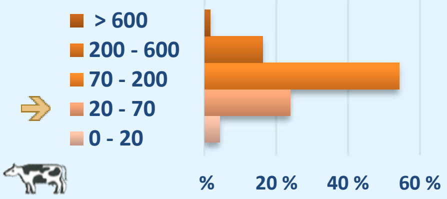
LUHS

Farm visited by Violeta Juškienė (2021 - 2022)

My farm vs the diversity of visited dairy units in all countries

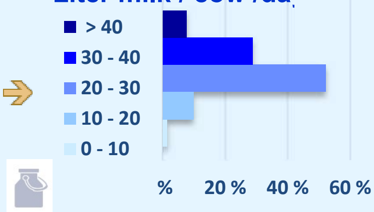
Tier	2b	2a	1	not used	total (3 gases)
nb obs.	9	3	0	0	12

lactating cows / house



40 - 54 cows

Liter milk / cow /day

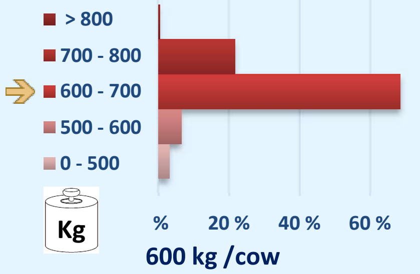


26 L milk /cow /day

The monitored dairy cows

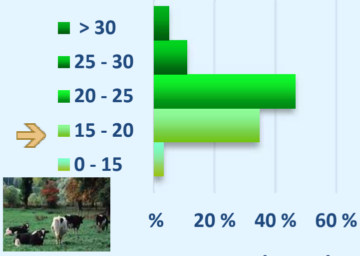
Farm 3

kg liveweight / cow



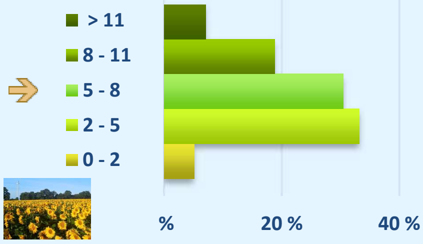
600 kg /cow

dry matter feed / cow /day



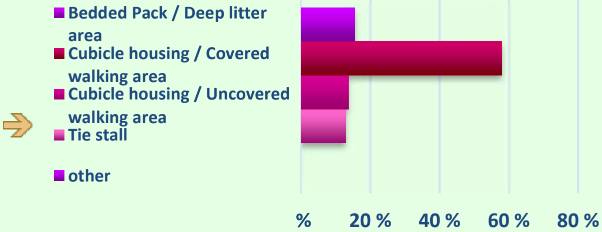
19 - 20 kg dry feed /cow /day

concentrate feed

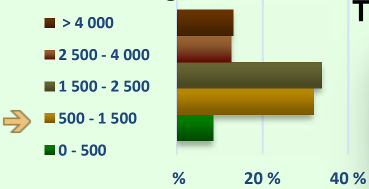


5 - 6 kg concentrate /cow /day

Housing category



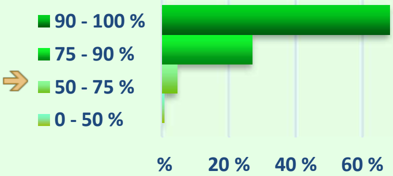
housing area



496,58 - 537,9 m² /house

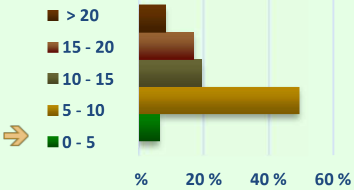
The monitored house

feed lactating cows (% feed all animals)



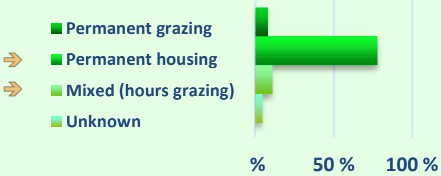
64 - 76 % total house

cow area



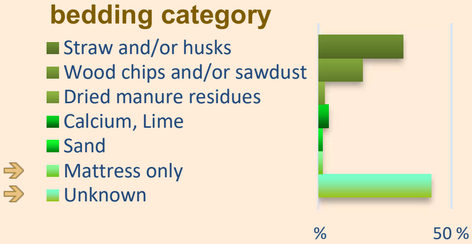
4,5 - 6,0 m² /lactating cow

grazing option

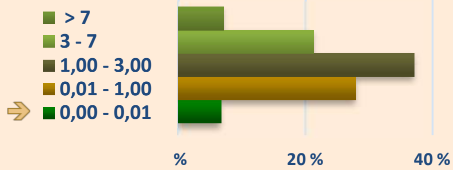


0 - 8 hours grazing /day

bedding category



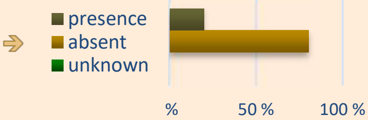
bedding input (kg bedding /cow /day)



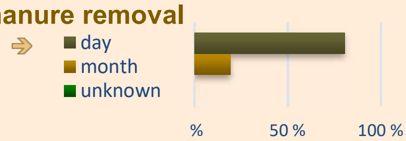
0 kg bedding /cow /day

The manure management

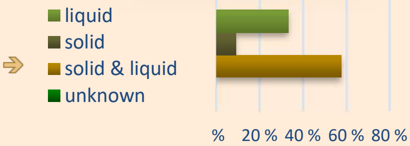
slatted floor



manure removal



Manure output

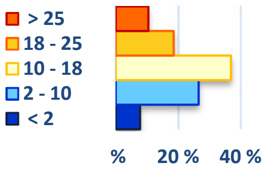


Farm 3 (Lithuania) LUHS

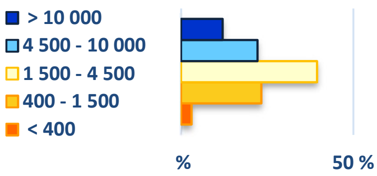
Take-home messages

- Emissions of ammonia and nitrous oxide are smaller than the population while methane emissions are normal for dairy cows;
- The farmer practices should serve as an example of "low emitting system" to improve similar farms in the same region

Outdoor temperature (°C)



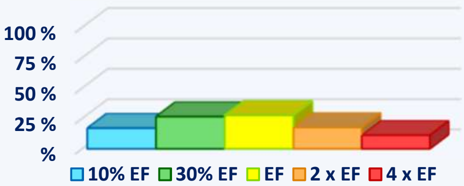
Ventilation (m3 /hour /cow)



Observed emissions

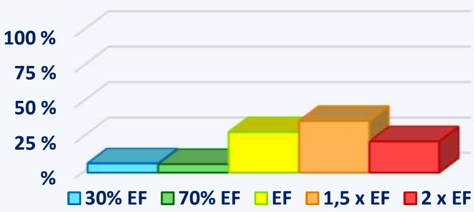
Observations in all countries

► Ammonia emissions (g NH3 /cow /day)



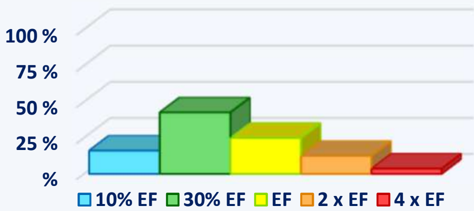
Reference emission factor: EF = 30 g NH3 /cow /day

► kg CH4 /cow /day (kg CH4 /cow /day)



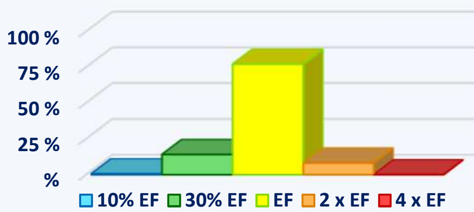
Reference emission factor: EF = 0,38 kg CH4 /cow /day

► Nitrous oxide emissions (g N2O /cow /day)



Reference emission factor: EF = 1,8 g N2O /cow /day

► GHG emissions (kg eq CO2 /L milk)

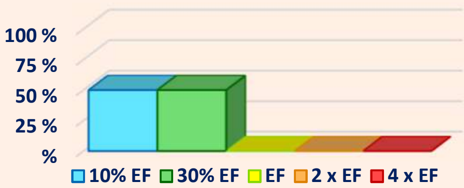


Reference emission factor: EF = 0,40 kg eq CO2 /L milk

Observations in my farm

Outdoor temperature -0,2 - 25 °C

Ventilation 170 - 1400 m3 /hour /cow

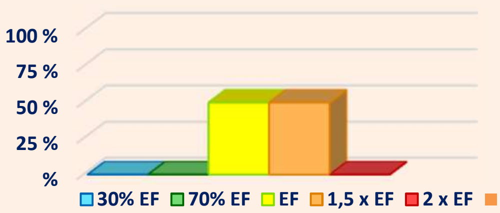


min: 2 g NH3 /cow /day

max: 7 g NH3 /cow /day

n: 8 emissions

min	max	min	max	min	max	min	max	min
0	4	4	15	15	45	45	101	101

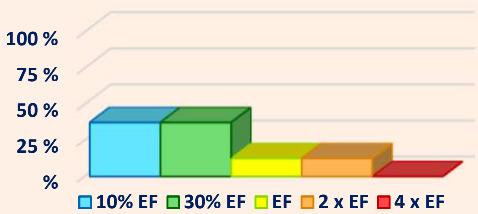


min: 0,4 kg CH4 /cow /day

max: 0,5 kg CH4 /cow /day

n: 8 emissions

min	max	min	max	min	max	min	max	min
0,00	0,19	0,19	0,30	0,30	0,45	0,45	0,65	0,65

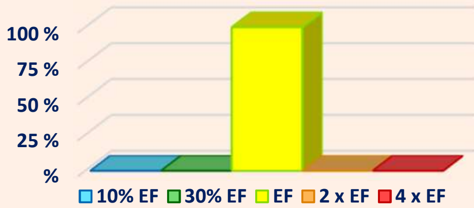


min: 0,02 g N2O /cow /day

max: 5 g N2O /cow /day

n: 8 emissions

min	max	min	max	min	max	min	max	min
0,00	0,23	0,23	0,91	0,91	2,73	2,73	6,14	6,14



min: 0,3 kg eq CO2 /L milk

max: 0,4 kg eq CO2 /L milk

min	max	min	max	min	max	min	max	min
0,00	0,05	0,05	0,20	0,20	0,61	0,61	1,36	1,36

Farm 4 (Lithuania)

Survey of housing emissions (2021 - 2023)

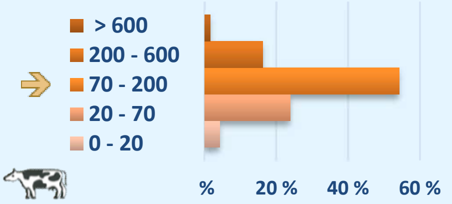
LUHS

Farm visited by Violeta Juškienė (2021 - 2022)

My farm vs the diversity of visited dairy units in all countries

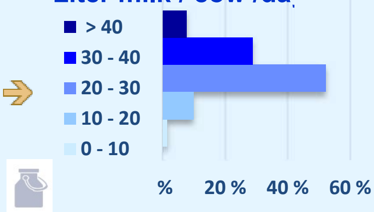
Tier	2b	2a	1	not used	total (3 gases)
nb obs.	8	3	1	0	12

lactating cows / house



144 - 213 cows

Liter milk / cow /day

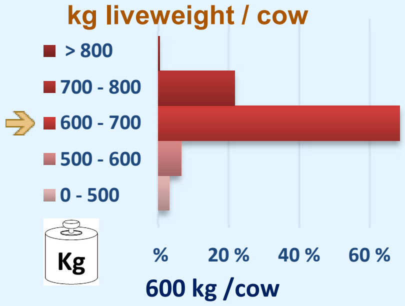


23 L milk /cow /day

The monitored dairy cows

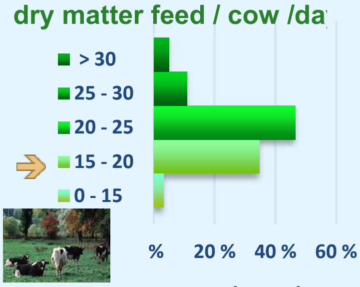
Farm 4

kg liveweight / cow



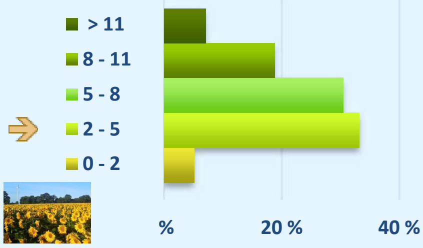
600 kg /cow

dry matter feed / cow /day



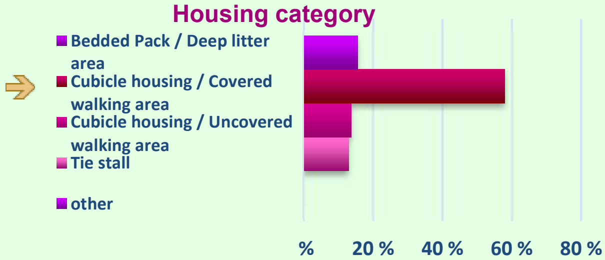
20 kg dry feed /cow /day

concentrate feed

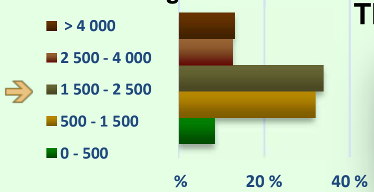


5 kg concentrate /cow /day

Housing category



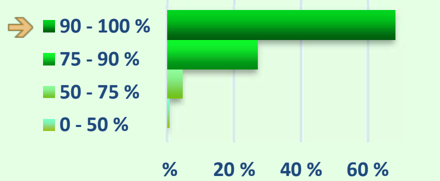
housing area



2204 m² /house

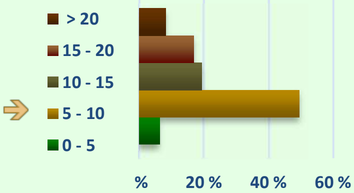
The monitored house

feed lactating cows (% feed all animals)



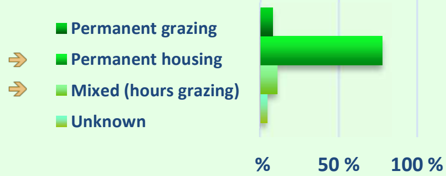
85 - 94 % total house

cow area



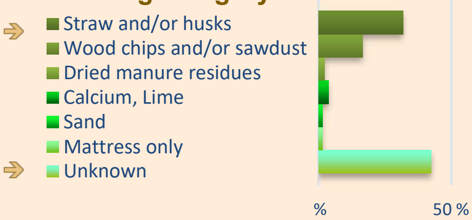
5,7 - 7,3 m² /lactating cow

grazing option

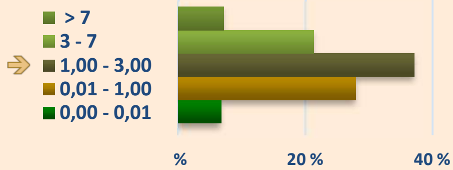


0 - 6 hours grazing /day

bedding category



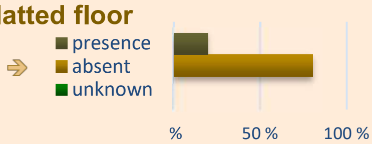
bedding input (kg bedding /cow /day)



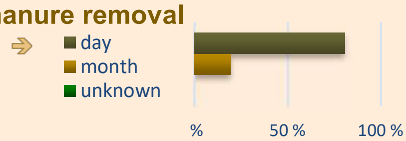
2,0 - 4,0 kg bedding /cow /day

The manure management

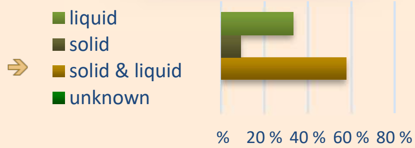
slatted floor



manure removal



Manure output

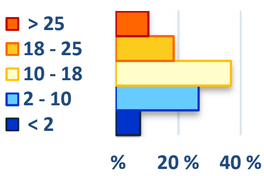


Farm 4 (Lithuania) LUHS

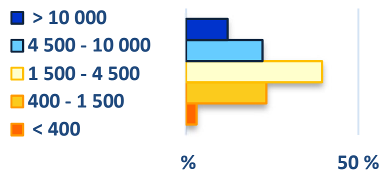
Take-home messages

- Emissions of ammonia and nitrous oxide are smaller than the population while methane emissions are normal for dairy cows;
- The farmer practices should serve as an example of "low emitting system" to improve similar farms in the same region

Outdoor temperature (°C)



Ventilation (m3 /hour /cow)



Observed emissions

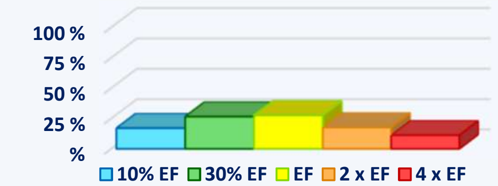
Observations in all countries

Observations in my farm

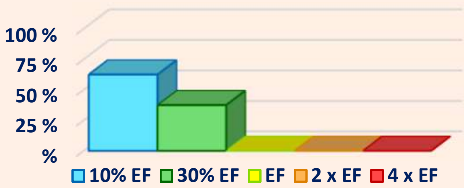
Outdoor temperature -3,2 - 21 °C

Ventilation 140 - 1600 m3 /hour /cow

► ***Ammonia emissions (g NH3 /cow /day)***



Reference emission factor: EF = 30 g NH3 /cow /day



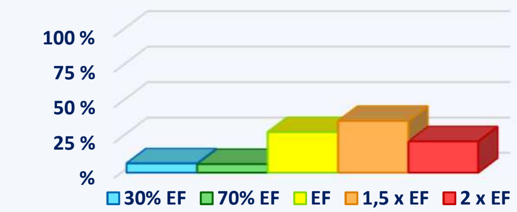
min: 1 g NH3 /cow /day

max: 8 g NH3 /cow /day

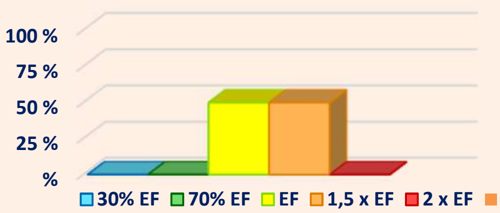
n: 8 emissions

min	max	min	max	min	max	min	max	min
0	4	4	15	15	45	45	101	101

► ***kg CH4 /cow /day (kg CH4 /cow /day)***



Reference emission factor: EF = 0,38 kg CH4 /cow /day



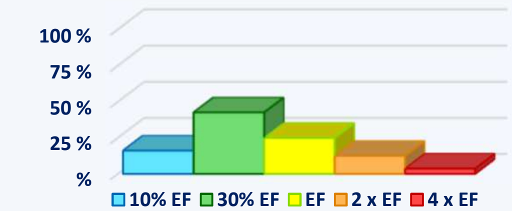
min: 0,4 kg CH4 /cow /day

max: 0,6 kg CH4 /cow /day

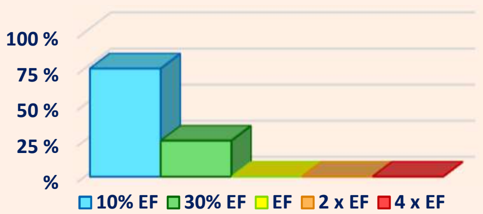
n: 8 emissions

min	max	min	max	min	max	min	max	min
0,00	0,19	0,19	0,30	0,30	0,45	0,45	0,65	0,65

► ***Nitrous oxide emissions (g N2O /cow /day)***



Reference emission factor: EF = 1,8 g N2O /cow /day



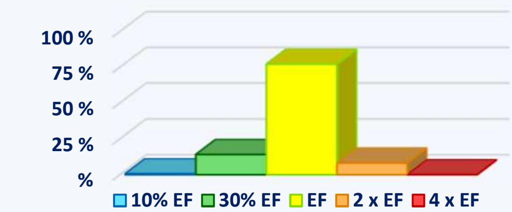
min: 0,02 g N2O /cow /day

max: 0,6 g N2O /cow /day

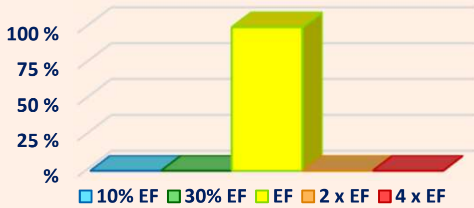
n: 8 emissions

min	max	min	max	min	max	min	max	min
0,00	0,23	0,23	0,91	0,91	2,73	2,73	6,14	6,14

► ***GHG emissions (kg eq CO2 /L milk)***



Reference emission factor: EF = 0,40 kg eq CO2 /L milk



min: 0,3 kg eq CO2 /L milk

max: 0,5 kg eq CO2 /L milk

min	max	min	max	min	max	min	max	min
0,00	0,05	0,05	0,20	0,20	0,61	0,61	1,36	1,36

Farm 1 (Latvia)

Survey of housing emissions (2021 - 2023)

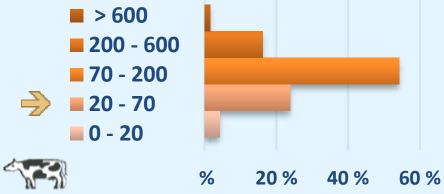
LLU

Farm visited by Diāna Ruska (2021)

My farm vs the diversity of visited dairy units in all countries

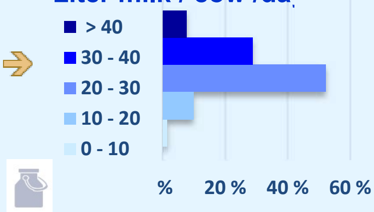
Tier	2b	2a	1	not used	total (3 gases)
nb obs.	2	3	4	3	12

lactating cows / house



20 - 33 cows

Liter milk / cow /day

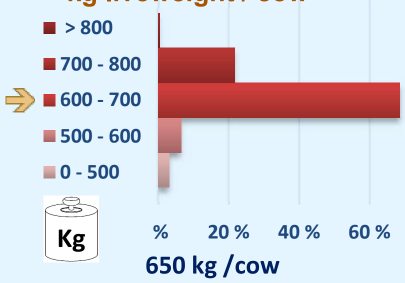


36 L milk /cow /day

The monitored dairy cows

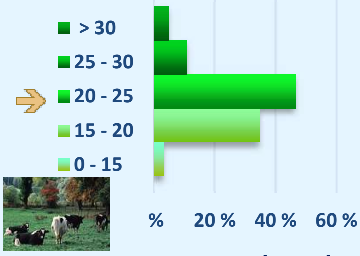
Farm 1

kg liveweight / cow



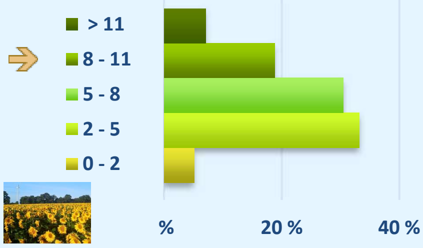
650 kg /cow

dry matter feed / cow /day



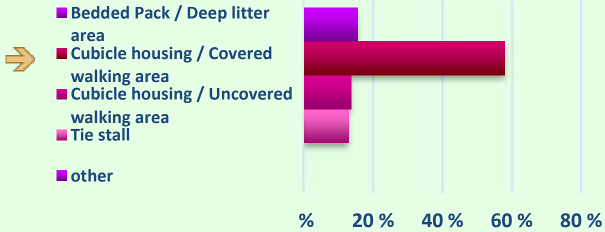
22 - 24 kg dry feed /cow /day

concentrate feed

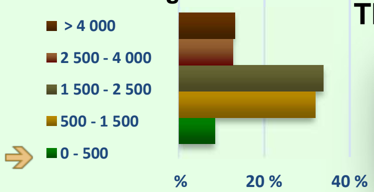


8 - 12 kg concentrate /cow /day

Housing category



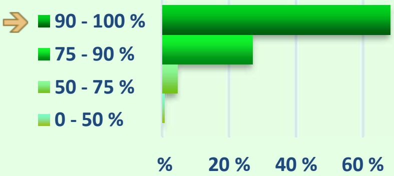
housing area



389,7 m² /house

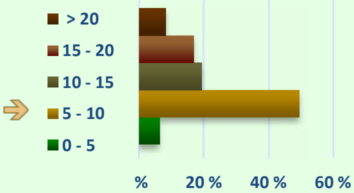
The monitored house

share of feed given to lactating cows (%)



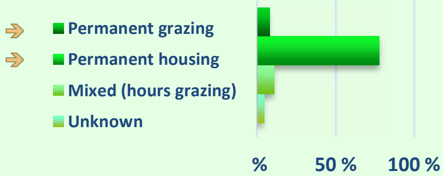
91 - 93 % total house

cow area



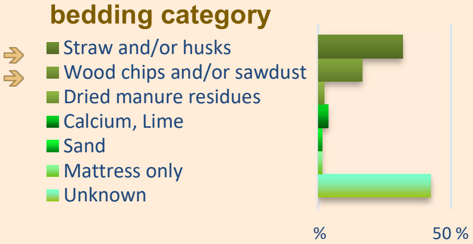
4,6 - 7,7 m² /lactating cow

grazing option

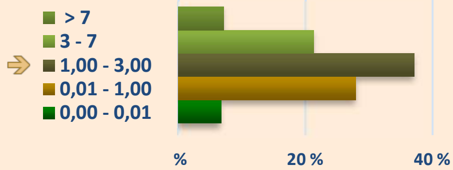


0 - 20 hours grazing /day

bedding category



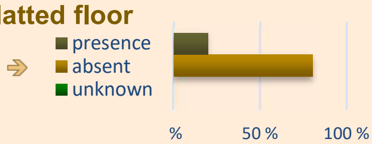
bedding input (kg bedding /cow /day)



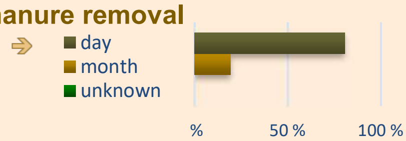
1,2 kg bedding /cow /day

The manure management

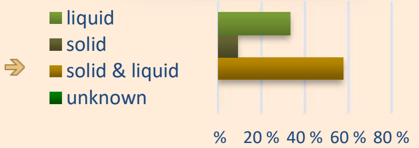
slatted floor



manure removal



Manure output

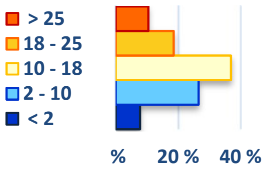


Farm 1 (Latvia) LLU

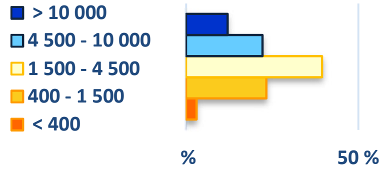
Take-home messages

· Emissions of ammonia and nitrous oxide are lower than the population;
· The reasons of occasional higher methane emissions should be understood to further improve the overall good quality of emissions

Outdoor temperature (°C)



Ventilation (m3 /hour /cow)



Observed emissions

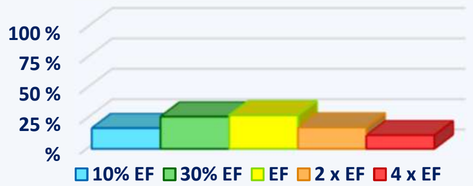
Observations in all countries

Observations in my farm

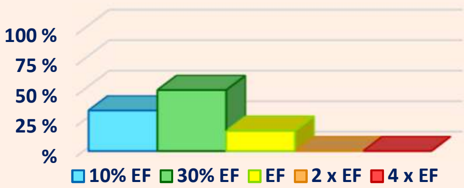
Outdoor temperature 2,5 - 21 °C

Ventilation 350 - 1900 m3 /hour /cow

► *Ammonia emissions (g NH3 /cow /day)*



Reference emission factor: EF = 30 g NH3 /cow /day



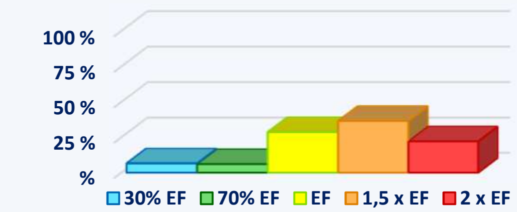
min: 3 g NH3 /cow /day

max: 17 g NH3 /cow /day

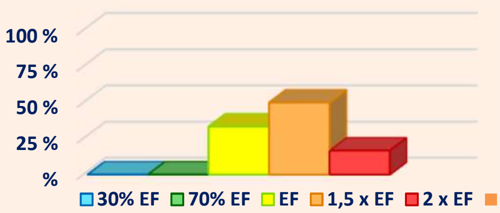
n: 6 emissions

min	max	min	max	min	max	min	max	min
0	4	4	15	15	45	45	101	101

► *kg CH4 /cow /day (kg CH4 /cow /day)*



Reference emission factor: EF = 0,38 kg CH4 /cow /day



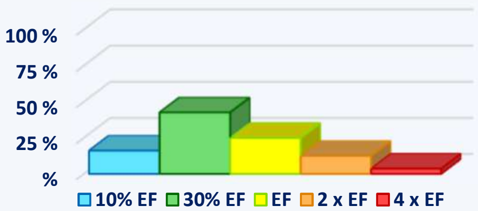
min: 0,4 kg CH4 /cow /day

max: 0,7 kg CH4 /cow /day

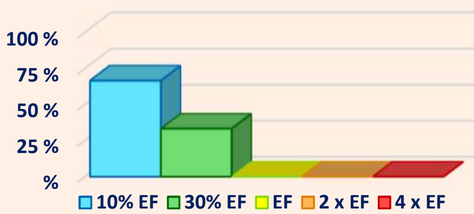
n: 6 emissions

min	max	min	max	min	max	min	max	min
0,00	0,19	0,19	0,30	0,30	0,45	0,45	0,65	0,65

► *Nitrous oxide emissions (g N2O /cow /day)*



Reference emission factor: EF = 1,8 g N2O /cow /day



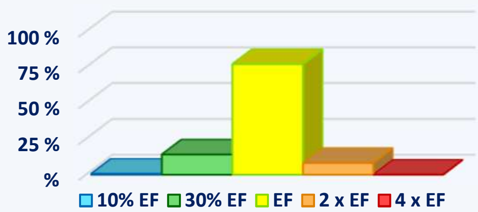
min: 0,05 g N2O /cow /day

max: 0,5 g N2O /cow /day

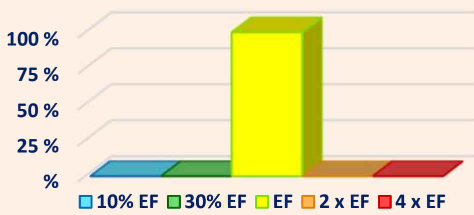
n: 6 emissions

min	max	min	max	min	max	min	max	min
0,00	0,23	0,23	0,91	0,91	2,73	2,73	6,14	6,14

► *GHG emissions (kg eq CO2 /L milk)*



Reference emission factor: EF = 0,40 kg eq CO2 /L milk



min: 0,3 kg eq CO2 /L milk

max: 0,4 kg eq CO2 /L milk

min	max	min	max	min	max	min	max	min
0,00	0,05	0,05	0,20	0,20	0,61	0,61	1,36	1,36

farming

Farm 2 (Latvia)

Survey of housing emissions (2021 - 2023)

LLU

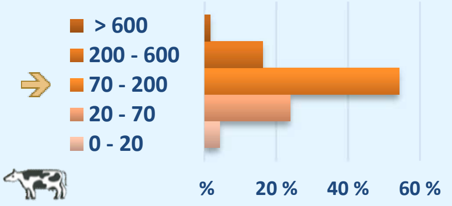
Farm visited by Diāna Ruska (2021)

FACCE ERA-GAS ERA-NET SUSAN ICT-AGRI era-net

My farm vs the diversity of visited dairy units in all countries

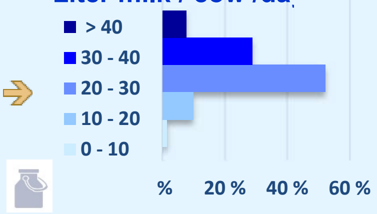
Tier	2b	2a	1	not used	total (3 gases)
nb obs.	5	0	4	3	12

lactating cows / house



74 - 82 cows

Liter milk / cow /day

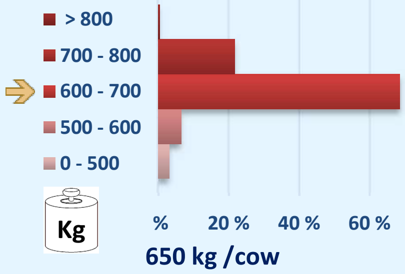


29 L milk /cow /day

The monitored dairy cows

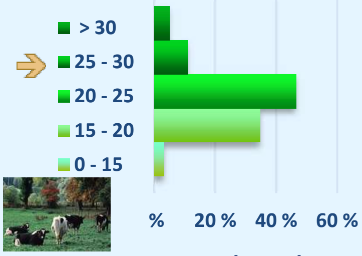
Farm 2

kg liveweight / cow



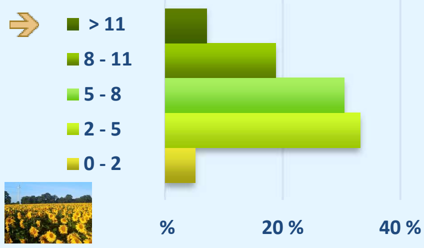
650 kg /cow

dry matter feed / cow /day



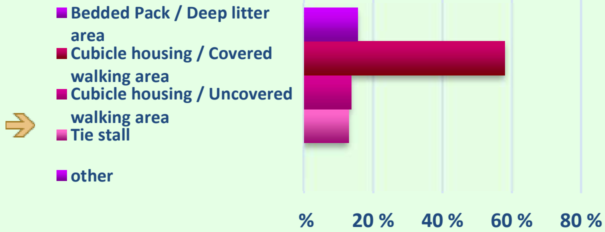
26 kg dry feed /cow /day

concentrate feed

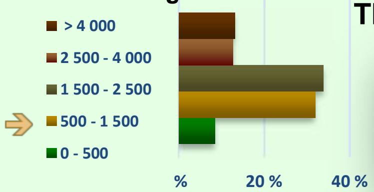


11 kg concentrate /cow /day

Housing category



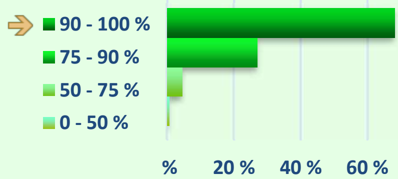
housing area



707,84 m² /house

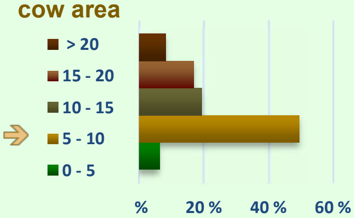
The monitored house

share of feed given to lactating cows (%)



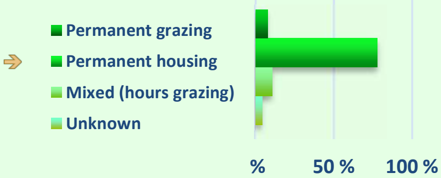
93 - 100 % total house

cow area

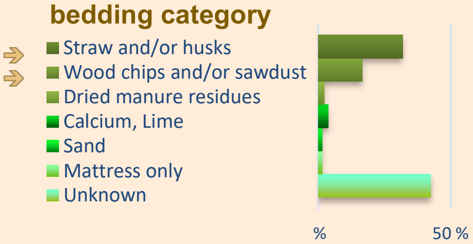


5,9 - 6,6 m² /lactating cow

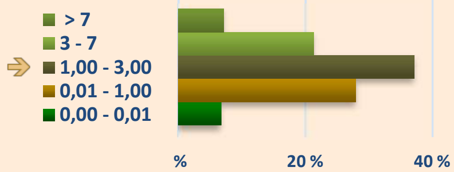
grazing option



bedding category



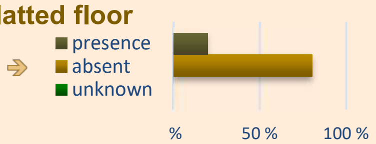
bedding input (kg bedding /cow /day)



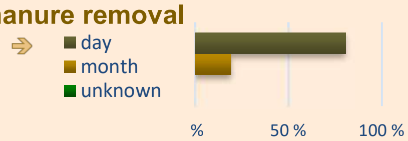
1,5 kg bedding /cow /day

The manure management

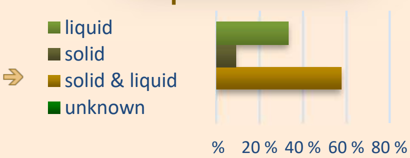
slatted floor



manure removal



Manure output

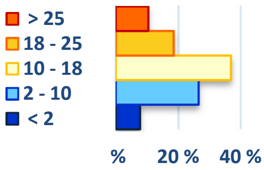


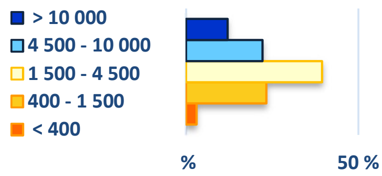
Farm 2 (Latvia) LLU

FACCE ERA-GAS ERA-NET SUSAN ICT-AGRI era-net

Take-home messages

- Emissions of ammonia and nitrous oxide are smaller than the population while methane emissions are normal for dairy cows;
- The farmer practices should serve as an example of "low emitting system" to improve similar farms in the same region





Observed emissions

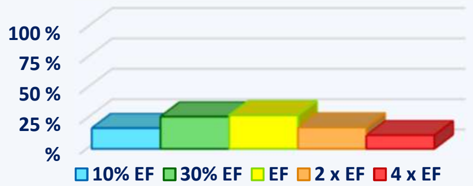
Observations in all countries

Observations in my farm

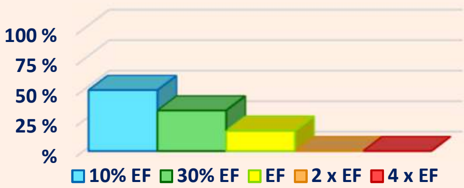
Outdoor temperature 2,7 - 28 °C

Ventilation 770 - 4700 m3 /hour /cow

► Ammonia emissions (g NH_3 /cow /day)



Reference emission factor: EF = 30 g NH_3 /cow /day



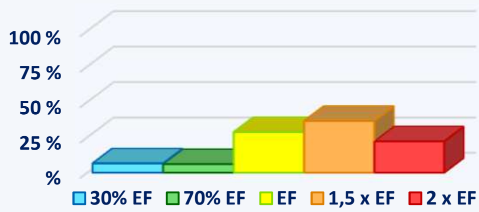
min: 1 g NH_3 /cow /day

max: 15 g NH_3 /cow /day

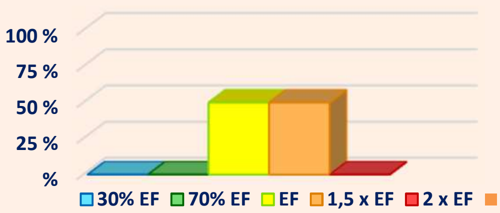
n: 6 emissions

min	max	min	max	min	max	min	max	min
0	4	4	15	15	45	45	101	101

► kg CH_4 /cow /day (kg CH_4 /cow /day)



Reference emission factor: EF = 0,38 kg CH_4 /cow /day



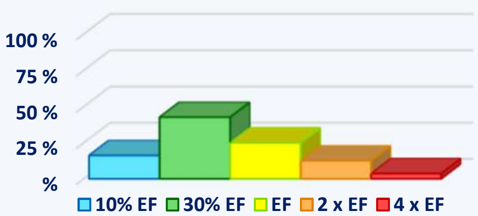
min: 0,3 kg CH_4 /cow /day

max: 0,5 kg CH_4 /cow /day

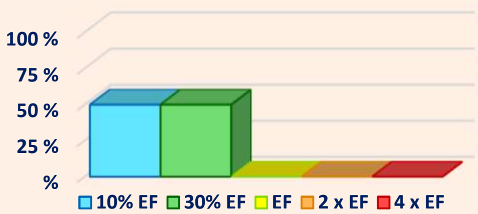
n: 6 emissions

min	max	min	max	min	max	min	max	min
0,00	0,19	0,19	0,30	0,30	0,45	0,45	0,65	0,65

► Nitrous oxide emissions (g N_2O /cow /day)



Reference emission factor: EF = 1,8 g N_2O /cow /day



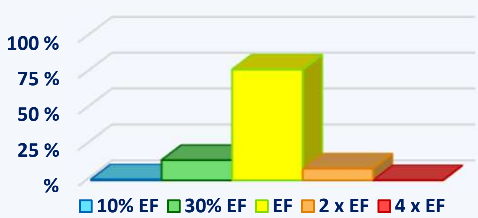
min: 0,1 g N_2O /cow /day

max: 0,6 g N_2O /cow /day

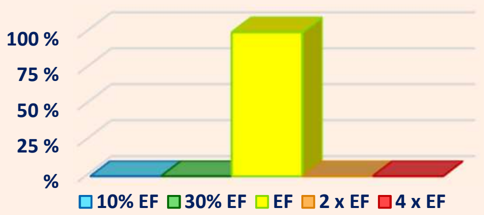
n: 6 emissions

min	max	min	max	min	max	min	max	min
0,00	0,23	0,23	0,91	0,91	2,73	2,73	6,14	6,14

► GHG emissions (kg eq CO_2 /L milk)



Reference emission factor: EF = 0,40 kg eq CO_2 /L milk



min: 0,2 kg eq CO_2 /L milk

max: 0,4 kg eq CO_2 /L milk

min	max	min	max	min	max	min	max	min
0,00	0,05	0,05	0,20	0,20	0,61	0,61	1,36	1,36

Farm 3 (Latvia)

Survey of housing emissions (2021 - 2023)

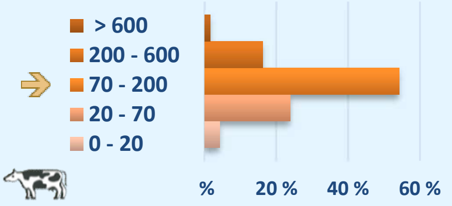
LLU

Farm visited by Diāna Ruska (2021)

My farm vs the diversity of visited dairy units in all countries

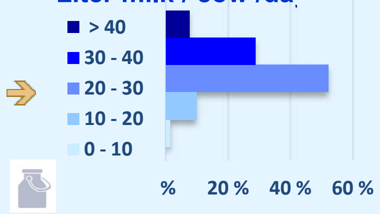
Tier	2b	2a	1	not used	total (3 gases)
nb obs.	2	9	1	0	12

lactating cows / house



98 - 110 cows

Liter milk / cow /day

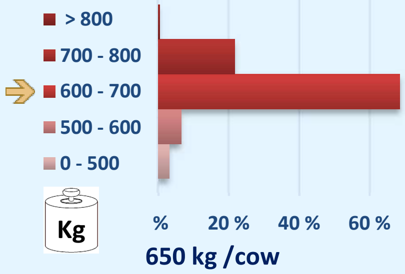


21 L milk /cow /day

The monitored dairy cows

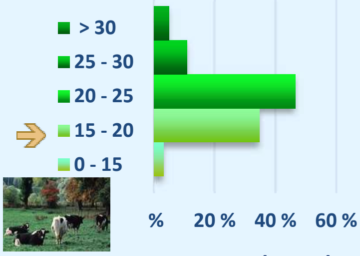
Farm 3

kg liveweight / cow



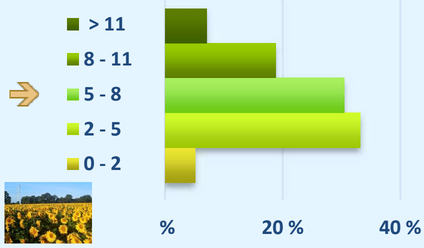
650 kg /cow

dry matter feed / cow /day



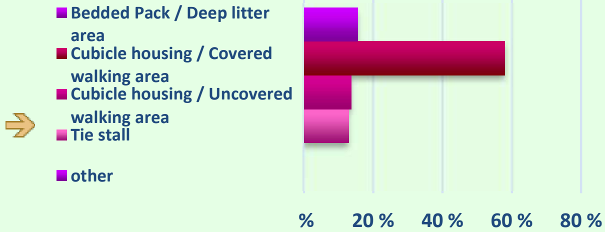
17 - 18 kg dry feed /cow /day

concentrate feed

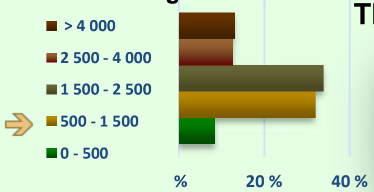


4 - 5 kg concentrate /cow /day

Housing category



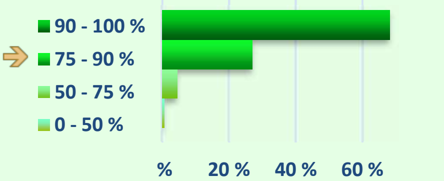
housing area



1408 m² /house

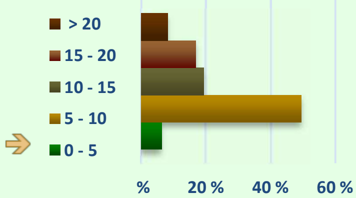
The monitored house

share of feed given to lactating cows (%)



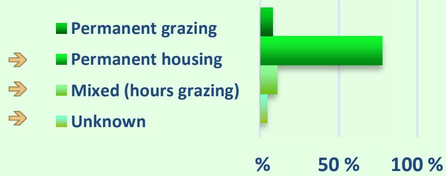
80 - 91 % total house

cow area



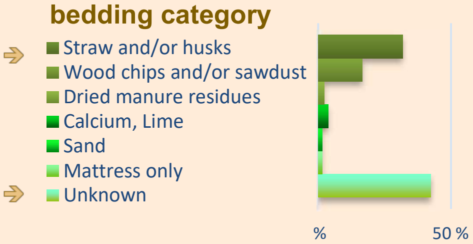
4,2 m² /lactating cow

grazing option

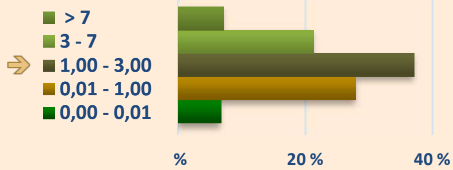


0 - 8 hours grazing /day

bedding category



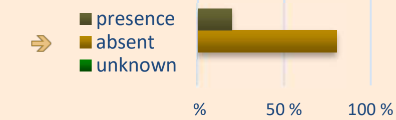
bedding input (kg bedding /cow /day)



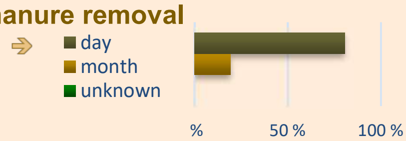
2,0 kg bedding /cow /day

The manure management

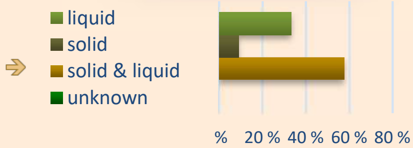
slatted floor



manure removal



Manure output

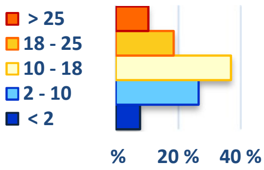


Farm 3 (Latvia)   **LLU**

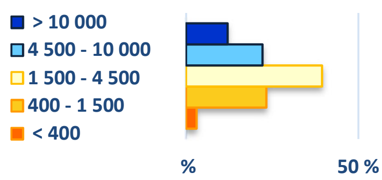
Take-home messages

- Emissions of ammonia and nitrous oxide are smaller than the population while methane emissions are normal for dairy cows;
- The farmer practices should serve as an example of “low emitting system” to improve similar farms in the same region

Outdoor temperature (°C)



Ventilation (m3 /hour /cow)



Observed emissions

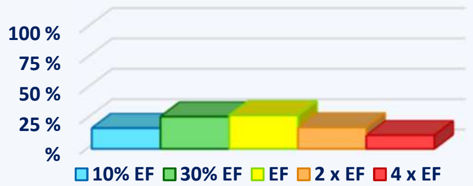
Observations in all countries

Observations in my farm

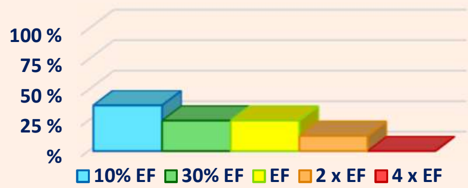
Outdoor temperature 1,8 - 25 °C

Ventilation 100 - 2900 m3 /hour /cow

► *Ammonia emissions (g NH3 /cow /day)*



Reference emission factor: EF = 30 g NH3 /cow /day



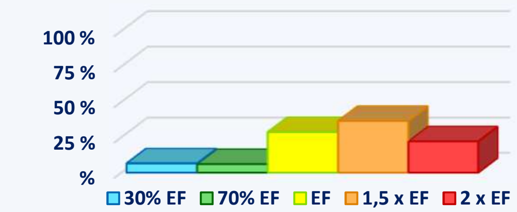
min: 1 g NH3 /cow /day

max: 60 g NH3 /cow /day

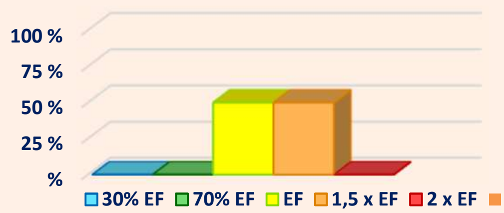
n: 8 emissions

min	max	min	max	min	max	min	max	min
0	4	4	15	15	45	45	101	101

► *kg CH4 /cow /day (kg CH4 /cow /day)*



Reference emission factor: EF = 0,38 kg CH4 /cow /day



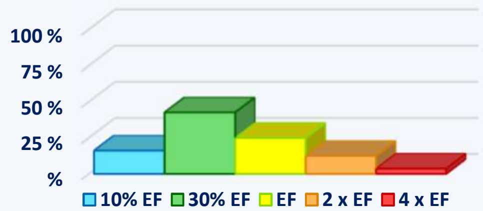
min: 0,4 kg CH4 /cow /day

max: 0,6 kg CH4 /cow /day

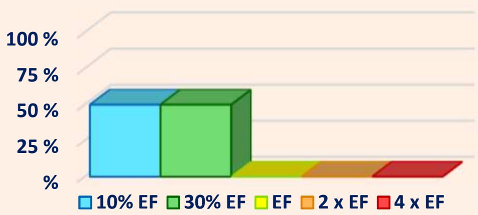
n: 8 emissions

min	max	min	max	min	max	min	max	min
0,00	0,19	0,19	0,30	0,30	0,45	0,45	0,65	0,65

► *Nitrous oxide emissions (g N2O /cow /day)*



Reference emission factor: EF = 1,8 g N2O /cow /day



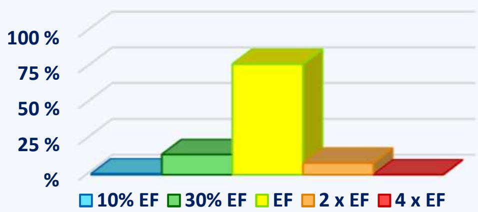
min: 0,08 g N2O /cow /day

max: 0,8 g N2O /cow /day

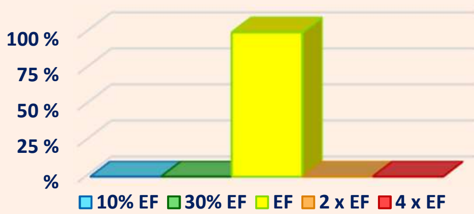
n: 8 emissions

min	max	min	max	min	max	min	max	min
0,00	0,23	0,23	0,91	0,91	2,73	2,73	6,14	6,14

► *GHG emissions (kg eq CO2 /L milk)*



Reference emission factor: EF = 0,40 kg eq CO2 /L milk



min: 0,4 kg eq CO2 /L milk

max: 0,6 kg eq CO2 /L milk

min	max	min	max	min	max	min	max	min
0,00	0,05	0,05	0,20	0,20	0,61	0,61	1,36	1,36

Farm 4 (Latvia)

Survey of housing emissions (2021 - 2023)

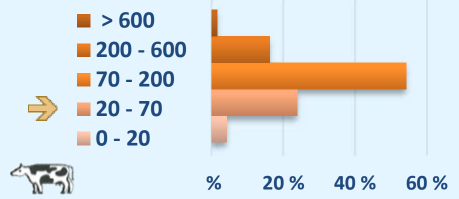
LLU

Farm visited by Diāna Ruska (2021)

My farm vs the diversity of visited dairy units in all countries

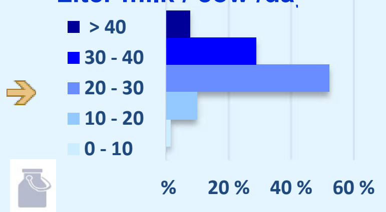
Tier	2b	2a	1	not used	total (3 gases)
nb obs.	2	5	2	3	12

lactating cows / house



52 - 63 cows

Liter milk / cow /day

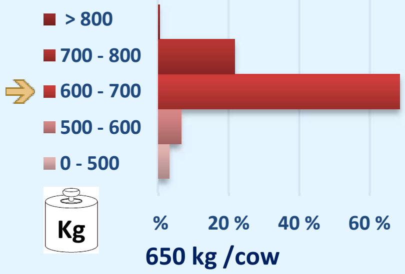


33 L milk /cow /day

The monitored dairy cows

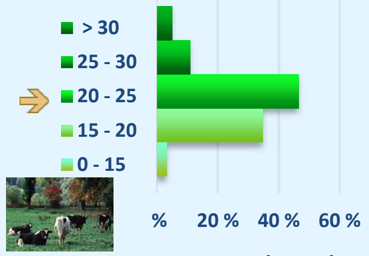
Farm 4

kg liveweight / cow



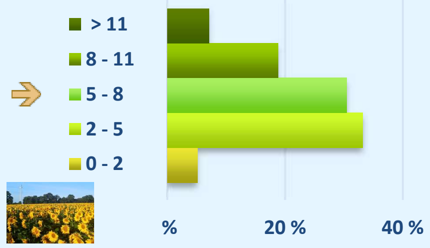
650 kg /cow

dry matter feed / cow /day



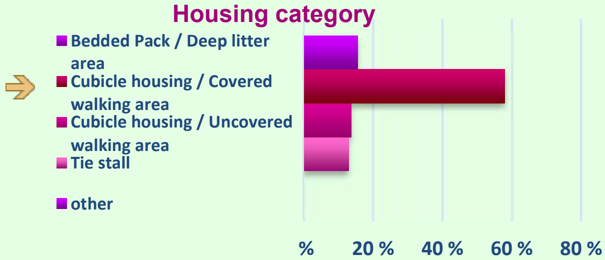
24 - 25 kg dry feed /cow /day

concentrate feed

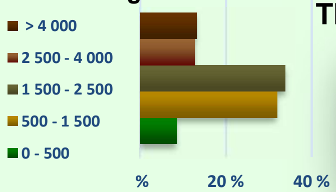


8 kg concentrate /cow /day

Housing category



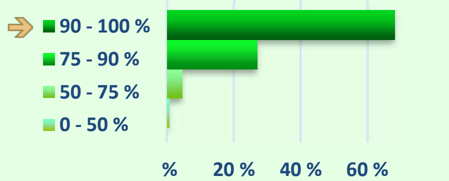
housing area



(no data)

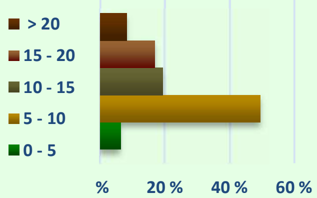
The monitored house

share of feed given to lactating cows (%)



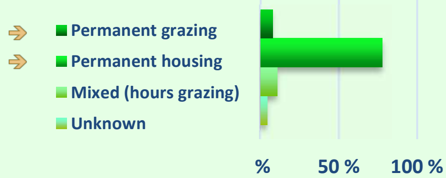
91 % total house

cow area



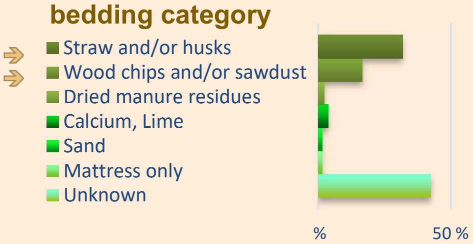
(no data)

grazing option

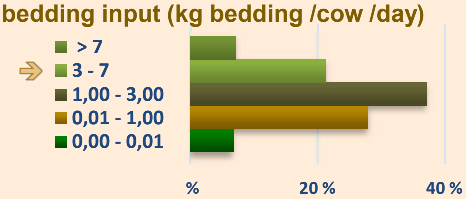


0 - 20 hours grazing /day

bedding category



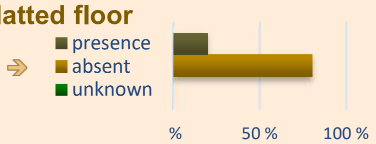
bedding input (kg bedding /cow /day)



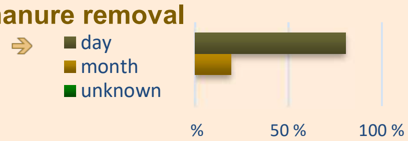
3,0 kg bedding /cow /day

The manure management

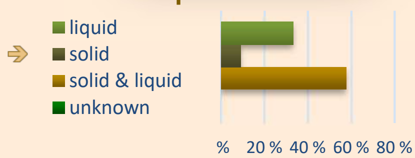
slatted floor



manure removal



Manure output

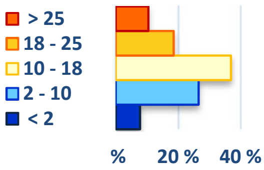


Farm 4 (Latvia) LLU

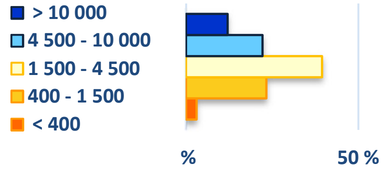
Take-home messages

- Emissions of ammonia and nitrous oxide are lower than the population;
- The reasons of occasional higher methane emissions should be understood to further improve the overall good quality of emissions

Outdoor temperature (°C)



Ventilation (m3 /hour /cow)



Observed emissions

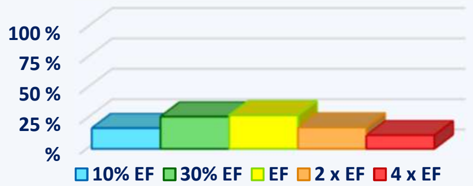
Observations in all countries

Observations in my farm

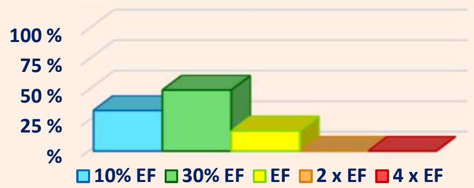
Outdoor temperature 3,0 - 22 °C

Ventilation 510 - 15000 m3 /hour /cow

► *Ammonia emissions (g NH3 /cow /day)*



Reference emission factor: EF = 30 g NH3 /cow /day



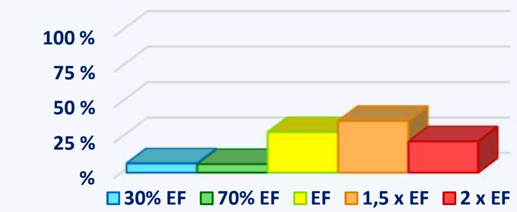
min: 1 g NH3 /cow /day

max: 34 g NH3 /cow /day

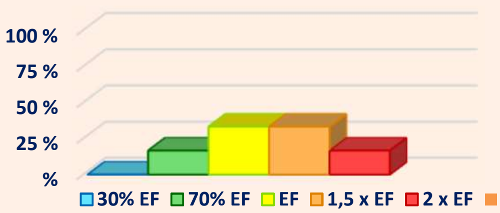
n: 6 emissions

min	max	min	max	min	max	min	max	min
0	4	4	15	15	45	45	101	101

► *kg CH4 /cow /day (kg CH4 /cow /day)*



Reference emission factor: EF = 0,38 kg CH4 /cow /day



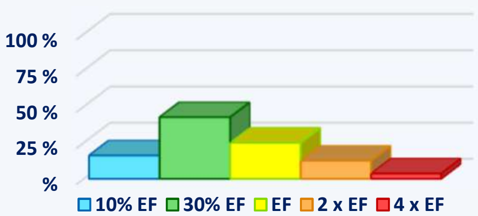
min: 0,3 kg CH4 /cow /day

max: 0,7 kg CH4 /cow /day

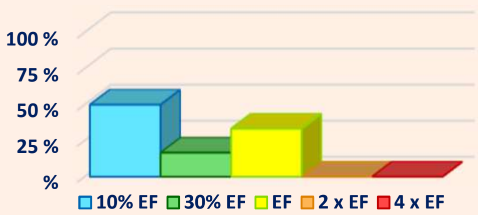
n: 6 emissions

min	max	min	max	min	max	min	max	min
0,00	0,19	0,19	0,30	0,30	0,45	0,45	0,65	0,65

► *Nitrous oxide emissions (g N2O /cow /day)*



Reference emission factor: EF = 1,8 g N2O /cow /day



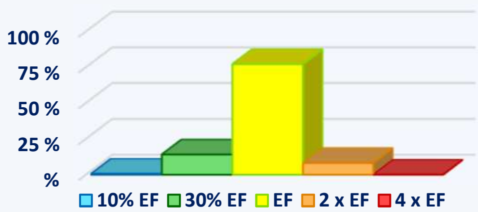
min: 0,09 g N2O /cow /day

max: 2 g N2O /cow /day

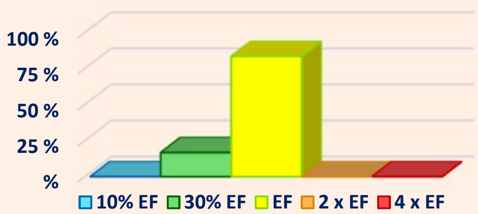
n: 6 emissions

min	max	min	max	min	max	min	max	min
0,00	0,23	0,23	0,91	0,91	2,73	2,73	6,14	6,14

► *GHG emissions (kg eq CO2 /L milk)*



Reference emission factor: EF = 0,40 kg eq CO2 /L milk



min: 0,2 kg eq CO2 /L milk

max: 0,5 kg eq CO2 /L milk

min	max	min	max	min	max	min	max	min
0,00	0,05	0,05	0,20	0,20	0,61	0,61	1,36	1,36

Farm 5 (Latvia)

Survey of housing emissions
(2021 - 2023)

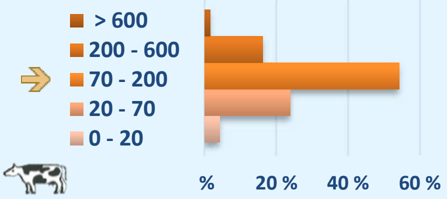
LLU

Farm visited by Diāna
Ruska (2021)

My farm vs the diversity of visited dairy units in all countries

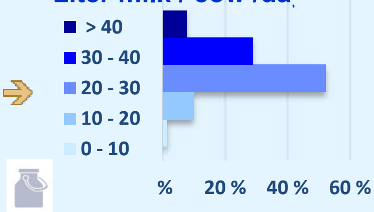
Tier	2b	2a	1	not used	total (3 gases)
nb obs.	0	9	3	0	12

lactating cows / house



92 - 116 cows

Liter milk / cow /day

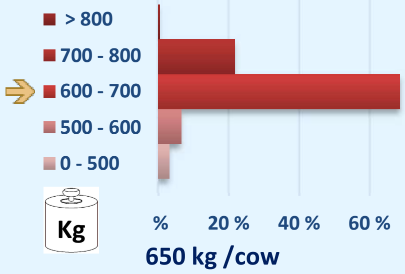


30 L milk /cow /day

The monitored dairy cows

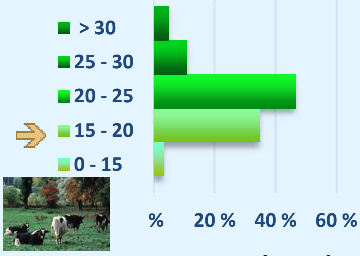
Farm 5

kg liveweight / cow



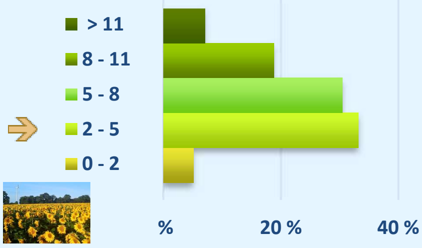
650 kg /cow

dry matter feed / cow /day



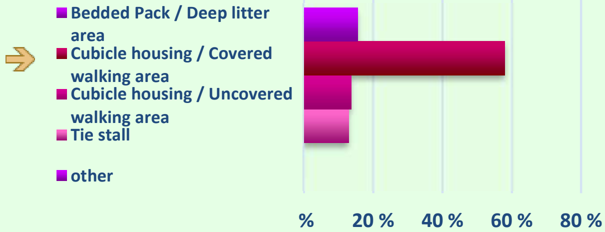
10 - 25 kg dry feed /cow /day

concentrate feed

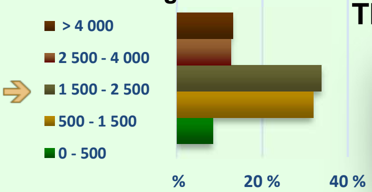


3 - 4 kg concentrate /cow /day

Housing category



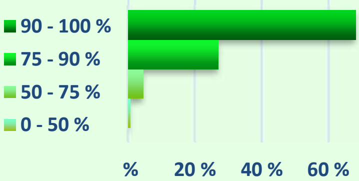
housing area



1502,4 m² /house

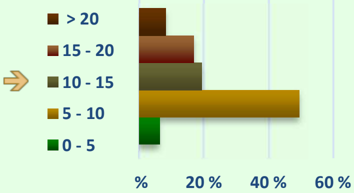
The monitored house

share of feed given to lactating cows (%)



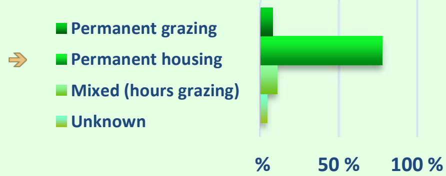
(no data)

cow area

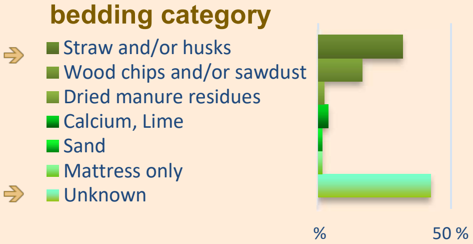


10,1 - 12,7 m² /lactating cow

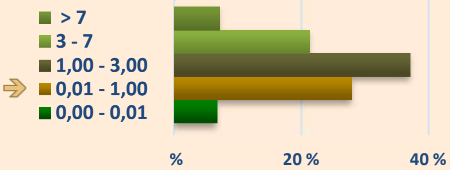
grazing option



bedding category



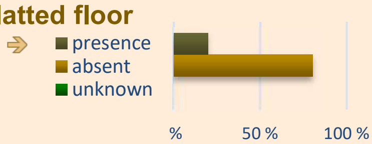
bedding input (kg bedding /cow /day)



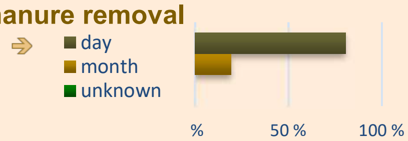
0,9 kg bedding /cow /day

The manure management

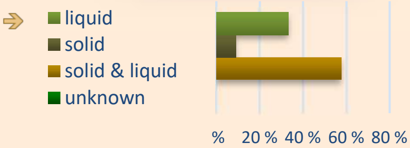
slatted floor



manure removal



Manure output



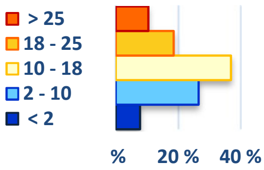
Farm 5 (Latvia) LLU

FACCE ERA-GAS ERA-NET SUSAN ICT AGRI era-net

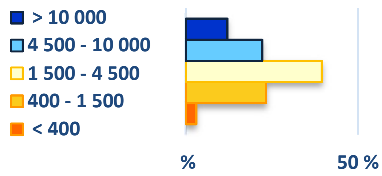
Take-home messages

- Emissions of ammonia and nitrous oxide are similar to the population;
- Manure management could be tuned to decrease the occurrence of methane (or ammonia) emissions higher than the emission factor

Outdoor temperature (°C)



Ventilation (m3 /hour /cow)



Observed emissions

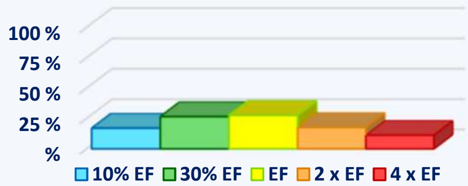
Observations in all countries

Observations in my farm

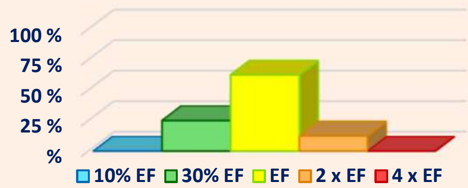
Outdoor temperature 5,4 - 24 °C

Ventilation 1 300 - 9100 m3 /hour /cow

► Ammonia emissions (g NH3 /cow /day)



Reference emission factor: EF = 30 g NH3 /cow /day



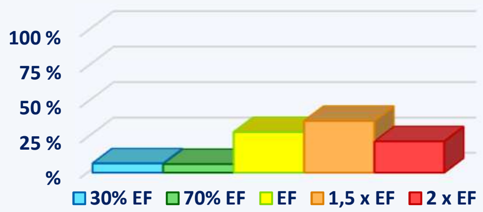
min: 7 g NH3 /cow /day

max: 69 g NH3 /cow /day

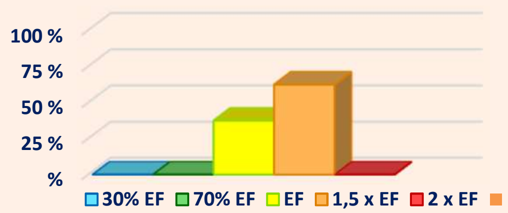
n: 8 emissions

min	max	min	max	min	max	min	max	min
0	4	4	15	15	45	45	101	101

► kg CH4 /cow /day (kg CH4 /cow /day)



Reference emission factor: EF = 0,38 kg CH4 /cow /day



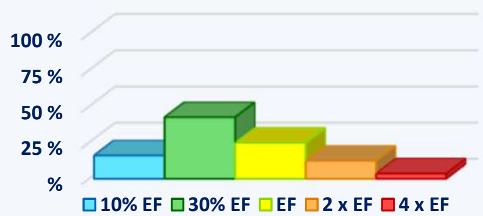
min: 0,4 kg CH4 /cow /day

max: 0,6 kg CH4 /cow /day

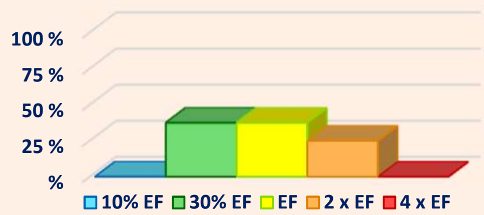
n: 8 emissions

min	max	min	max	min	max	min	max	min
0,00	0,19	0,19	0,30	0,30	0,45	0,45	0,65	0,65

► Nitrous oxide emissions (g N2O /cow /day)



Reference emission factor: EF = 1,8 g N2O /cow /day



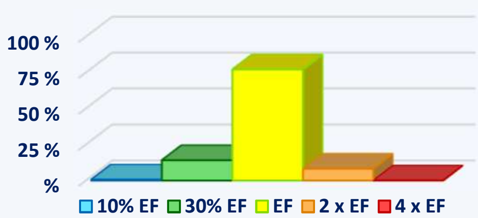
min: 0,4 g N2O /cow /day

max: 3 g N2O /cow /day

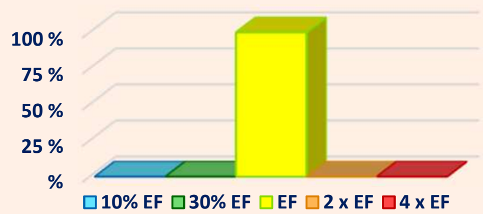
n: 8 emissions

min	max	min	max	min	max	min	max	min
0,00	0,23	0,23	0,91	0,91	2,73	2,73	6,14	6,14

► GHG emissions (kg eq CO2 /L milk)



Reference emission factor: EF = 0,40 kg eq CO2 /L milk



min: 0,3 kg eq CO2 /L milk

max: 0,5 kg eq CO2 /L milk

min	max	min	max	min	max	min	max	min
0,00	0,05	0,05	0,20	0,20	0,61	0,61	1,36	1,36

Farm 6 (Latvia)

Survey of housing emissions (2021 - 2023)

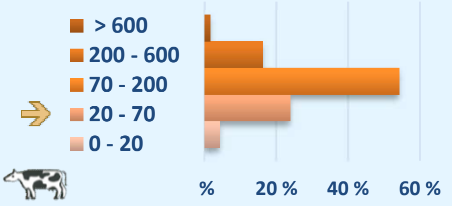
LLU

Farm visited by Diāna Ruska (2021)

My farm vs the diversity of visited dairy units in all countries

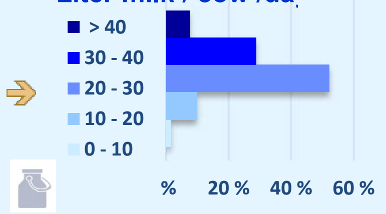
Tier	2b	2a	1	not used	total (3 gases)
nb obs.	0	9	3	0	12

lactating cows / house



46 - 65 cows

Liter milk / cow /day

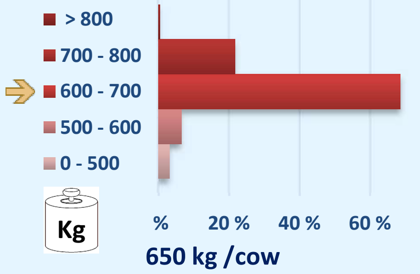


34 L milk /cow /day

The monitored dairy cows

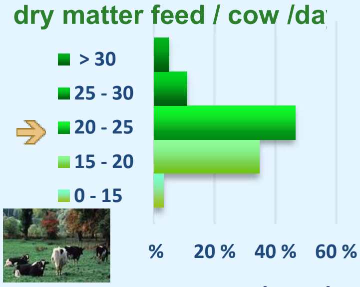
Farm 6

kg liveweight / cow



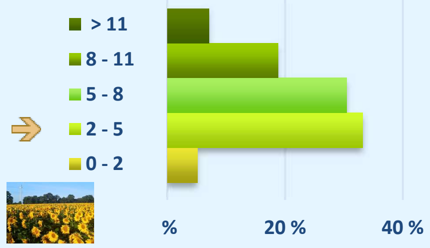
650 kg /cow

dry matter feed / cow /day



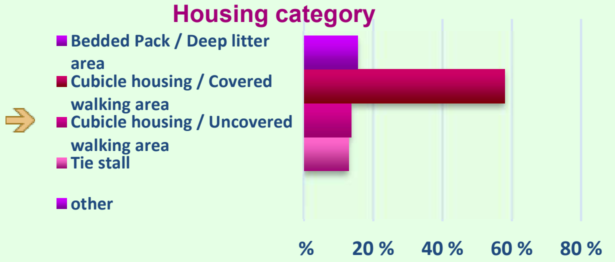
24 - 27 kg dry feed /cow /day

concentrate feed

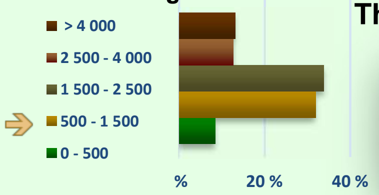


1 - 8 kg concentrate /cow /day

Housing category



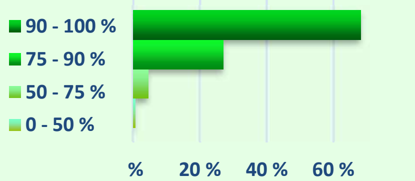
housing area



598 m² /house

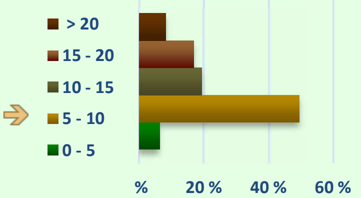
The monitored house

share of feed given to lactating cows (%)



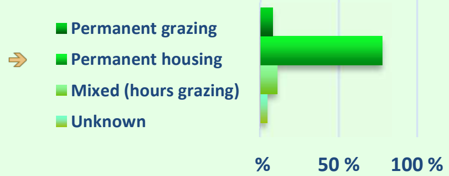
(no data)

cow area

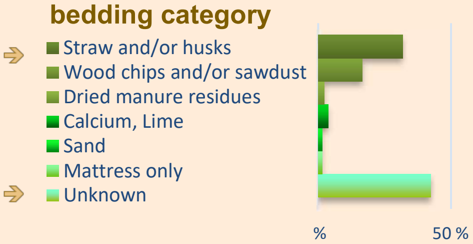


4,6 - 6,5 m² /lactating cow

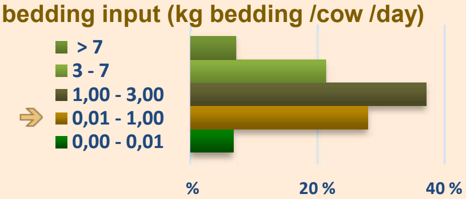
grazing option



bedding category



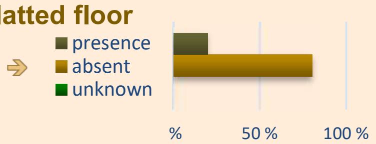
bedding input (kg bedding /cow /day)



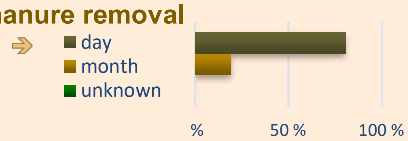
0,9 kg bedding /cow /day

The manure management

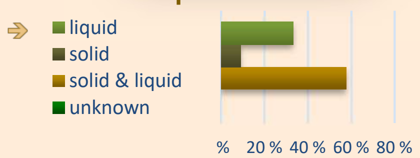
slatted floor



manure removal



Manure output

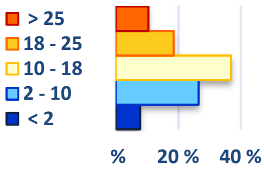


Farm 6 (Latvia) LLU

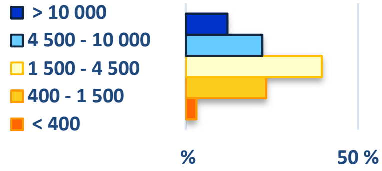
Take-home messages

- Emissions of ammonia and nitrous oxide are smaller than the population while methane emissions are normal for dairy cows;
- The farmer practices should serve as an example of "low emitting system" to improve similar farms in the same region

Outdoor temperature (°C)



Ventilation (m3 /hour /cow)



Observed emissions

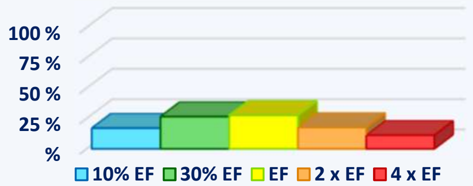
Observations in all countries

Observations in my farm

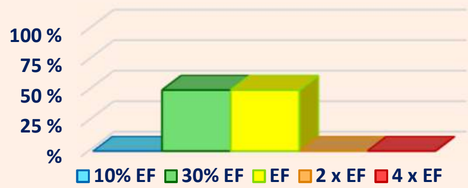
Outdoor temperature 1,2 - 21 °C

Ventilation 520 - 6600 m3 /hour /cow

► *Ammonia emissions (g NH3 /cow /day)*



Reference emission factor: EF = 30 g NH3 /cow /day



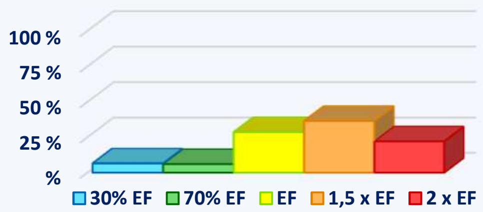
min: 4 g NH3 /cow /day

max: 37 g NH3 /cow /day

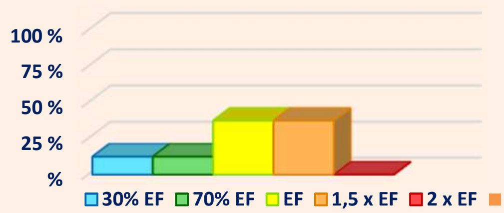
n: 8 emissions

min	max	min	max	min	max	min	max	min
0	4	4	15	15	45	45	101	101

► *kg CH4 /cow /day (kg CH4 /cow /day)*



Reference emission factor: EF = 0,38 kg CH4 /cow /day



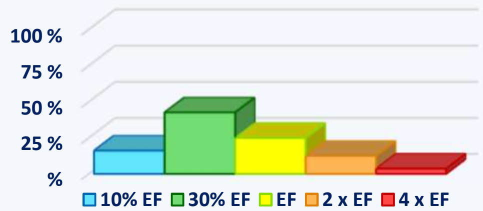
min: 0,2 kg CH4 /cow /day

max: 0,5 kg CH4 /cow /day

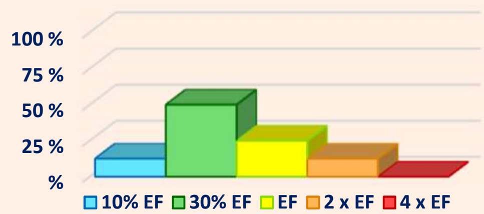
n: 8 emissions

min	max	min	max	min	max	min	max	min
0,00	0,19	0,19	0,30	0,30	0,45	0,45	0,65	0,65

► *Nitrous oxide emissions (g N2O /cow /day)*



Reference emission factor: EF = 1,8 g N2O /cow /day



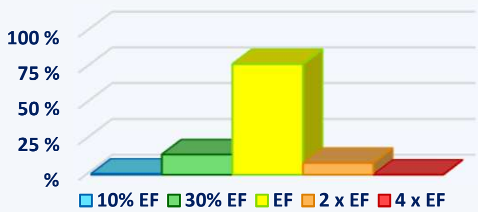
min: 0,1 g N2O /cow /day

max: 5 g N2O /cow /day

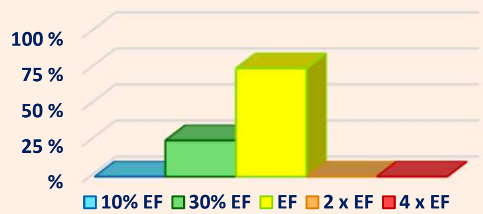
n: 8 emissions

min	max	min	max	min	max	min	max	min
0,00	0,23	0,23	0,91	0,91	2,73	2,73	6,14	6,14

► *GHG emissions (kg eq CO2 /L milk)*



Reference emission factor: EF = 0,40 kg eq CO2 /L milk



min: 0,1 kg eq CO2 /L milk

max: 0,5 kg eq CO2 /L milk

min	max	min	max	min	max	min	max	min
0,00	0,05	0,05	0,20	0,20	0,61	0,61	1,36	1,36

Farm 7 (Latvia)

Survey of housing emissions (2021 - 2023)

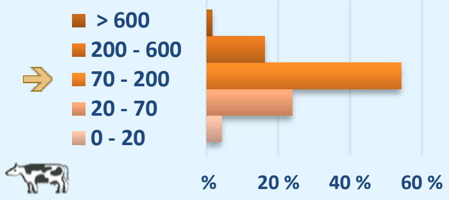
LLU

Farm visited by Diāna Ruska (2021)

My farm vs the diversity of visited dairy units in all countries

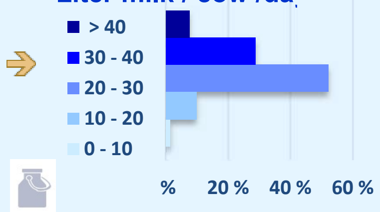
Tier	2b	2a	1	not used	total (3 gases)
nb obs.	0	3	6	3	12

lactating cows / house



96 - 116 cows

Liter milk / cow /day

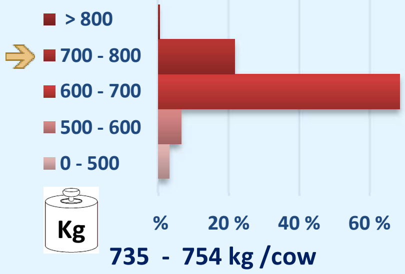


41 L milk /cow /day

The monitored dairy cows

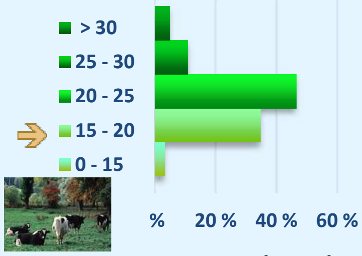
Farm 7

kg liveweight / cow



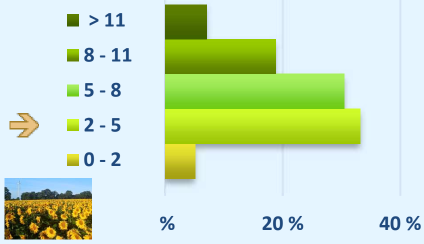
735 - 754 kg /cow

dry matter feed / cow /day



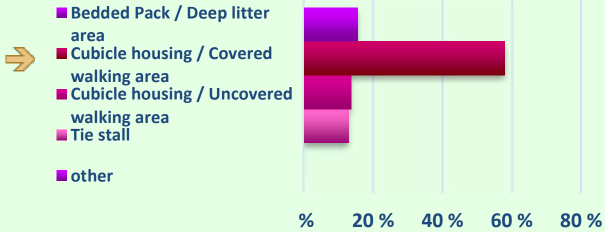
13 - 23 kg dry feed /cow /day

concentrate feed

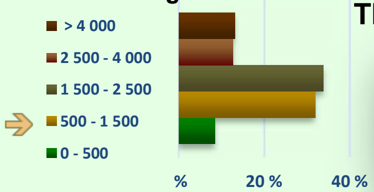


1 - 5 kg concentrate /cow /day

Housing category



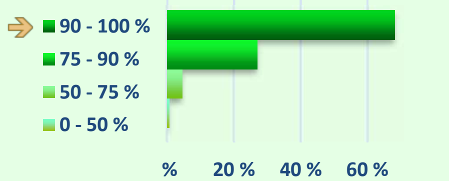
housing area



1237,5 m² /house

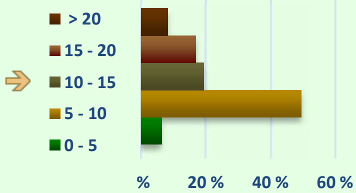
The monitored house

share of feed given to lactating cows (%)



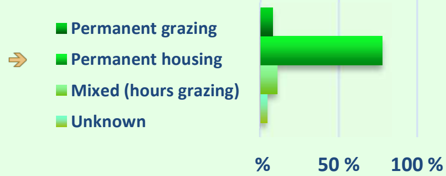
100 % total house

cow area

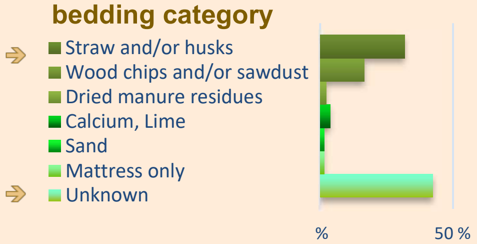


9,5 - 11,5 m² /lactating cow

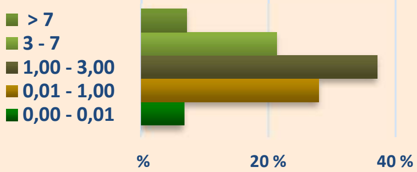
grazing option



bedding category



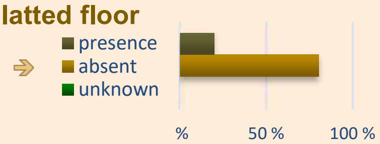
bedding input (kg bedding /cow /day)



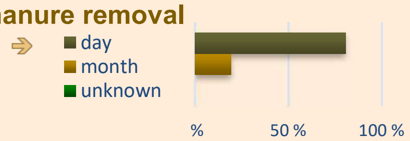
no data

The manure management

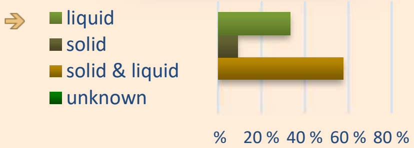
slatted floor



manure removal



Manure output



farming

Farm 7 (Latvia)

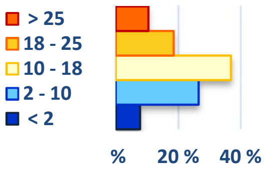
LLU

FACCE ERA-GAS   ERA-NET SUSAN   ICT AGRI era-net

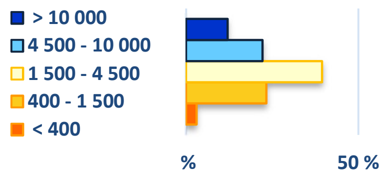
Take-home messages

- Emissions of ammonia and methane higher than the population are occasionally observed;
- Conditions of these high emissions should be identified to decrease there occurrence while maintaining small nitrous oxide emissions

Outdoor temperature (°C)



Ventilation (m3 /hour /cow)



Observed emissions

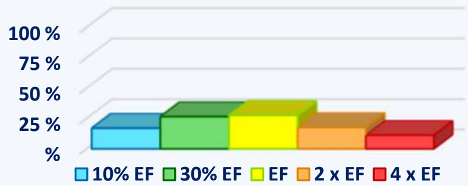
Observations in all countries

Observations in my farm

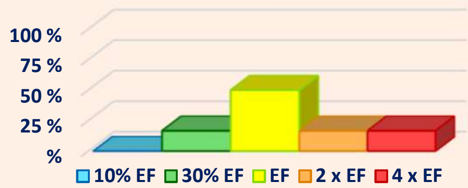
Outdoor temperature -2,1 - 21 °C

Ventilation 480 - 11000 m3 /hour /cow

► ***Ammonia emissions (g NH3 /cow /day)***



Reference emission factor: EF = 30 g NH3 /cow /day



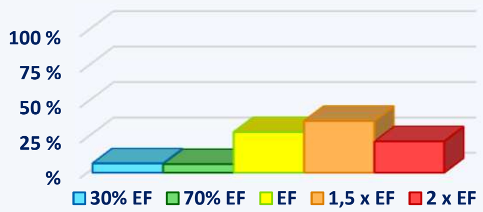
min: 14 g NH3 /cow /day

max: 140 g NH3 /cow /day

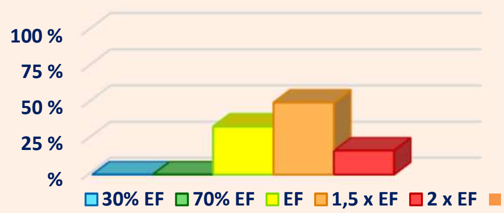
n: 6 emissions

min	max	min	max	min	max	min	max	min
0	4	4	15	15	45	45	101	101

► ***kg CH4 /cow /day (kg CH4 /cow /day)***



Reference emission factor: EF = 0,38 kg CH4 /cow /day



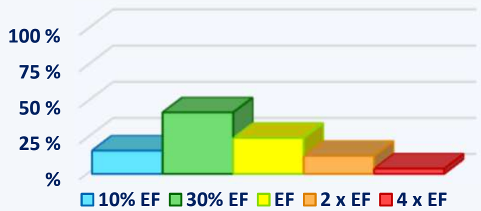
min: 0,4 kg CH4 /cow /day

max: 0,7 kg CH4 /cow /day

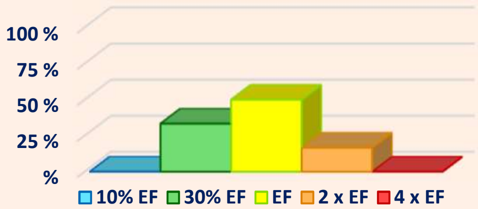
n: 6 emissions

min	max	min	max	min	max	min	max	min
0,00	0,19	0,19	0,30	0,30	0,45	0,45	0,65	0,65

► ***Nitrous oxide emissions (g N2O /cow /day)***



Reference emission factor: EF = 1,8 g N2O /cow /day



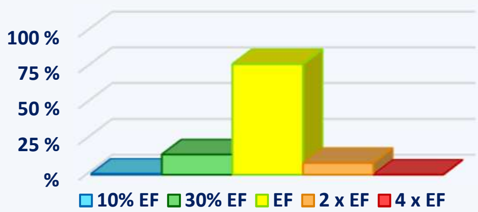
min: 0,6 g N2O /cow /day

max: 3 g N2O /cow /day

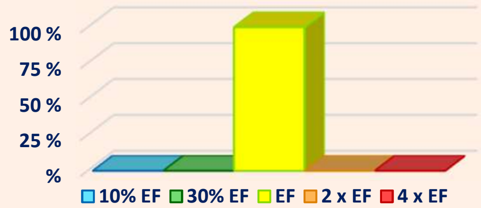
n: 6 emissions

min	max	min	max	min	max	min	max	min
0,00	0,23	0,23	0,91	0,91	2,73	2,73	6,14	6,14

► ***GHG emissions (kg eq CO2 /L milk)***



Reference emission factor: EF = 0,40 kg eq CO2 /L milk



min: 0,2 kg eq CO2 /L milk

max: 0,5 kg eq CO2 /L milk

min	max	min	max	min	max	min	max	min
0,00	0,05	0,05	0,20	0,20	0,61	0,61	1,36	1,36

Farm 8 (Latvia)

Survey of housing emissions (2021 - 2023)

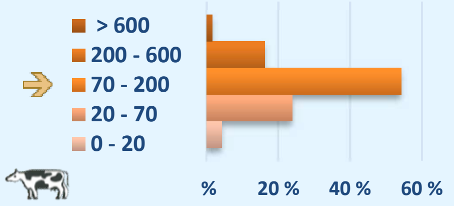
LLU

Farm visited by Diāna Ruska (2021)

My farm vs the diversity of visited dairy units in all countries

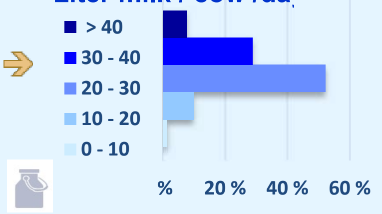
Tier	2b	2a	1	not used	total (3 gases)
nb obs.	0	2	10	0	12

lactating cows / house



129 - 136 cows

Liter milk / cow /day

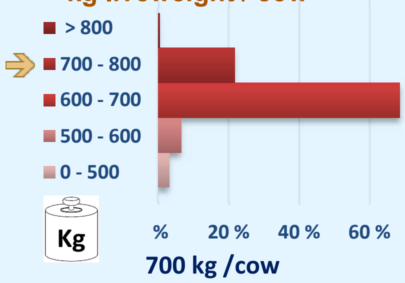


35 L milk /cow /day

The monitored dairy cows

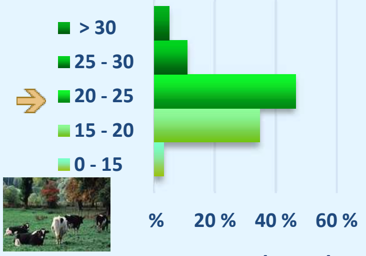
Farm 8

kg liveweight / cow



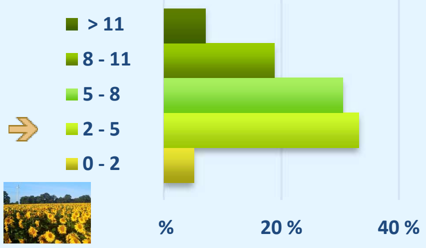
700 kg /cow

dry matter feed / cow /day



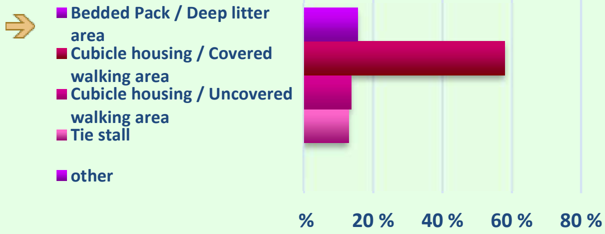
20 - 21 kg dry feed /cow /day

concentrate feed

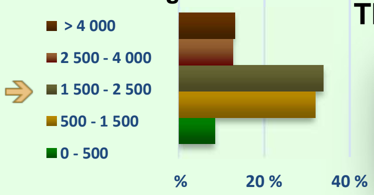


3 - 6 kg concentrate /cow /day

Housing category



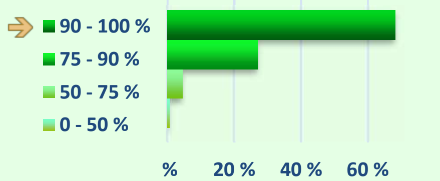
housing area



1617 m² /house

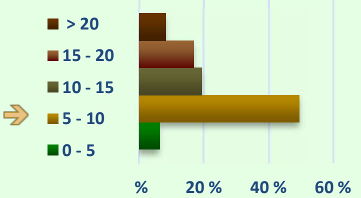
The monitored house

share of feed given to lactating cows (%)



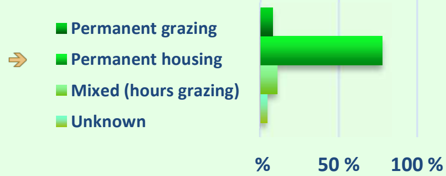
95 % total house

cow area

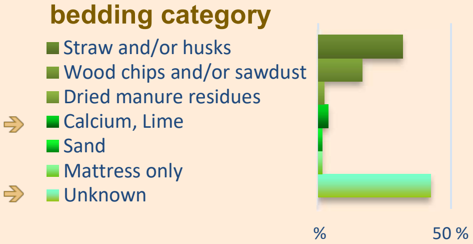


7,4 m² /lactating cow

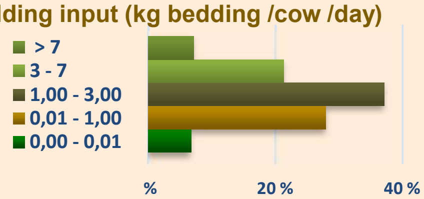
grazing option



bedding category



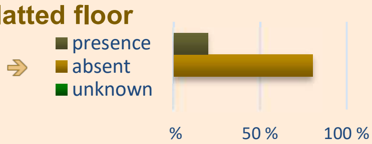
bedding input (kg bedding /cow /day)



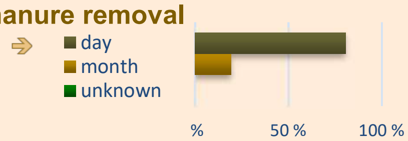
no data

The manure management

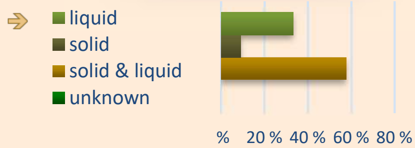
slatted floor



manure removal



Manure output



farming

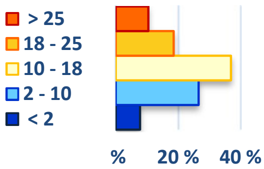
Farm 8 (Latvia) LLU

FACCE ERA-GAS · ERA-NET SUSAN · ICT-AGRI era-net

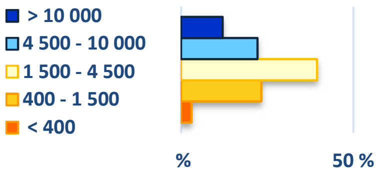
Take-home messages

- Emissions of ammonia and nitrous oxide are lower than the population;
- The reasons of occasional higher methane emissions should be understood to further improve the overall good quality of emissions

Outdoor temperature (°C)



Ventilation (m3 /hour /cow)



Observed emissions

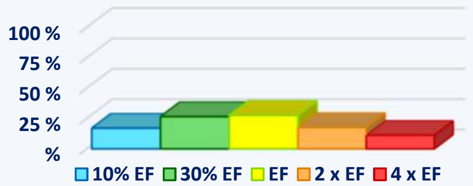
Observations in all countries

Observations in my farm

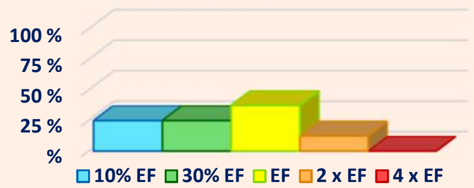
Outdoor temperature -0,4 - 22 °C

Ventilation 500 - 12000 m3 /hour /cow

► *Ammonia emissions (g NH3 /cow /day)*



Reference emission factor: EF = 30 g NH3 /cow /day



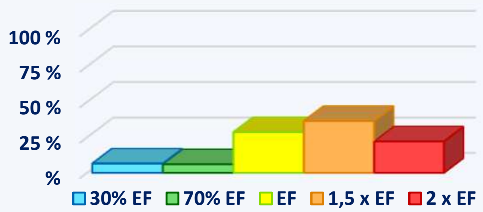
min: 3 g NH3 /cow /day

max: 56 g NH3 /cow /day

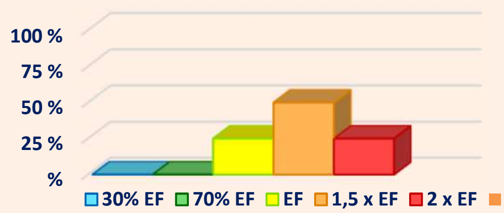
n: 8 emissions

min	max	min	max	min	max	min	max	min
0	4	4	15	15	45	45	101	101

► *kg CH4 /cow /day (kg CH4 /cow /day)*



Reference emission factor: EF = 0,38 kg CH4 /cow /day



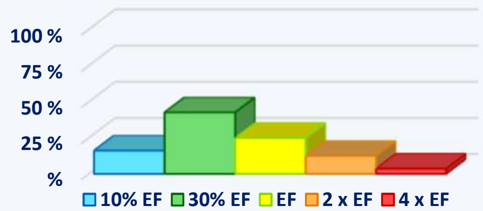
min: 0,4 kg CH4 /cow /day

max: 0,8 kg CH4 /cow /day

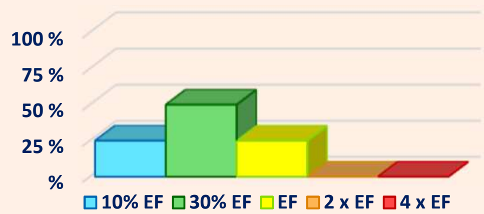
n: 8 emissions

min	max	min	max	min	max	min	max	min
0,00	0,19	0,19	0,30	0,30	0,45	0,45	0,65	0,65

► *Nitrous oxide emissions (g N2O /cow /day)*



Reference emission factor: EF = 1,8 g N2O /cow /day



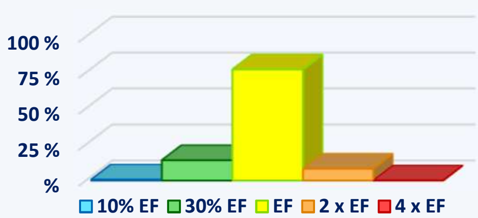
min: 0,09 g N2O /cow /day

max: 1 g N2O /cow /day

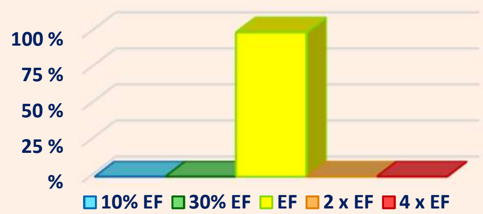
n: 8 emissions

min	max	min	max	min	max	min	max	min
0,00	0,23	0,23	0,91	0,91	2,73	2,73	6,14	6,14

► *GHG emissions (kg eq CO2 /L milk)*



Reference emission factor: EF = 0,40 kg eq CO2 /L milk



min: 0,2 kg eq CO2 /L milk

max: 0,5 kg eq CO2 /L milk

min	max	min	max	min	max	min	max	min
0,00	0,05	0,05	0,20	0,20	0,61	0,61	1,36	1,36

Farm 1 (Netherlands)

WR

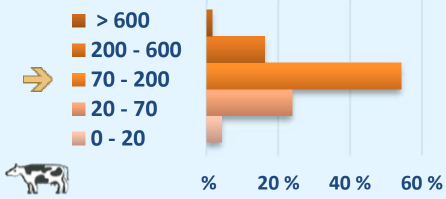
Survey of housing emissions
(2021 - 2023)

Farm visited by Paul
Galama (2021 - 2022)

My farm vs the diversity of visited dairy units in all countries

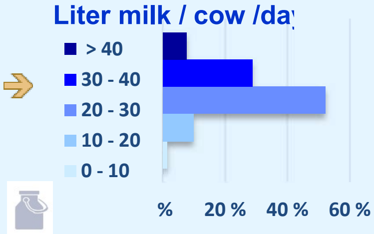
Tier	2b	2a	1	not used	total (3 gases)
nb obs.	0	7	2	3	12

lactating cows / house



68 - 76 cows

Liter milk / cow /day

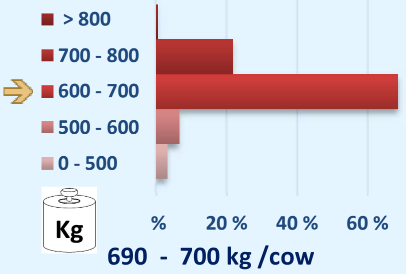


34 L milk /cow /day

The monitored dairy cows

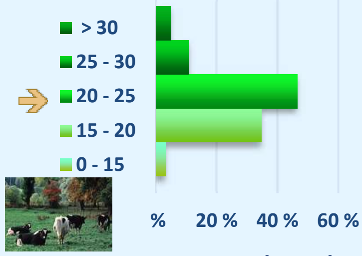
Farm 1

kg liveweight / cow



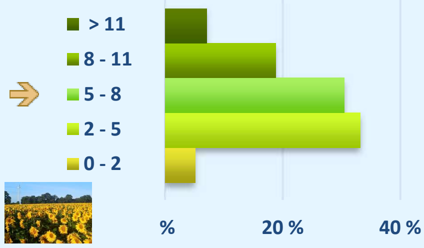
690 - 700 kg /cow

dry matter feed / cow /day



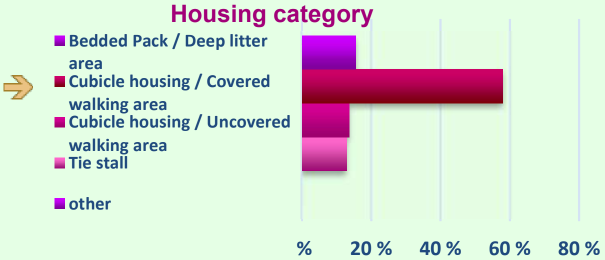
22 - 25 kg dry feed /cow /day

concentrate feed

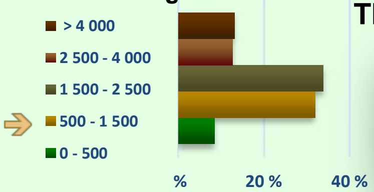


4 - 7 kg concentrate /cow /day

Housing category



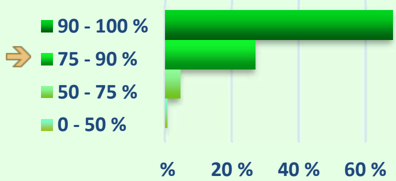
housing area



851 - 1104 m² /house

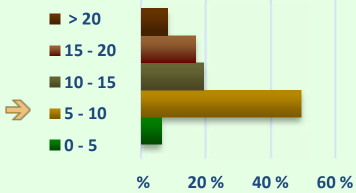
The monitored house

feed lactating cows (% feed all animals)



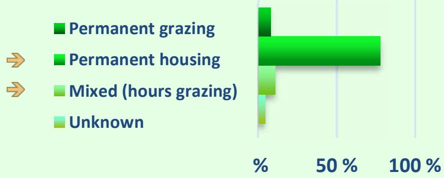
79 - 85 % total house

cow area

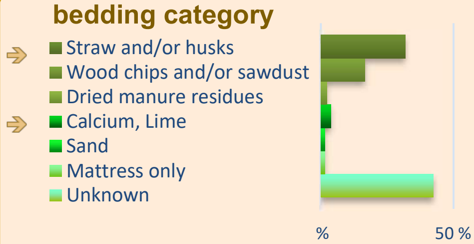


7,0 m² /lactating cow

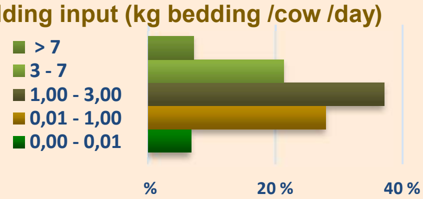
grazing option



bedding category



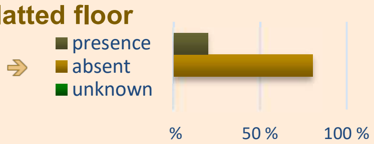
bedding input (kg bedding /cow /day)



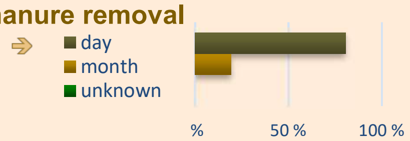
no data

The manure management

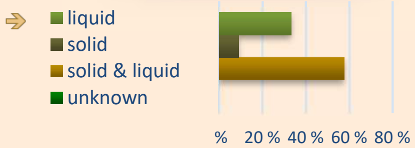
slatted floor



manure removal



Manure output

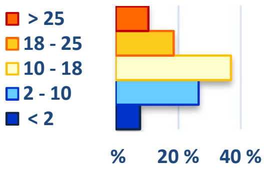


Farm 1 (Netherlands) WR

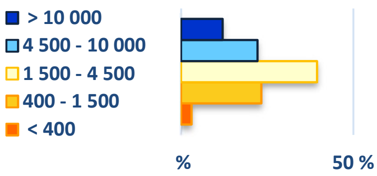
Take-home messages

- Emissions of ammonia and nitrous oxide are smaller than the population while methane emissions are normal for dairy cows;
- The farmer practices should serve as an example of "low emitting system" to improve similar farms in the same region

Outdoor temperature (°C)



Ventilation (m3 /hour /cow)



Observed emissions

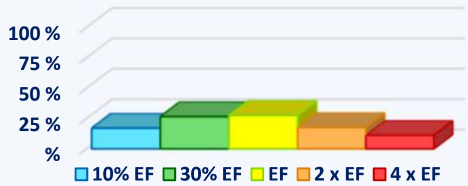
Observations in all countries

Observations in my farm

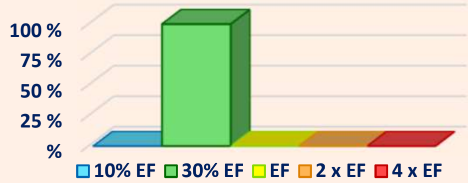
Outdoor temperature 2,7 - 28 °C

Ventilation 1 100 - 7100 m3 /hour /cow

► *Ammonia emissions (g NH3 /cow /day)*



Reference emission factor: EF = 30 g NH3 /cow /day



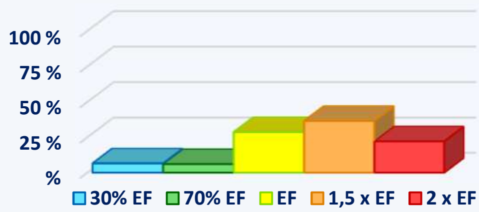
min: 4 g NH3 /cow /day

max: 15 g NH3 /cow /day

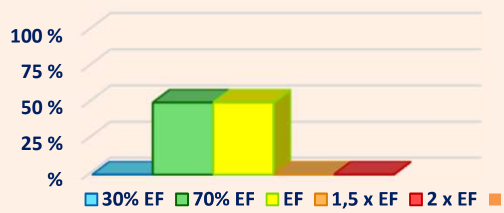
n: 6 emissions

min	max	min	max	min	max	min	max	min
0	4	4	15	15	45	45	101	101

► *kg CH4 /cow /day (kg CH4 /cow /day)*



Reference emission factor: EF = 0,38 kg CH4 /cow /day



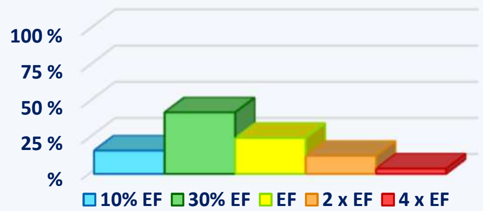
min: 0,2 kg CH4 /cow /day

max: 0,4 kg CH4 /cow /day

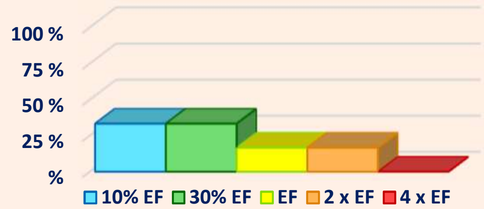
n: 6 emissions

min	max	min	max	min	max	min	max	min
0,00	0,19	0,19	0,30	0,30	0,45	0,45	0,65	0,65

► *Nitrous oxide emissions (g N2O /cow /day)*



Reference emission factor: EF = 1,8 g N2O /cow /day



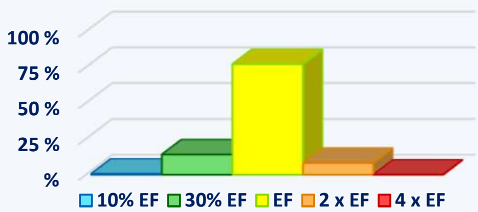
min: 0,2 g N2O /cow /day

max: 4 g N2O /cow /day

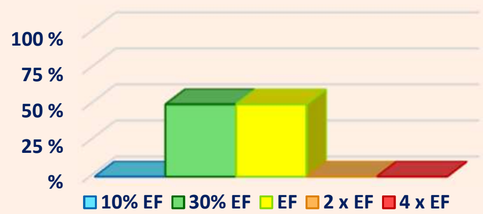
n: 6 emissions

min	max	min	max	min	max	min	max	min
0,00	0,23	0,23	0,91	0,91	2,73	2,73	6,14	6,14

► *GHG emissions (kg eq CO2 /L milk)*



Reference emission factor: EF = 0,40 kg eq CO2 /L milk



min: 0,2 kg eq CO2 /L milk

max: 0,3 kg eq CO2 /L milk

min	max	min	max	min	max	min	max	min
0,00	0,05	0,05	0,20	0,20	0,61	0,61	1,36	1,36

Farm 2 (Netherlands)

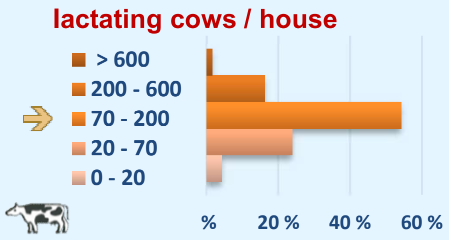
Survey of housing emissions (2021 - 2023)

WR

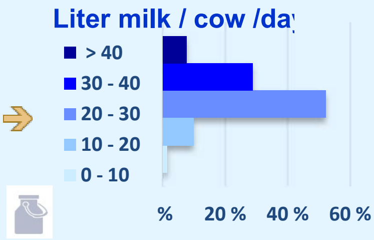
Farm visited by Paul Galama (2021 - 2022)

My farm vs the diversity of visited dairy units in all countries

Tier	2b	2a	1	not used	total (3 gases)
nb obs.	7	0	5	0	12



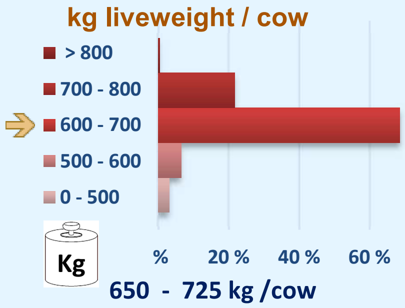
77 - 81 cows



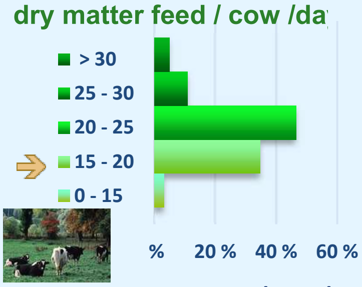
27 L milk /cow /day

The monitored dairy cows

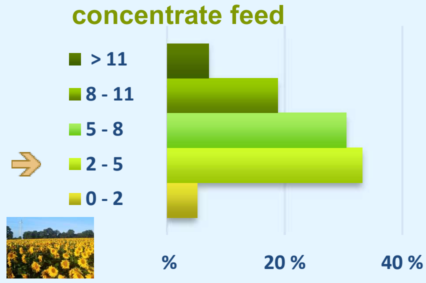
Farm 2



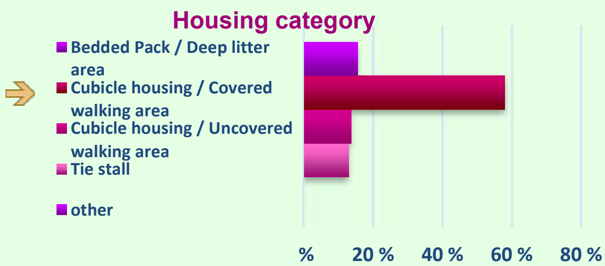
650 - 725 kg /cow

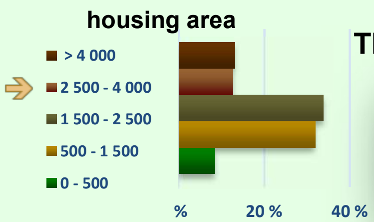


15 - 17 kg dry feed /cow /day



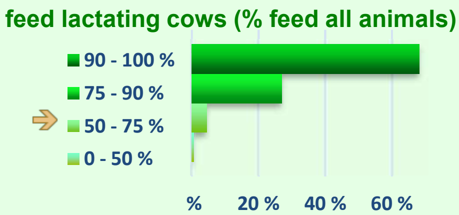
3 - 3 kg concentrate /cow /day



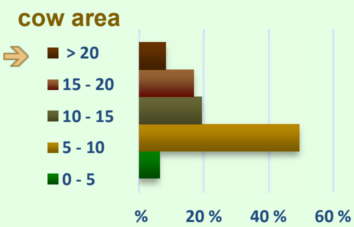


2771 - 3371 m² /house

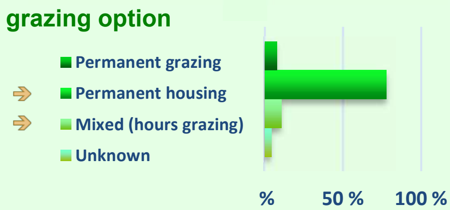
The monitored house

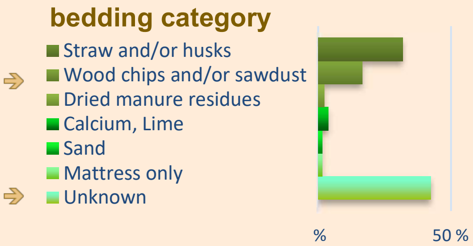


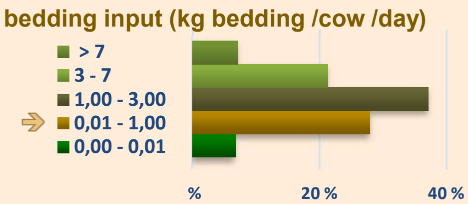
72 - 75 % total house



23,1 - 32,1 m² /lactating cow

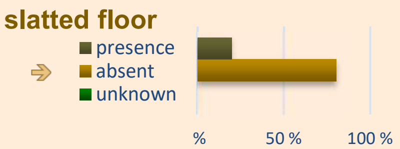


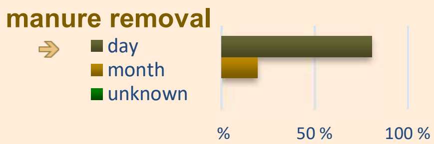


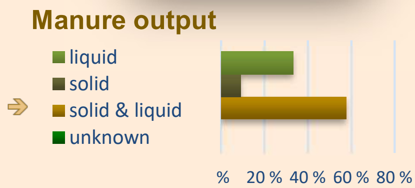


0,8 kg bedding /cow /day

The manure management





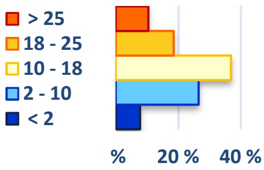


Farm 2 (Netherlands) WR

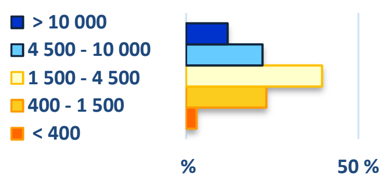
Take-home messages

- Emissions of ammonia and methane higher than the population are occasionally observed;
- Conditions of these high emissions should be identified to decrease there occurrence while maintaining small nitrous oxide emissions

Outdoor temperature (°C)



Ventilation (m3 /hour /cow)



Observed emissions

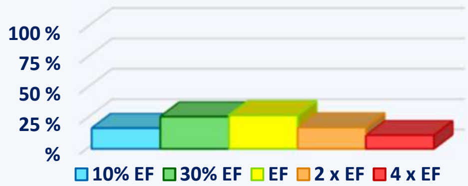
Observations in all countries

Observations in my farm

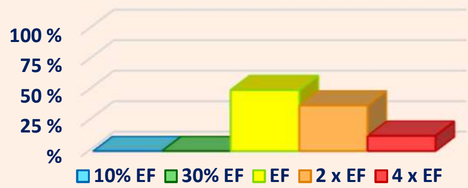
Outdoor temperature 1,8 - 19 °C

Ventilation 1 300 - 7200 m3 /hour /cow

► *Ammonia emissions (g NH3 /cow /day)*



Reference emission factor: EF = 30 g NH3 /cow /day



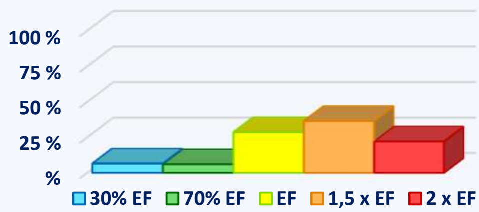
min: 17 g NH3 /cow /day

max: 160 g NH3 /cow /day

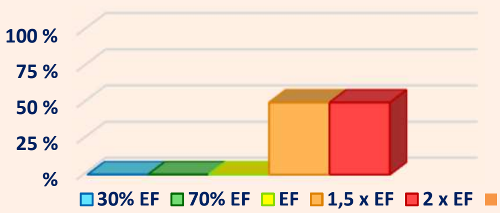
n: 8 emissions

min	max	min	max	min	max	min	max	min
0	4	4	15	15	45	45	101	101

► *kg CH4 /cow /day (kg CH4 /cow /day)*



Reference emission factor: EF = 0,38 kg CH4 /cow /day



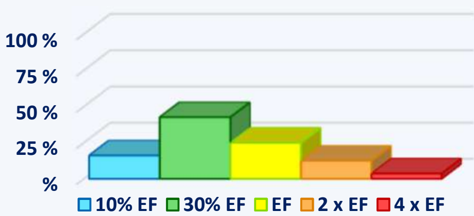
min: 0,5 kg CH4 /cow /day

max: 0,8 kg CH4 /cow /day

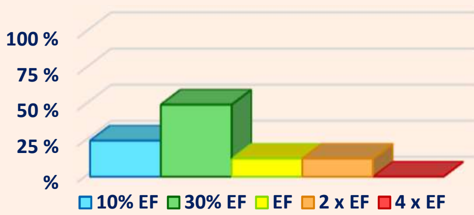
n: 8 emissions

min	max	min	max	min	max	min	max	min
0,00	0,19	0,19	0,30	0,30	0,45	0,45	0,65	0,65

► *Nitrous oxide emissions (g N2O /cow /day)*



Reference emission factor: EF = 1,8 g N2O /cow /day



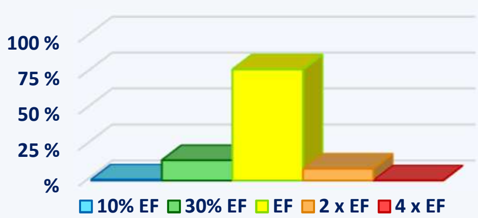
min: 0,2 g N2O /cow /day

max: 4 g N2O /cow /day

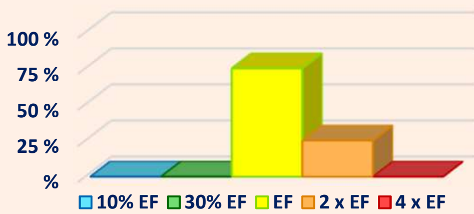
n: 8 emissions

min	max	min	max	min	max	min	max	min
0,00	0,23	0,23	0,91	0,91	2,73	2,73	6,14	6,14

► *GHG emissions (kg eq CO2 /L milk)*



Reference emission factor: EF = 0,40 kg eq CO2 /L milk



min: 0,4 kg eq CO2 /L milk

max: 0,7 kg eq CO2 /L milk

min	max	min	max	min	max	min	max	min
0,00	0,05	0,05	0,20	0,20	0,61	0,61	1,36	1,36

Farm 3 (Netherlands)

Survey of housing emissions (2021 - 2023)

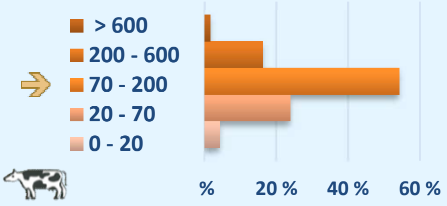
WR

Farm visited by Paul Galama (2021 - 2022)

My farm vs the diversity of visited dairy units in all countries

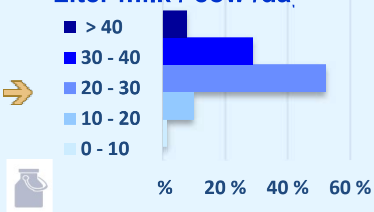
Tier	2b	2a	1	not used	total (3 gases)
nb obs.	8	0	3	1	12

lactating cows / house



108 - 120 cows

Liter milk / cow /day

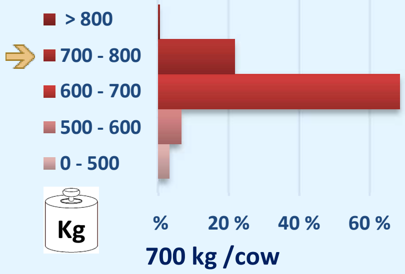


29 L milk /cow /day

The monitored dairy cows

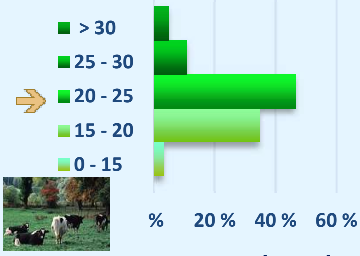
Farm 3

kg liveweight / cow



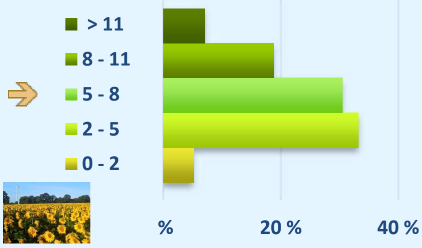
700 kg /cow

dry matter feed / cow /day



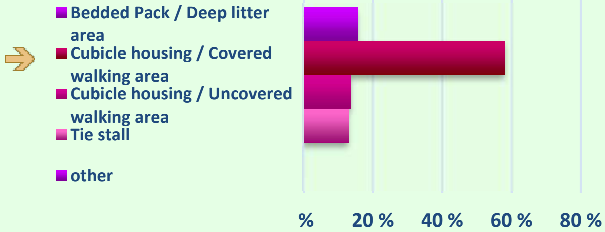
20 - 22 kg dry feed /cow /day

concentrate feed

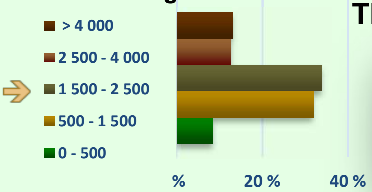


5 - 8 kg concentrate /cow /day

Housing category



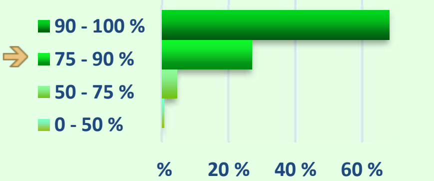
housing area



1716 - 2516 m² /house

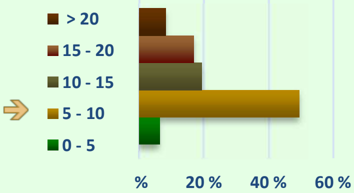
The monitored house

feed lactating cows (% feed all animals)



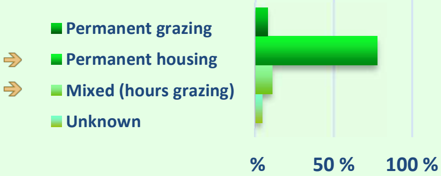
75 - 79 % total house

cow area

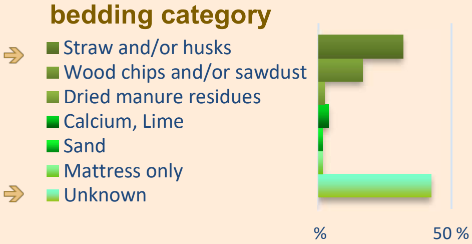


6,7 - 7,4 m² /lactating cow

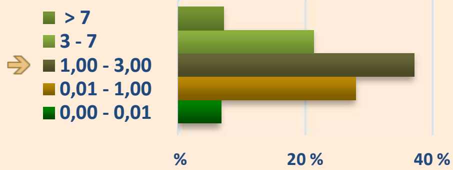
grazing option



bedding category



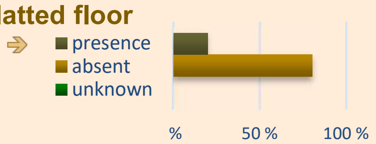
bedding input (kg bedding /cow /day)



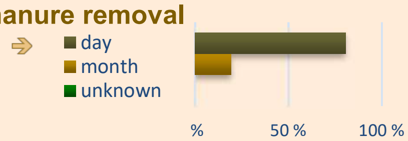
1,2 - 1,2 kg bedding /cow /day

The manure management

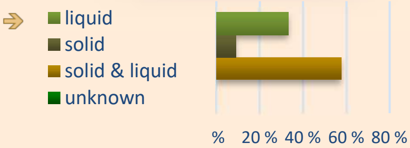
slatted floor



manure removal



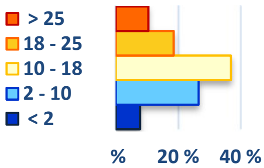
Manure output

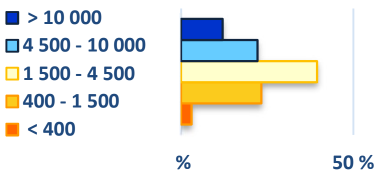


Farm 3 (Netherlands) WR

Take-home messages

- Emissions of ammonia and nitrous oxide are lower than the population;
- The reasons of occasional higher methane emissions should be understood to further improve the overall good quality of emissions





Observed emissions

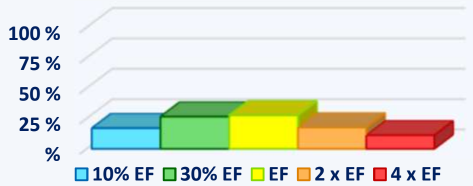
Observations in all countries

Observations in my farm

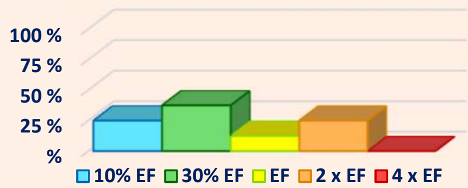
Outdoor temperature 4,8 - 19 °C

Ventilation 1 200 - 22000 m3 /hour /cow

► *Ammonia emissions (g NH3 /cow /day)*



Reference emission factor: EF = 30 g NH3 /cow /day



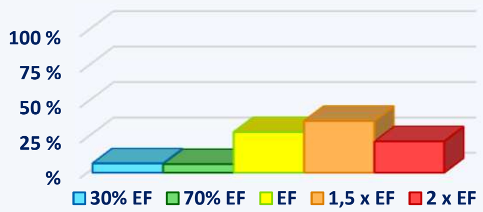
min: 3 g NH3 /cow /day

max: 99 g NH3 /cow /day

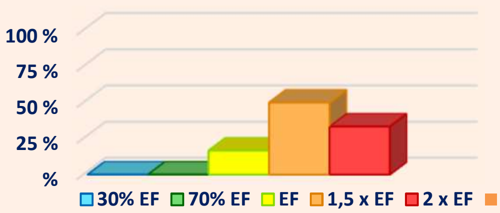
n: 8 emissions

min	max	min	max	min	max	min	max	min
0	4	4	15	15	45	45	101	101

► *kg CH4 /cow /day (kg CH4 /cow /day)*



Reference emission factor: EF = 0,38 kg CH4 /cow /day



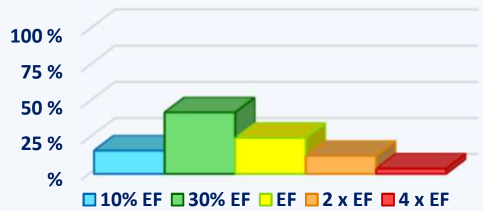
min: 0,5 kg CH4 /cow /day

max: 1 kg CH4 /cow /day

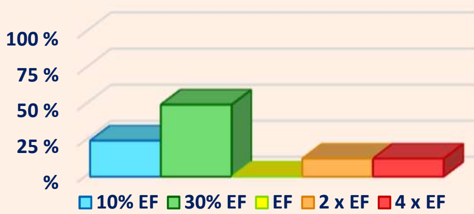
n: 6 emissions

min	max	min	max	min	max	min	max	min
0,00	0,19	0,19	0,30	0,30	0,45	0,45	0,65	0,65

► *Nitrous oxide emissions (g N2O /cow /day)*



Reference emission factor: EF = 1,8 g N2O /cow /day



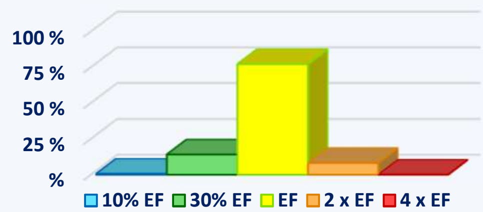
min: 0,2 g N2O /cow /day

max: 9 g N2O /cow /day

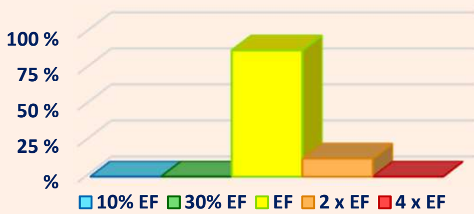
n: 8 emissions

min	max	min	max	min	max	min	max	min
0,00	0,23	0,23	0,91	0,91	2,73	2,73	6,14	6,14

► *GHG emissions (kg eq CO2 /L milk)*



Reference emission factor: EF = 0,40 kg eq CO2 /L milk



min: 0,3 kg eq CO2 /L milk

max: 0,7 kg eq CO2 /L milk

min	max	min	max	min	max	min	max	min
0,00	0,05	0,05	0,20	0,20	0,61	0,61	1,36	1,36

Farm 4 (Netherlands)

Survey of housing emissions (2021 - 2023)

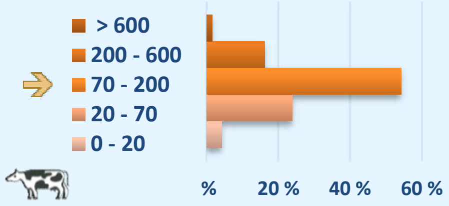
WR

Farm visited by Paul Galama (2021 - 2022)

My farm vs the diversity of visited dairy units in all countries

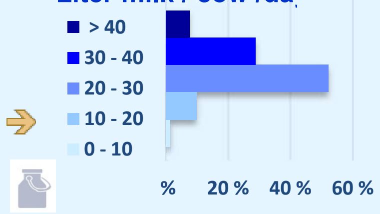
Tier	2b	2a	1	not used	total (3 gases)
nb obs.	7	0	2	3	12

lactating cows / house



91 - 120 cows

Liter milk / cow /day

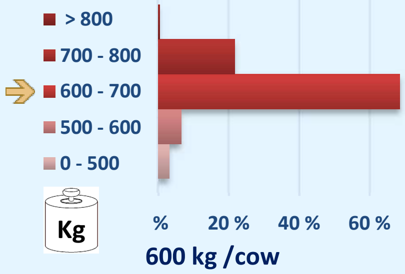


23 L milk /cow /day

The monitored dairy cows

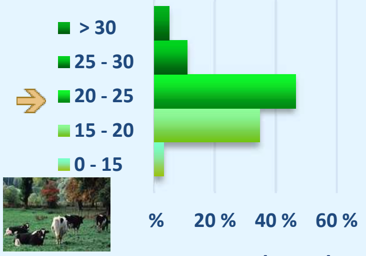
Farm 4

kg liveweight / cow



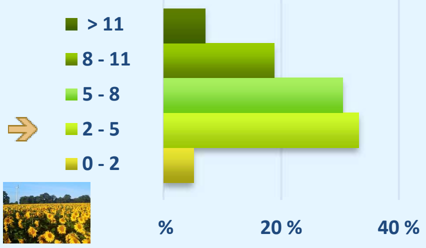
600 kg /cow

dry matter feed / cow /day



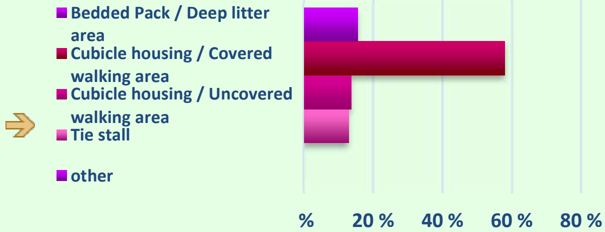
21 - 25 kg dry feed /cow /day

concentrate feed

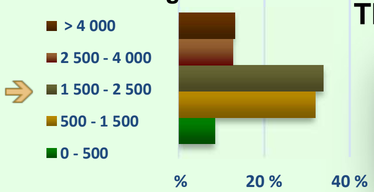


2 - 3 kg concentrate /cow /day

Housing category



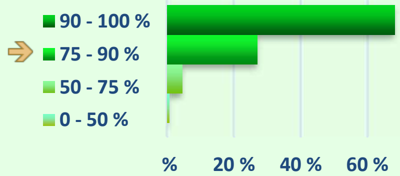
housing area



2263 m² /house

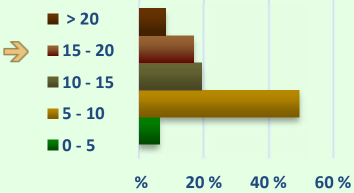
The monitored house

feed lactating cows (% feed all animals)



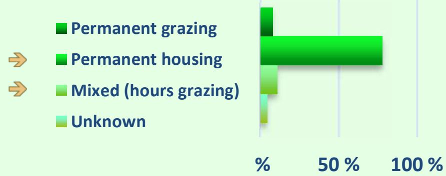
80 - 100 % total house

cow area

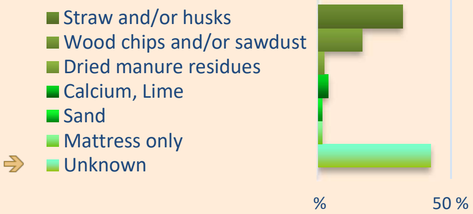


15,9 - 21,0 m² /lactating cow

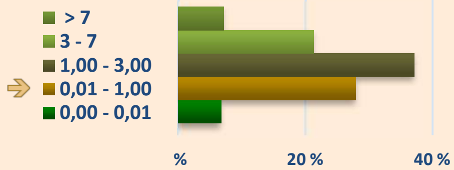
grazing option



bedding category



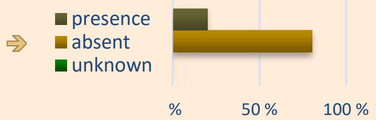
bedding input (kg bedding /cow /day)



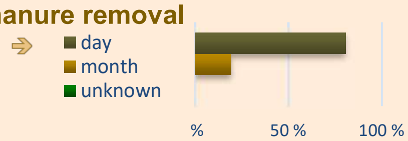
0,2 kg bedding /cow /day

The manure management

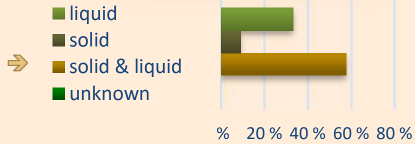
slatted floor



manure removal



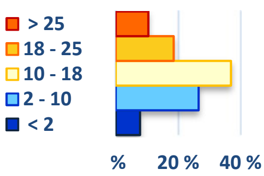
Manure output

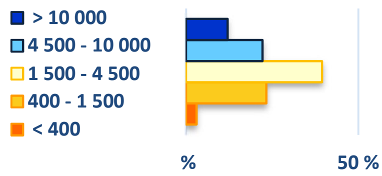


Farm 4 (Netherlands) WR

Take-home messages

- Emissions of ammonia, methane and nitrous oxide are higher than the population;
- Changes in manure management should be studied to decrease these emissions





Observed emissions

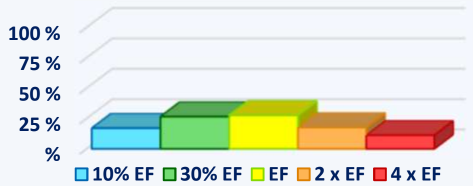
Observations in all countries

Observations in my farm

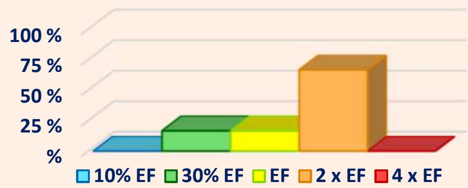
Outdoor temperature 11 - 14 °C

Ventilation 1 300 - 7600 m3 /hour /cow

► *Ammonia emissions (g NH_3 /cow /day)*



Reference emission factor: EF = 30 g NH_3 /cow /day



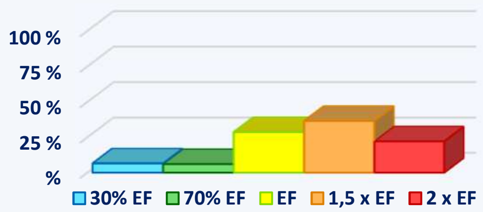
min: 13 g NH_3 /cow /day

max: 97 g NH_3 /cow /day

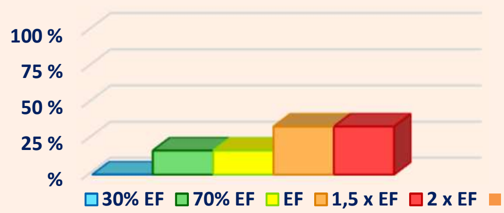
n: 6 emissions

min	max	min	max	min	max	min	max	min
0	4	4	15	15	45	45	101	101

► *kg CH_4 /cow /day (kg CH_4 /cow /day)*



Reference emission factor: EF = 0,38 kg CH_4 /cow /day



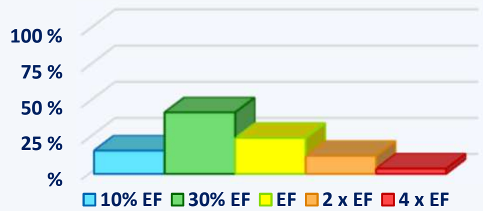
min: 0,2 kg CH_4 /cow /day

max: 0,7 kg CH_4 /cow /day

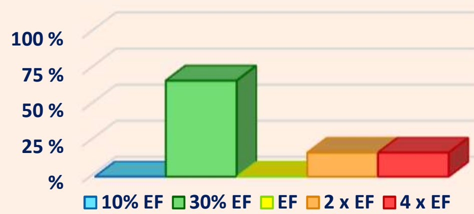
n: 6 emissions

min	max	min	max	min	max	min	max	min
0,00	0,19	0,19	0,30	0,30	0,45	0,45	0,65	0,65

► *Nitrous oxide emissions (g N_2O /cow /day)*



Reference emission factor: EF = 1,8 g N_2O /cow /day



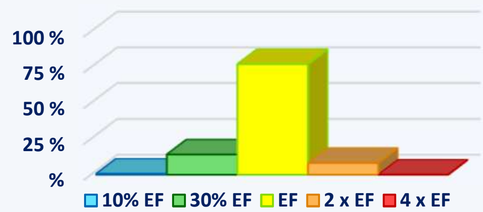
min: 0,8 g N_2O /cow /day

max: 7 g N_2O /cow /day

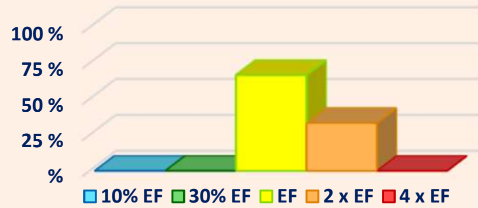
n: 6 emissions

min	max	min	max	min	max	min	max	min
0,00	0,23	0,23	0,91	0,91	2,73	2,73	6,14	6,14

► *GHG emissions (kg eq CO_2 /L milk)*



Reference emission factor: EF = 0,40 kg eq CO_2 /L milk



min: 0,3 kg eq CO_2 /L milk

max: 0,7 kg eq CO_2 /L milk

min	max	min	max	min	max	min	max	min
0,00	0,05	0,05	0,20	0,20	0,61	0,61	1,36	1,36

Farm 5 (Netherlands)

Survey of housing emissions (2021 - 2023)

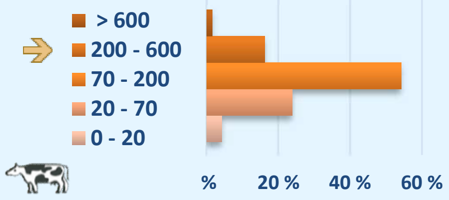
WR

Farm visited by Paul Galama (2021 - 2022)

My farm vs the diversity of visited dairy units in all countries

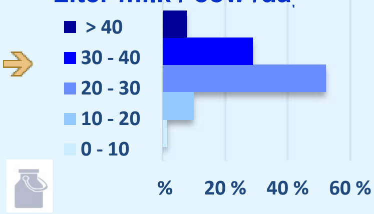
Tier	2b	2a	1	not used	total (3 gases)
nb obs.	9	0	2	1	12

lactating cows / house



204 - 225 cows

Liter milk / cow /day

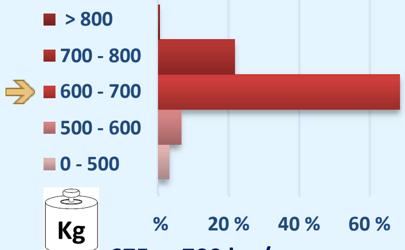


32 L milk /cow /day

The monitored dairy cows

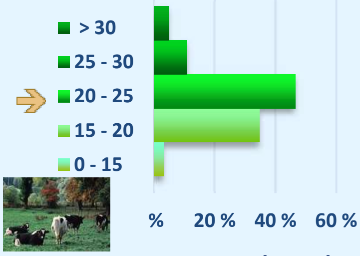
Farm 5

kg liveweight / cow



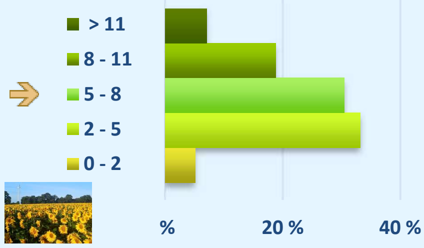
675 - 700 kg /cow

dry matter feed / cow /day



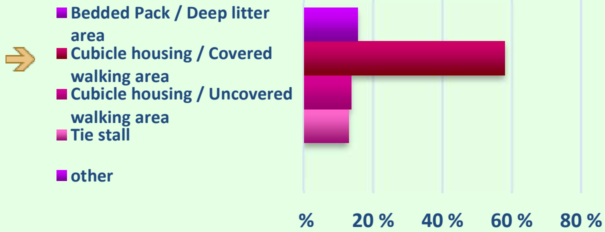
18 - 25 kg dry feed /cow /day

concentrate feed

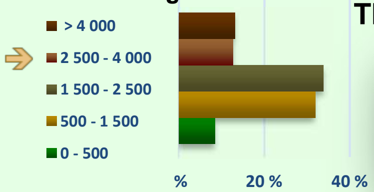


5 - 8 kg concentrate /cow /day

Housing category



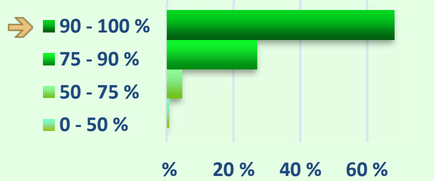
housing area



2565 m² /house

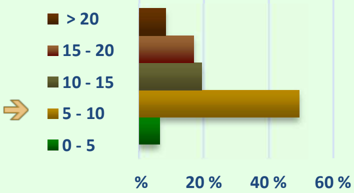
The monitored house

feed lactating cows (% feed all animals)



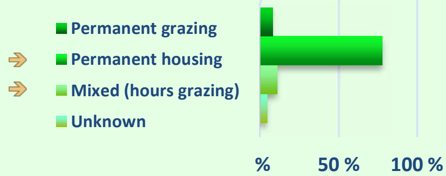
90 - 93 % total house

cow area

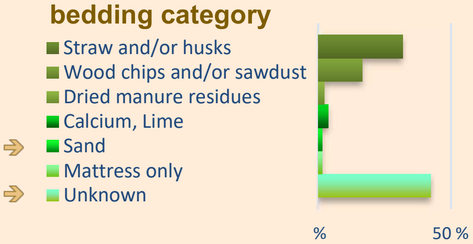


9,0 - 9,9 m² /lactating cow

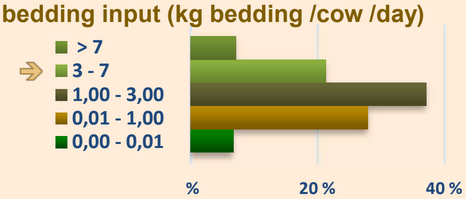
grazing option



bedding category



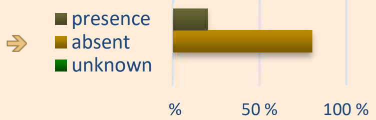
bedding input (kg bedding /cow /day)



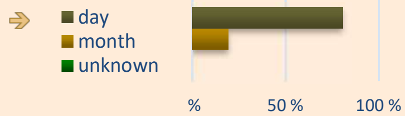
4,0 - 4,1 kg bedding /cow /day

The manure management

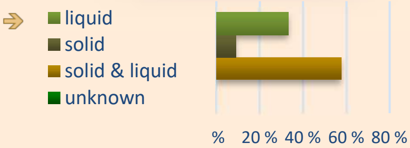
slatted floor



manure removal



Manure output

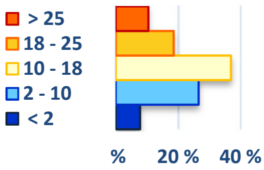


Farm 5 (Netherlands) WR

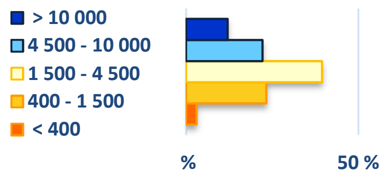
Take-home messages

- Emissions of ammonia, methane and nitrous oxide higher than the population are repeatedly observed;
- Changes in manure or cow management can induce significant decrease in polluting emissions

Outdoor temperature (°C)



Ventilation (m3 /hour /cow)



Observed emissions

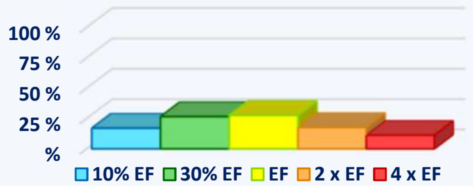
Observations in all countries

Observations in my farm

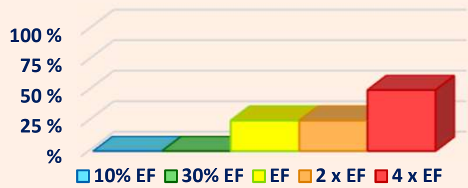
Outdoor temperature 4,6 - 19 °C

Ventilation 2 600 - 32000 m3 /hour /cow

► *Ammonia emissions (g NH3 /cow /day)*



Reference emission factor: EF = 30 g NH3 /cow /day



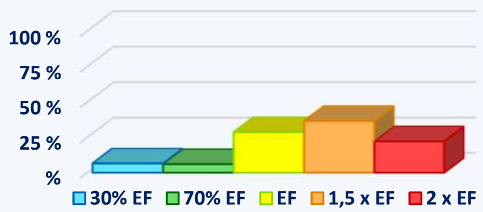
min: 18 g NH3 /cow /day

max: 230 g NH3 /cow /day

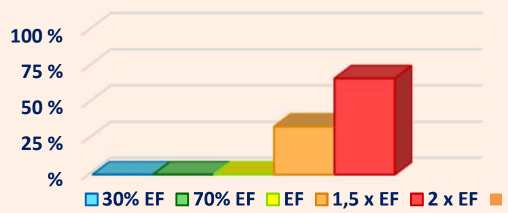
n: 8 emissions

min	max	min	max	min	max	min	max	min
0	4	4	15	15	45	45	101	101

► *kg CH4 /cow /day (kg CH4 /cow /day)*



Reference emission factor: EF = 0,38 kg CH4 /cow /day



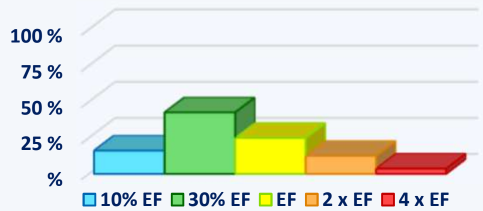
min: 0,5 kg CH4 /cow /day

max: 1,0 kg CH4 /cow /day

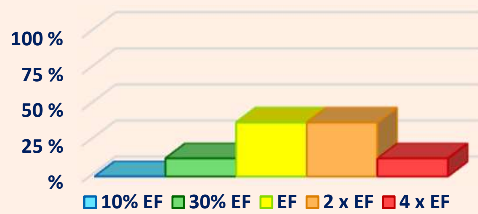
n: 6 emissions

min	max	min	max	min	max	min	max	min
0,00	0,19	0,19	0,30	0,30	0,45	0,45	0,65	0,65

► *Nitrous oxide emissions (g N2O /cow /day)*



Reference emission factor: EF = 1,8 g N2O /cow /day



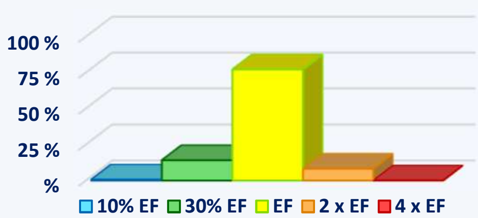
min: 0,5 g N2O /cow /day

max: 10 g N2O /cow /day

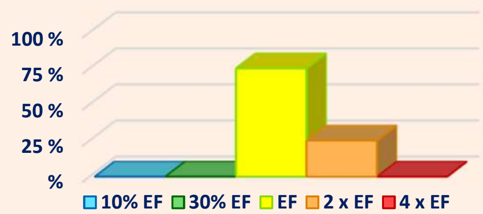
n: 8 emissions

min	max	min	max	min	max	min	max	min
0,00	0,23	0,23	0,91	0,91	2,73	2,73	6,14	6,14

► *GHG emissions (kg eq CO2 /L milk)*



Reference emission factor: EF = 0,40 kg eq CO2 /L milk



min: 0,3 kg eq CO2 /L milk

max: 0,6 kg eq CO2 /L milk

min	max	min	max	min	max	min	max	min
0,00	0,05	0,05	0,20	0,20	0,61	0,61	1,36	1,36

Farm 6 (Netherlands) WR

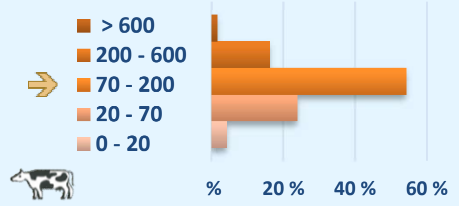
Survey of housing emissions (2021 - 2023)

Farm visited by Paul Galama (2021 - 2022)

My farm vs the diversity of visited dairy units in all countries

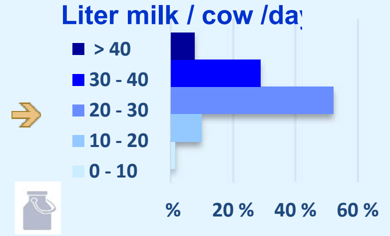
Tier	2b	2a	1	not used	total (3 gases)
nb obs.	0	11	1	0	12

lactating cows / house



60 - 87 cows

Liter milk / cow /day

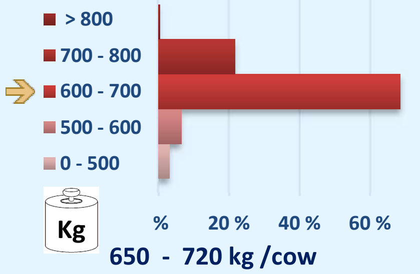


27 L milk /cow /day

The monitored dairy cows

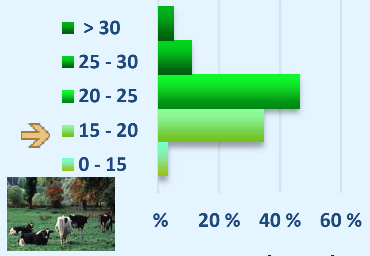
Farm 6

kg liveweight / cow



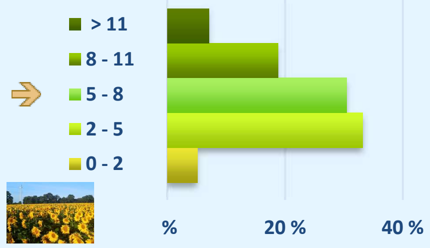
650 - 720 kg /cow

dry matter feed / cow /day



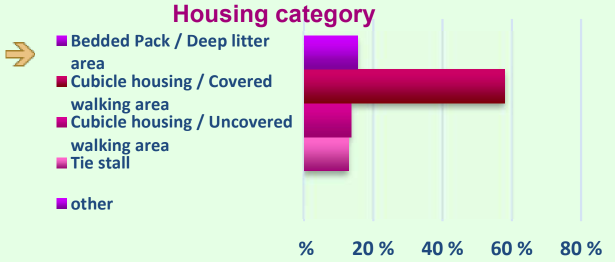
19 - 21 kg dry feed /cow /day

concentrate feed

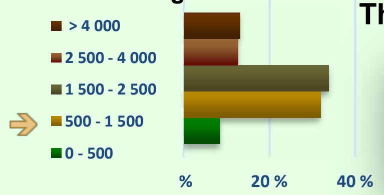


5 - 6 kg concentrate /cow /day

Housing category



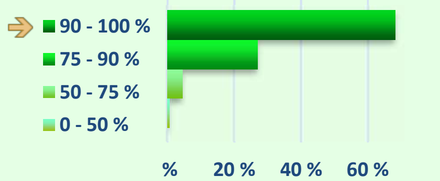
housing area



1053 m² /house

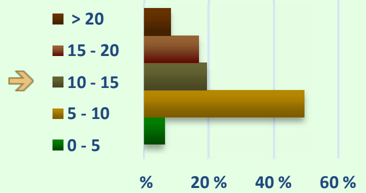
The monitored house

feed lactating cows (% feed all animals)



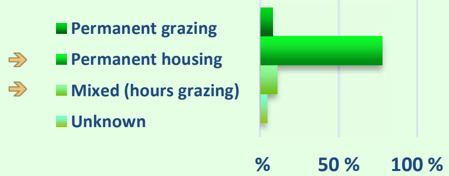
100 % total house

cow area

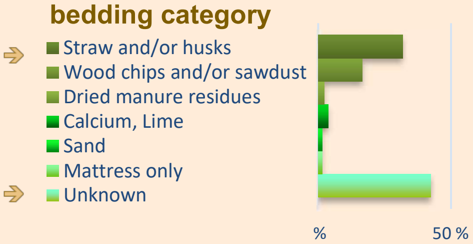


8,9 - 12,9 m² /lactating cow

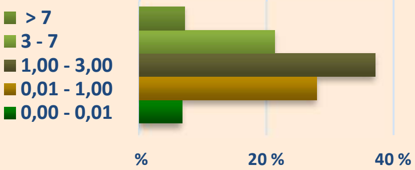
grazing option



bedding category



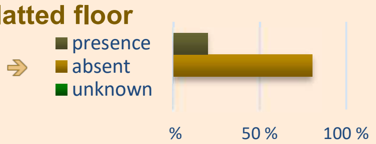
bedding input (kg bedding /cow /day)



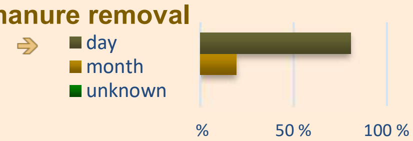
no data

The manure management

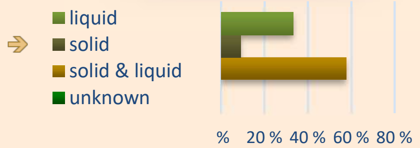
slatted floor



manure removal



Manure output

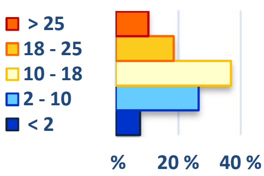


Farm 6 (Netherlands) WR

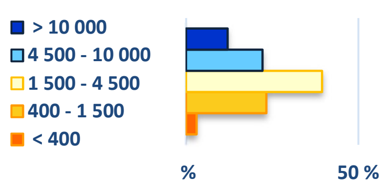
Take-home messages

- Emissions of ammonia and nitrous oxide are lower than the population;
- The reasons of occasional higher methane emissions should be understood to further improve the overall good quality of emissions

Outdoor temperature (°C)



Ventilation (m3 /hour /cow)



Observed emissions

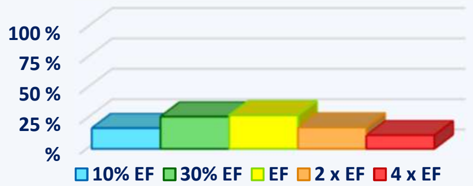
Observations in all countries

Observations in my farm

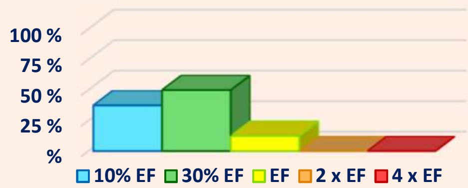
Outdoor temperature 2,3 - 25 °C

Ventilation 1 000 - 8500 m3 /hour /cow

► Ammonia emissions (g NH3 /cow /day)



Reference emission factor: EF = 30 g NH3 /cow /day



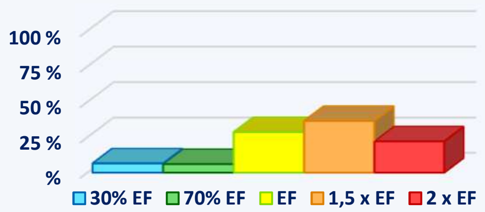
min: 2 g NH3 /cow /day

max: 17 g NH3 /cow /day

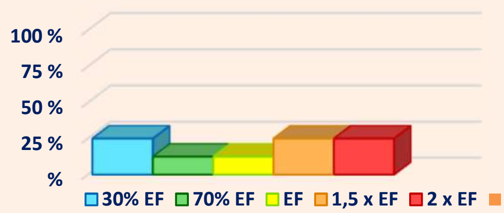
n: 8 emissions

min	max	min	max	min	max	min	max	min
0	4	4	15	15	45	45	101	101

► kg CH4 /cow /day (kg CH4 /cow /day)



Reference emission factor: EF = 0,38 kg CH4 /cow /day



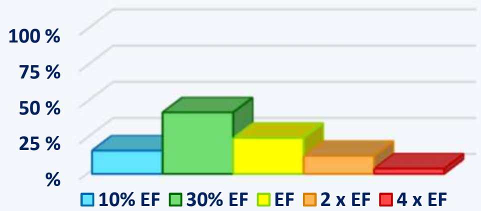
min: 0,1 kg CH4 /cow /day

max: 0,7 kg CH4 /cow /day

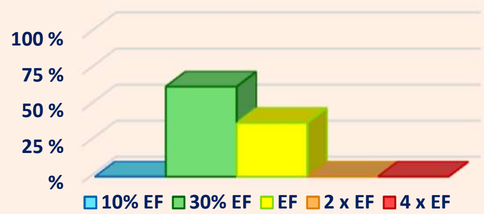
n: 8 emissions

min	max	min	max	min	max	min	max	min
0,00	0,19	0,19	0,30	0,30	0,45	0,45	0,65	0,65

► Nitrous oxide emissions (g N2O /cow /day)



Reference emission factor: EF = 1,8 g N2O /cow /day



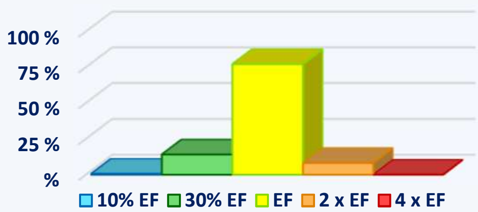
min: 0,3 g N2O /cow /day

max: 2 g N2O /cow /day

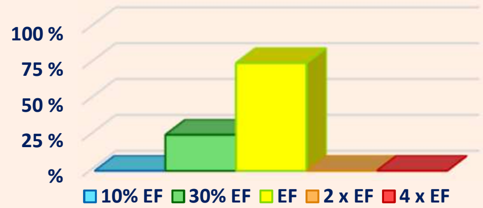
n: 8 emissions

min	max	min	max	min	max	min	max	min
0,00	0,23	0,23	0,91	0,91	2,73	2,73	6,14	6,14

► GHG emissions (kg eq CO2 /L milk)



Reference emission factor: EF = 0,40 kg eq CO2 /L milk



min: 0,09 kg eq CO2 /L milk

max: 0,5 kg eq CO2 /L milk

min	max	min	max	min	max	min	max	min
0,00	0,05	0,05	0,20	0,20	0,61	0,61	1,36	1,36

Farm 7 (Netherlands)

Survey of housing emissions (2021 - 2023)

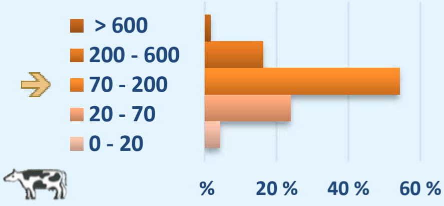
WR

Farm visited by Paul Galama (2021 - 2022)

My farm vs the diversity of visited dairy units in all countries

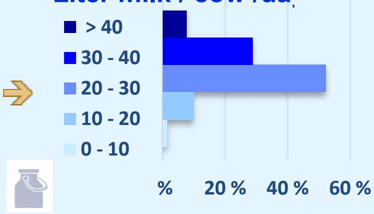
Tier	2b	2a	1	not used	total (3 gases)
nb obs.	9	0	3	0	12

lactating cows / house



90 - 99 cows

Liter milk / cow /day

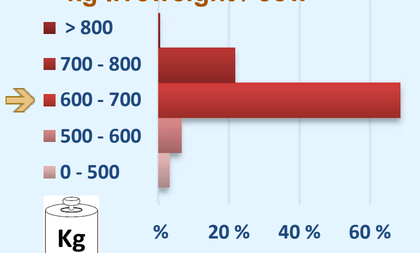


32 L milk /cow /day

The monitored dairy cows

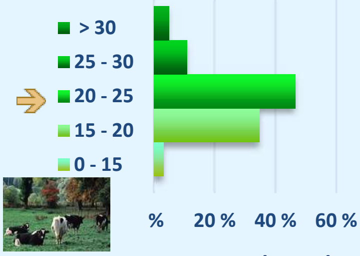
Farm 7

kg liveweight / cow



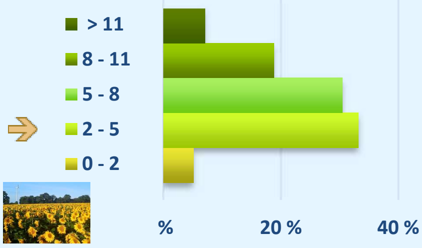
650 - 670 kg /cow

dry matter feed / cow /day



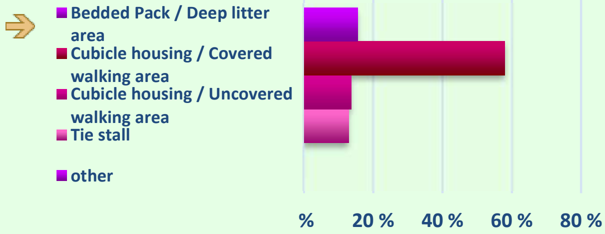
20 - 22 kg dry feed /cow /day

concentrate feed

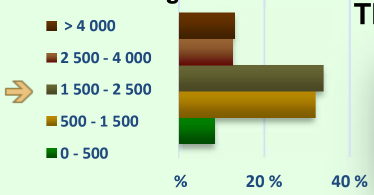


3 - 5 kg concentrate /cow /day

Housing category



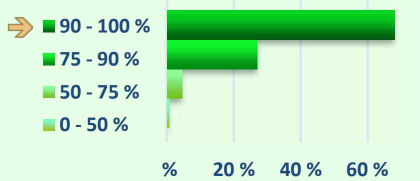
housing area



2069 m² /house

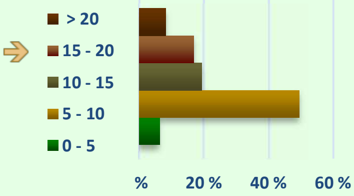
The monitored house

feed lactating cows (% feed all animals)



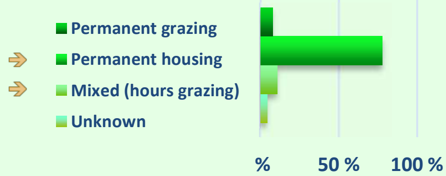
100 % total house

cow area

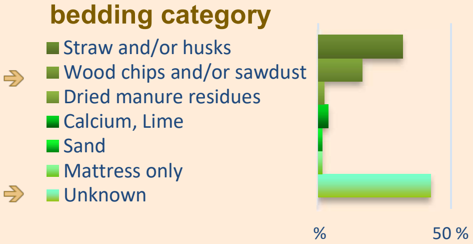


17,6 - 19,4 m² /lactating cow

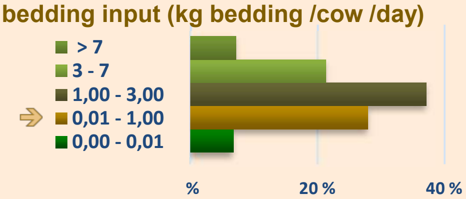
grazing option



bedding category



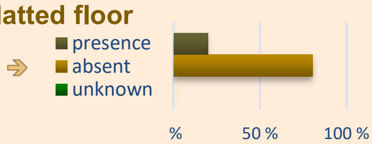
bedding input (kg bedding /cow /day)



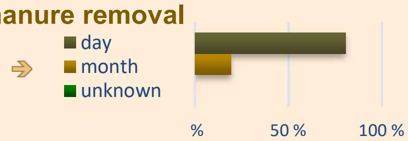
0,8 kg bedding /cow /day

The manure management

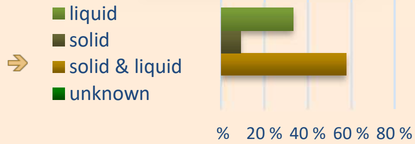
slatted floor



manure removal



Manure output

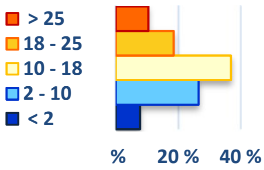


Farm 7 (Netherlands) WR

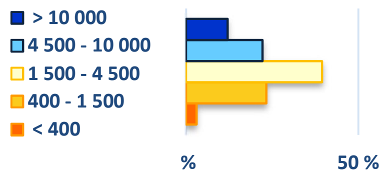
Take-home messages

- Emissions of ammonia and methane higher than the population are occasionally observed;
- Conditions of these high emissions should be identified to decrease there occurrence while maintaining small nitrous oxide emissions

Outdoor temperature (°C)



Ventilation (m3 /hour /cow)



Observed emissions

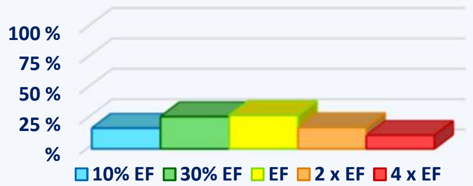
Observations in all countries

Observations in my farm

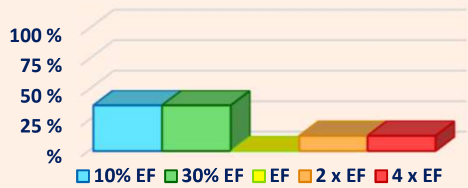
Outdoor temperature 10 - 19 °C

Ventilation 2 200 - 15000 m3 /hour /cow

► *Ammonia emissions (g NH3 /cow /day)*



Reference emission factor: EF = 30 g NH3 /cow /day



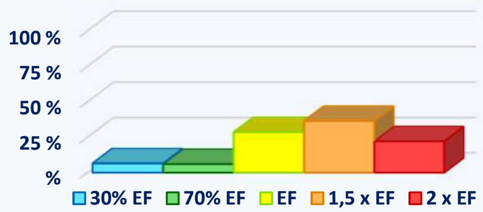
min: 3 g NH3 /cow /day

max: 120 g NH3 /cow /day

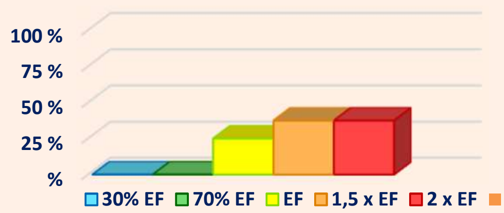
n: 8 emissions

min	max	min	max	min	max	min	max	min
0	4	4	15	15	45	45	101	101

► *kg CH4 /cow /day (kg CH4 /cow /day)*



Reference emission factor: EF = 0,38 kg CH4 /cow /day



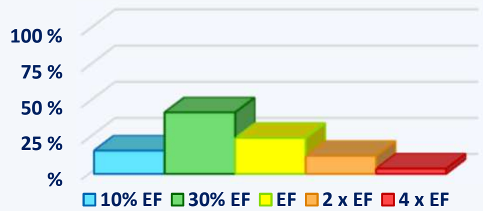
min: 0,4 kg CH4 /cow /day

max: 1,0 kg CH4 /cow /day

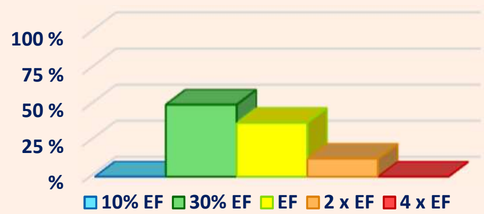
n: 8 emissions

min	max	min	max	min	max	min	max	min
0,00	0,19	0,19	0,30	0,30	0,45	0,45	0,65	0,65

► *Nitrous oxide emissions (g N2O /cow /day)*



Reference emission factor: EF = 1,8 g N2O /cow /day



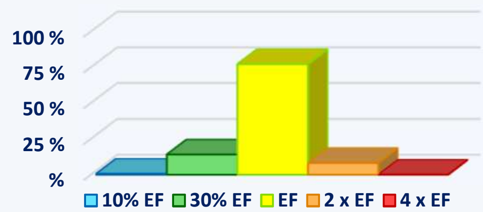
min: 0,4 g N2O /cow /day

max: 5 g N2O /cow /day

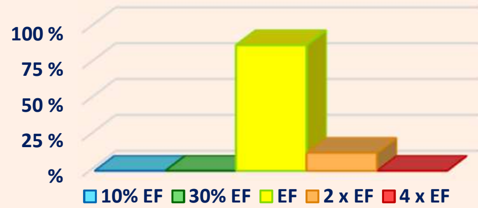
n: 8 emissions

min	max	min	max	min	max	min	max	min
0,00	0,23	0,23	0,91	0,91	2,73	2,73	6,14	6,14

► *GHG emissions (kg eq CO2 /L milk)*



Reference emission factor: EF = 0,40 kg eq CO2 /L milk



min: 0,3 kg eq CO2 /L milk

max: 0,6 kg eq CO2 /L milk

min	max	min	max	min	max	min	max	min
0,00	0,05	0,05	0,20	0,20	0,61	0,61	1,36	1,36

Farm 8 (Netherlands)

WR

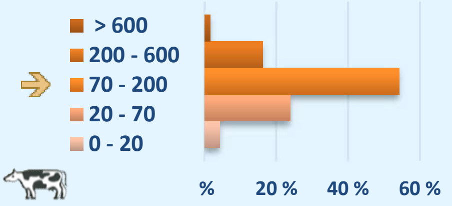
Survey of housing emissions (2021 - 2023)

Farm visited by Paul Galama (2021 - 2022)

My farm vs the diversity of visited dairy units in all countries

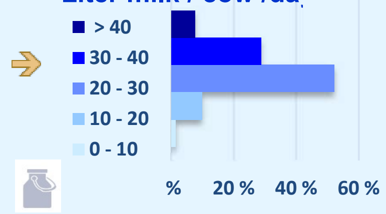
Tier	2b	2a	1	not used	total (3 gases)
nb obs.	0	6	6	0	12

lactating cows / house



97 - 115 cows

Liter milk / cow /day

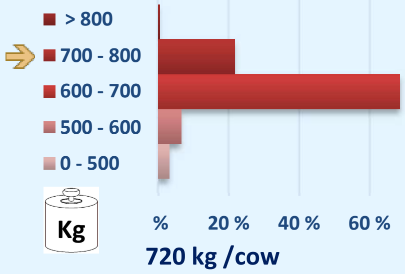


35 L milk /cow /day

The monitored dairy cows

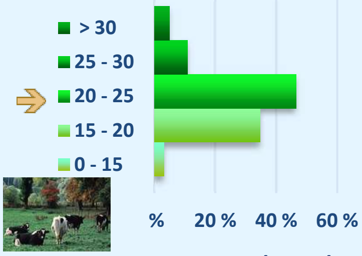
Farm 8

kg liveweight / cow



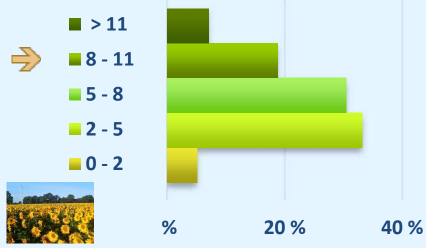
720 kg /cow

dry matter feed / cow /day



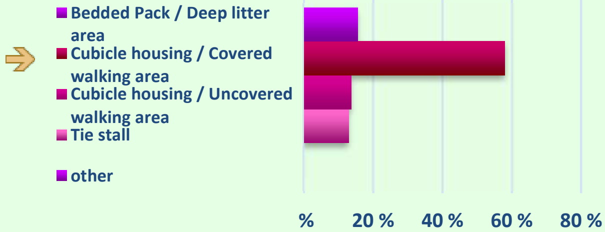
21 - 28 kg dry feed /cow /day

concentrate feed

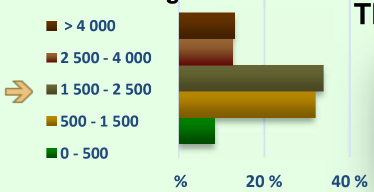


7 - 10 kg concentrate /cow /day

Housing category



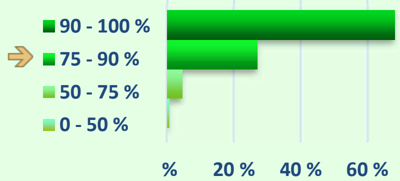
housing area



2182 m² /house

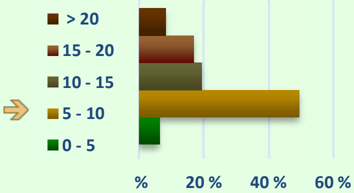
The monitored house

feed lactating cows (% feed all animals)



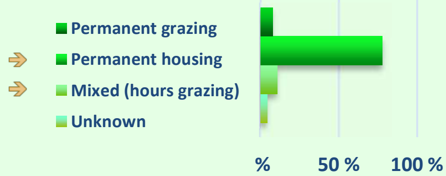
75 - 81 % total house

cow area

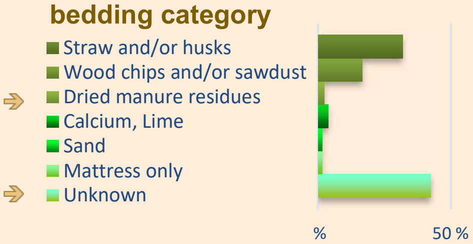


8,7 - 10,3 m² /lactating cow

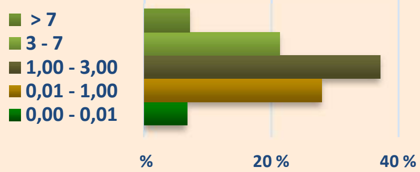
grazing option



bedding category



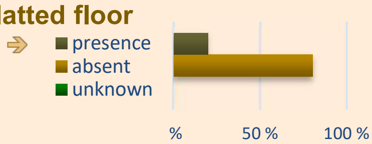
bedding input (kg bedding /cow /day)



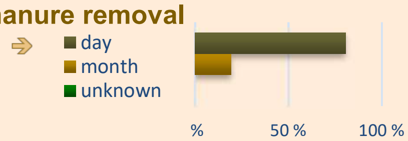
no data

The manure management

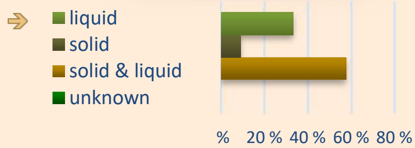
slatted floor



manure removal



Manure output

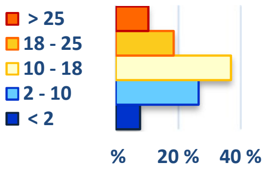


Farm 8 (Netherlands) WR

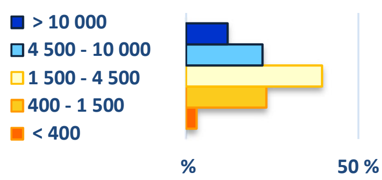
Take-home messages

- Emissions of ammonia are lower than in most farms;
- However, high methane and nitrous oxide are observed which can be due to the manure management (e.g. 1: reusing dried manure with moist litter; e.g. 2: moist litter for methane; e.g. 3: frequent tu

Outdoor temperature (°C)



Ventilation (m3 /hour /cow)



Observed emissions

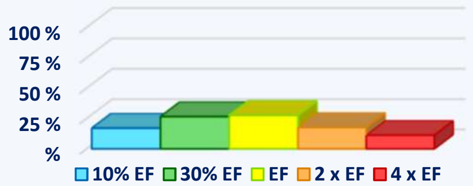
Observations in all countries

Observations in my farm

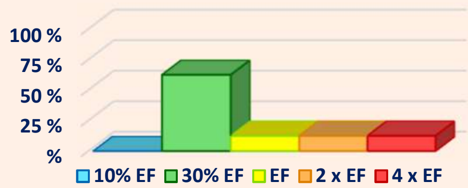
Outdoor temperature 2,4 - 25 °C

Ventilation 610 - 15000 m3 /hour /cow

► *Ammonia emissions (g NH3 /cow /day)*



Reference emission factor: EF = 30 g NH3 /cow /day



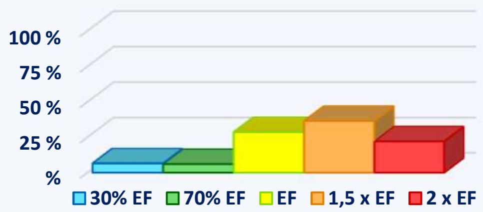
min: 5 g NH3 /cow /day

max: 110 g NH3 /cow /day

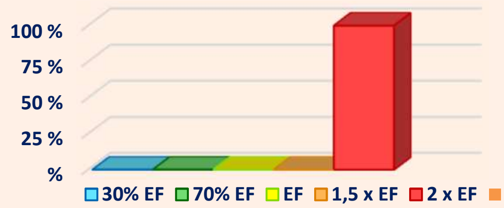
n: 8 emissions

min	max	min	max	min	max	min	max	min
0	4	4	15	15	45	45	101	101

► *kg CH4 /cow /day (kg CH4 /cow /day)*



Reference emission factor: EF = 0,38 kg CH4 /cow /day



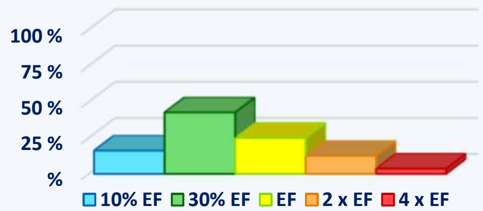
min: 0,7 kg CH4 /cow /day

max: 1 kg CH4 /cow /day

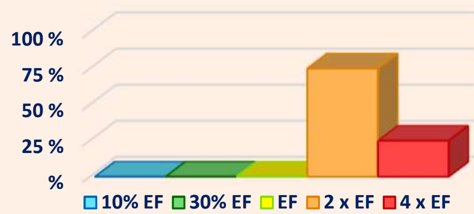
n: 8 emissions

min	max	min	max	min	max	min	max	min
0,00	0,19	0,19	0,30	0,30	0,45	0,45	0,65	0,65

► *Nitrous oxide emissions (g N2O /cow /day)*



Reference emission factor: EF = 1,8 g N2O /cow /day



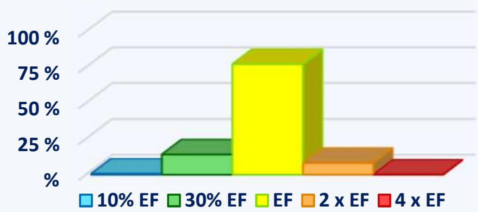
min: 3 g N2O /cow /day

max: 15 g N2O /cow /day

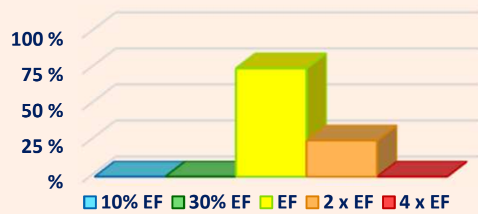
n: 8 emissions

min	max	min	max	min	max	min	max	min
0,00	0,23	0,23	0,91	0,91	2,73	2,73	6,14	6,14

► *GHG emissions (kg eq CO2 /L milk)*



Reference emission factor: EF = 0,40 kg eq CO2 /L milk



min: 0,4 kg eq CO2 /L milk

max: 0,7 kg eq CO2 /L milk

min	max	min	max	min	max	min	max	min
0,00	0,05	0,05	0,20	0,20	0,61	0,61	1,36	1,36

Farm 9 (Netherlands)

Survey of housing emissions (2021 - 2023)

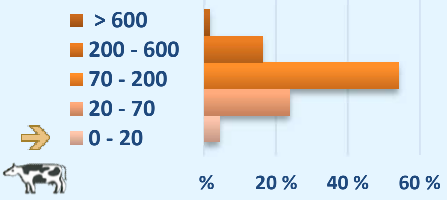
WR

Farm visited by Paul Galama (2021)

My farm vs the diversity of visited dairy units in all countries

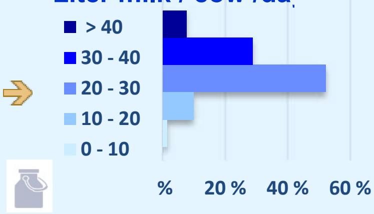
Tier	2b	2a	1	not used	total (3 gases)
nb obs.	12	0	0	0	12

lactating cows / house



16 cows

Liter milk / cow /day

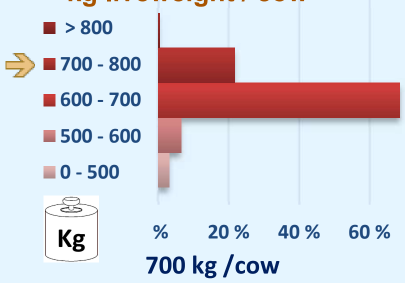


28 L milk /cow /day

The monitored dairy cows

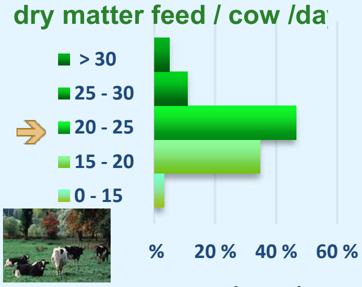
Farm 9

kg liveweight / cow



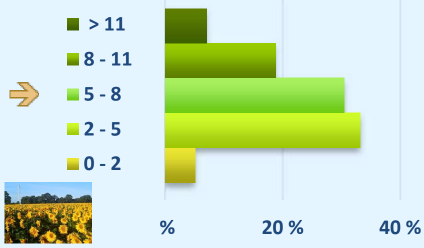
700 kg /cow

dry matter feed / cow /day



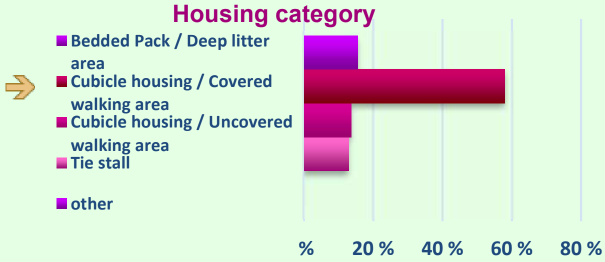
22 kg dry feed /cow /day

concentrate feed

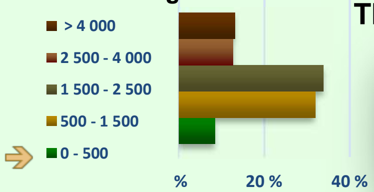


6 kg concentrate /cow /day

Housing category



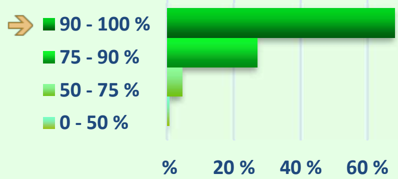
housing area



194,4 m² /house

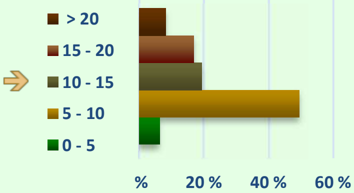
The monitored house

feed lactating cows (% feed all animals)



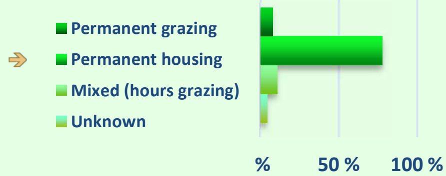
100 % total house

cow area

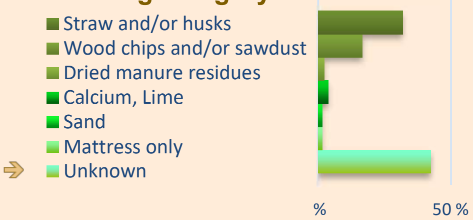


12,2 m² /lactating cow

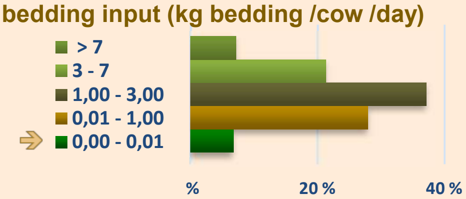
grazing option



bedding category



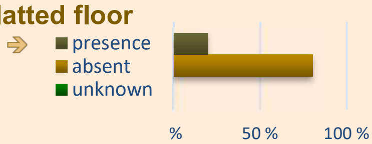
bedding input (kg bedding /cow /day)



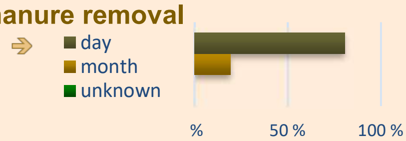
0 kg bedding /cow /day

The manure management

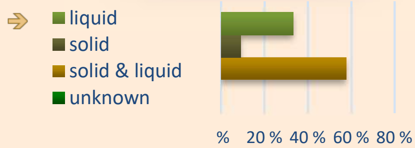
slatted floor



manure removal



Manure output



farming

Farm 9 (Netherlands) WR

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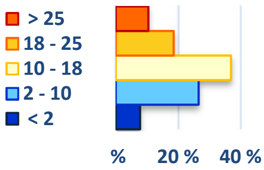
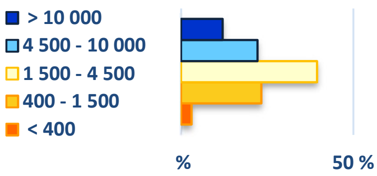
Take-home messages

- Emissions of ammonia and nitrous oxide are similar to the population;
- Manure management could be tuned to decrease the occurrence of methane (or ammonia) emissions higher than the emission factor

Outdoor temperature (°C)



Ventilation (m3 /hour /cow)



Observed emissions

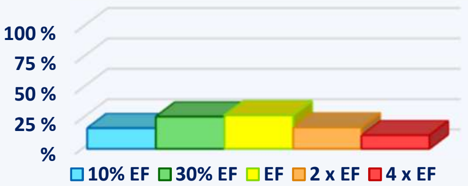
Observations in all countries

Observations in my farm

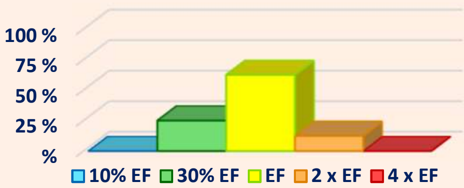
Outdoor temperature 17 - 18 °C

Ventilation 850 - 2600 m3 /hour /cow

► *Ammonia emissions (g NH3 /cow /day)*



Reference emission factor: EF = 30 g NH3 /cow /day



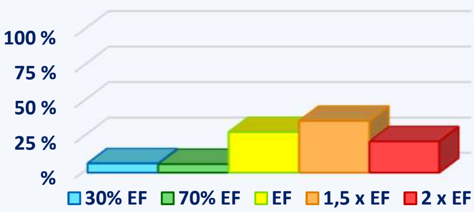
min: 10 g NH3 /cow /day

max: 50 g NH3 /cow /day

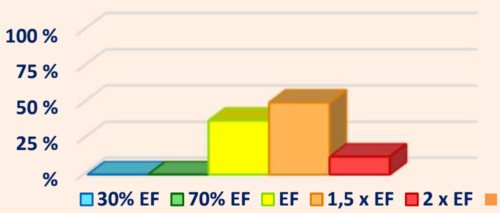
n: 8 emissions

min	max	min	max	min	max	min	max	min
0	4	4	15	15	45	45	101	101

► *kg CH4 /cow /day (kg CH4 /cow /day)*



Reference emission factor: EF = 0,38 kg CH4 /cow /day



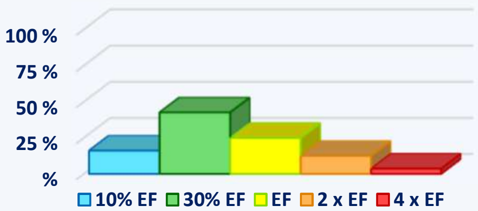
min: 0,3 kg CH4 /cow /day

max: 0,7 kg CH4 /cow /day

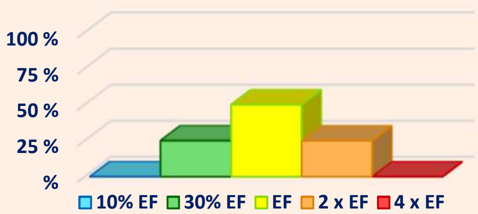
n: 8 emissions

min	max	min	max	min	max	min	max	min
0,00	0,19	0,19	0,30	0,30	0,45	0,45	0,65	0,65

► *Nitrous oxide emissions (g N2O /cow /day)*



Reference emission factor: EF = 1,8 g N2O /cow /day



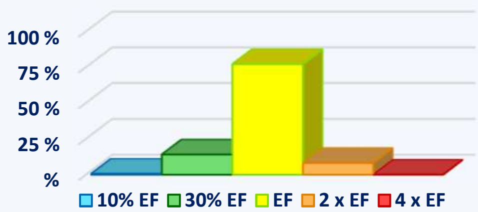
min: 0,4 g N2O /cow /day

max: 4 g N2O /cow /day

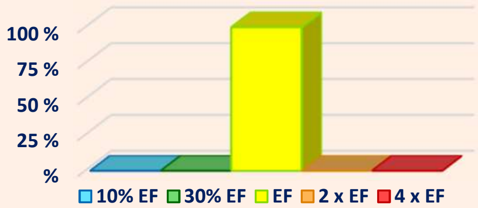
n: 8 emissions

min	max	min	max	min	max	min	max	min
0,00	0,23	0,23	0,91	0,91	2,73	2,73	6,14	6,14

► *GHG emissions (kg eq CO2 /L milk)*



Reference emission factor: EF = 0,40 kg eq CO2 /L milk



min: 0,3 kg eq CO2 /L milk

max: 0,5 kg eq CO2 /L milk

min	max	min	max	min	max	min	max	min
0,00	0,05	0,05	0,20	0,20	0,61	0,61	1,36	1,36

Farm 1 (Poland)

Survey of housing emissions
(2021 - 2023)

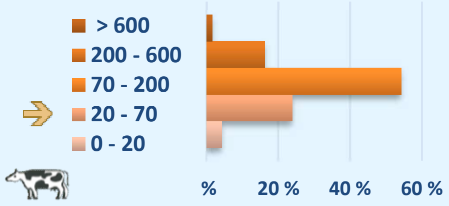
PULS

Farm visited by Adam Cieślak (2021 - 2022)

My farm vs the diversity of visited dairy units in all countries

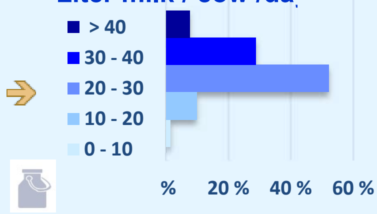
Tier	2b	2a	1	not used	total (3 gases)
nb obs.	2	2	2	6	12

lactating cows / house



55 - 57 cows

Liter milk / cow /day

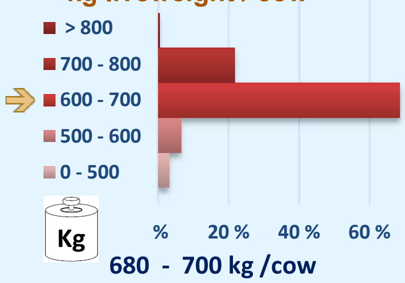


30 L milk /cow /day

The monitored dairy cows

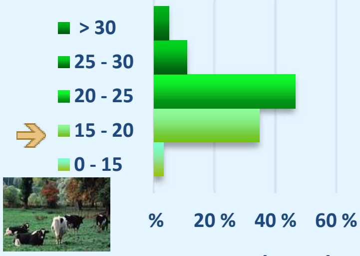
Farm 1

kg liveweight / cow



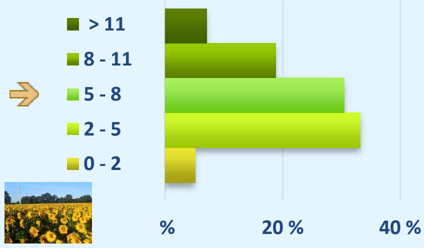
680 - 700 kg /cow

dry matter feed / cow /day



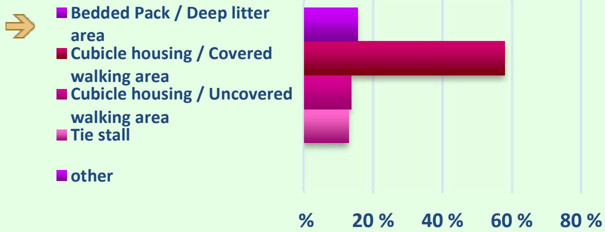
19 - 21 kg dry feed /cow /day

concentrate feed

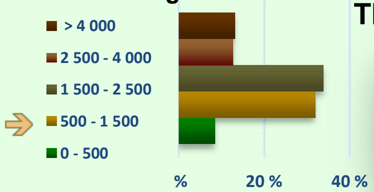


5 - 6 kg concentrate /cow /day

Housing category



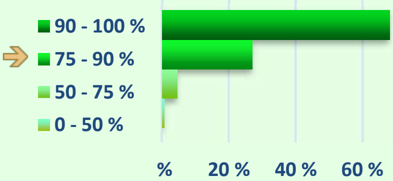
housing area



767 m² /house

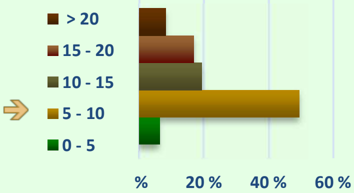
The monitored house

feed lactating cows (% feed all animals)



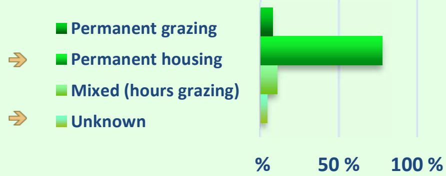
87 - 91 % total house

cow area

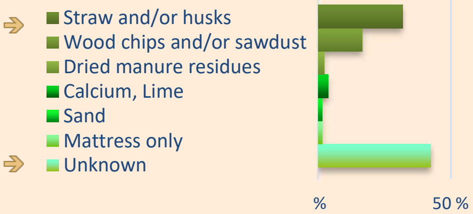


7,9 - 8,2 m² /lactating cow

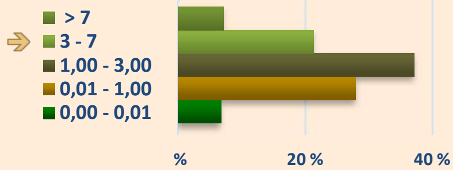
grazing option



bedding category



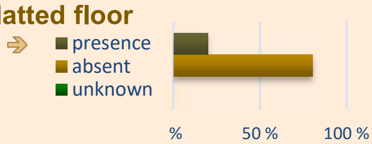
bedding input (kg bedding /cow /day)



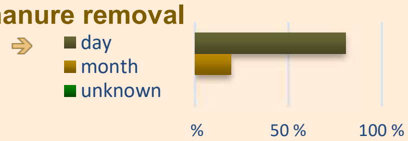
6,0 kg bedding /cow /day

The manure management

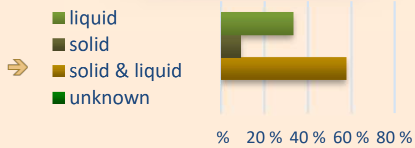
slatted floor



manure removal



Manure output



farming

Farm 1 (Poland) PULS

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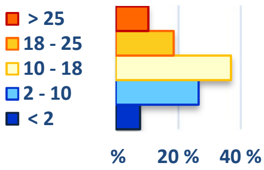
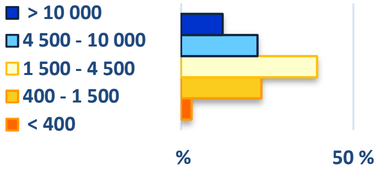
Take-home messages

- Emissions of ammonia and nitrous oxide are similar to the population;
- Manure management could be tuned to decrease the occurrence of methane (or ammonia) emissions higher than the emission factor

Outdoor temperature (°C)



Ventilation (m3 /hour /cow)



Observed emissions

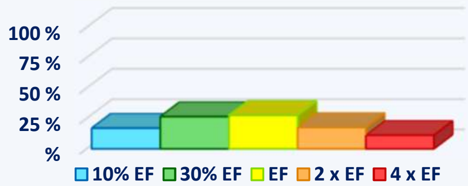
Observations in all countries

Observations in my farm

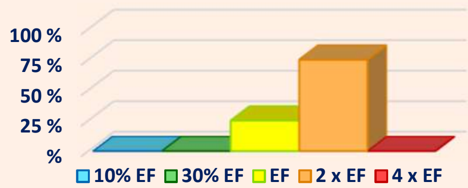
Outdoor temperature -0,6 - 29 °C

Ventilation 1 700 - 4500 m3 /hour /cow

► ***Ammonia emissions (g NH3 /cow /day)***



Reference emission factor: EF = 30 g NH3 /cow /day



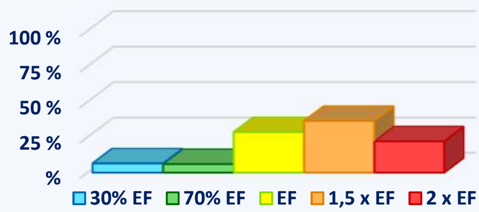
min: 24 g NH3 /cow /day

max: 93 g NH3 /cow /day

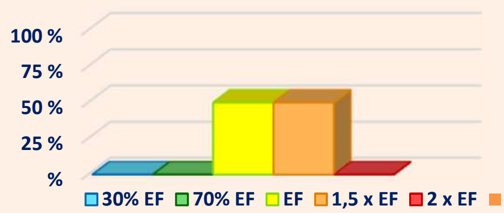
n: 4 emissions

min	max	min	max	min	max	min	max	min
0	4	4	15	15	45	45	101	101

► ***kg CH4 /cow /day (kg CH4 /cow /day)***



Reference emission factor: EF = 0,38 kg CH4 /cow /day



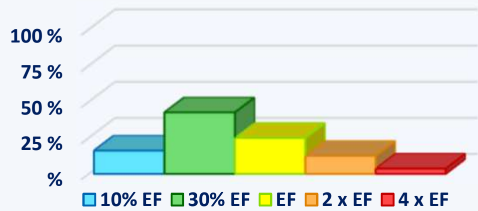
min: 0,4 kg CH4 /cow /day

max: 0,6 kg CH4 /cow /day

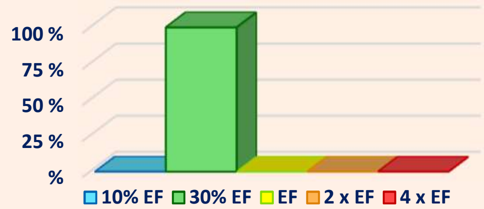
n: 4 emissions

min	max	min	max	min	max	min	max	min
0,00	0,19	0,19	0,30	0,30	0,45	0,45	0,65	0,65

► ***Nitrous oxide emissions (g N2O /cow /day)***



Reference emission factor: EF = 1,8 g N2O /cow /day



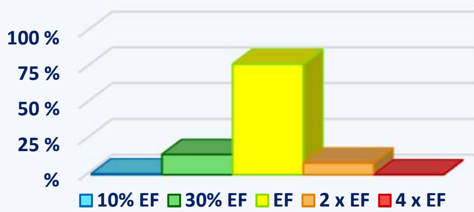
min: 0,3 g N2O /cow /day

max: 0,5 g N2O /cow /day

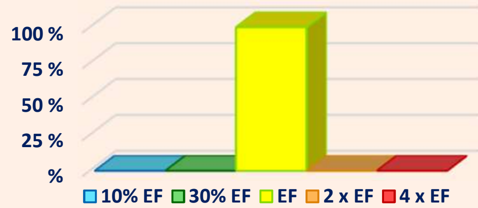
n: 4 emissions

min	max	min	max	min	max	min	max	min
0,00	0,23	0,23	0,91	0,91	2,73	2,73	6,14	6,14

► ***GHG emissions (kg eq CO2 /L milk)***



Reference emission factor: EF = 0,40 kg eq CO2 /L milk



min: 0,3 kg eq CO2 /L milk

max: 0,5 kg eq CO2 /L milk

min	max	min	max	min	max	min	max	min
0,00	0,05	0,05	0,20	0,20	0,61	0,61	1,36	1,36

Farm 2 (Poland)

Survey of housing emissions (2021 - 2023)

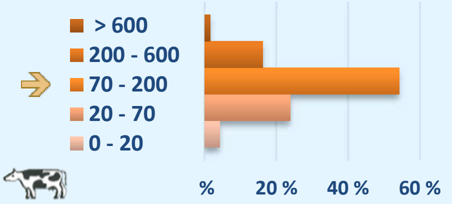
PULS

Farm visited by Adam Cieślak (2021 - 2022)

My farm vs the diversity of visited dairy units in all countries

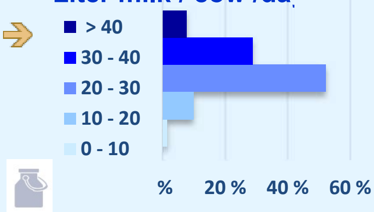
Tier	2b	2a	1	not used	total (3 gases)
nb obs.	4	5	3	0	12

lactating cows / house



87 - 130 cows

Liter milk / cow /day

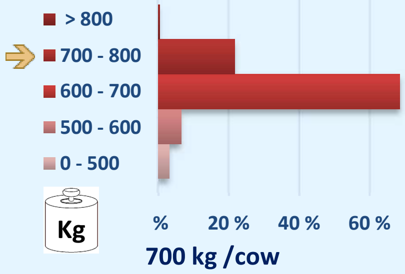


56 L milk /cow /day

The monitored dairy cows

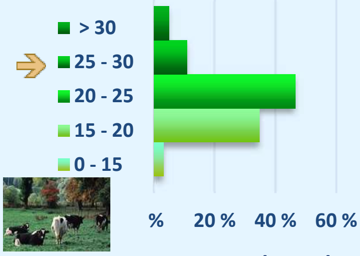
Farm 2

kg liveweight / cow



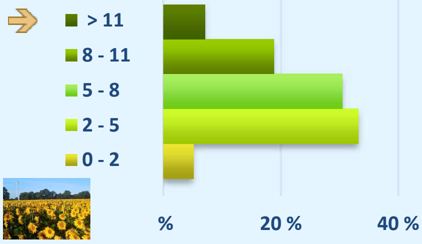
700 kg /cow

dry matter feed / cow /day



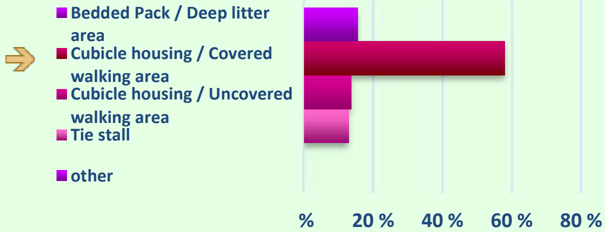
27 - 27 kg dry feed /cow /day

concentrate feed

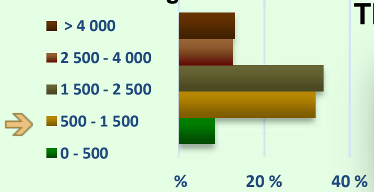


12 - 12 kg concentrate /cow /day

Housing category



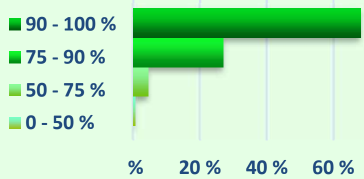
housing area



1098 m² /house

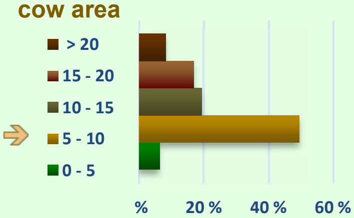
The monitored house

feed lactating cows (% feed all animals)



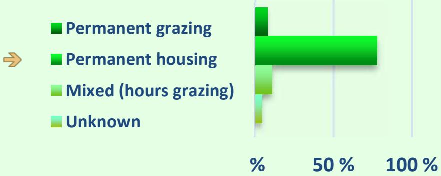
(no data)

cow area

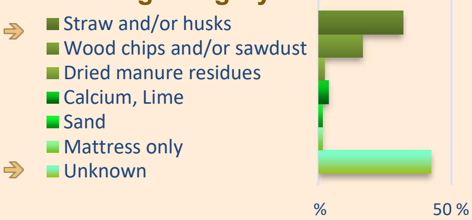


5,4 - 8,1 m² /lactating cow

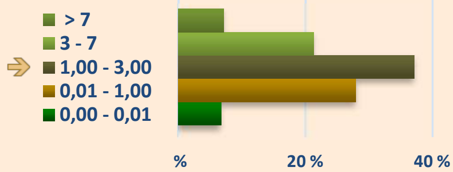
grazing option



bedding category



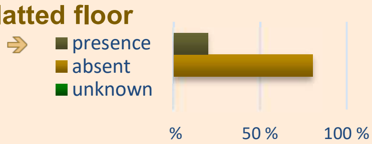
bedding input (kg bedding /cow /day)



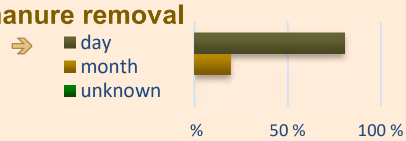
1,8 - 2,0 kg bedding /cow /day

The manure management

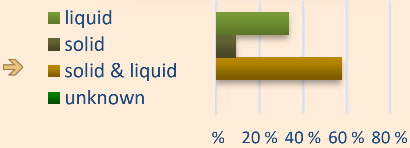
slatted floor



manure removal



Manure output

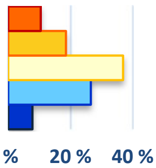


Farm 2 (Poland) PULS

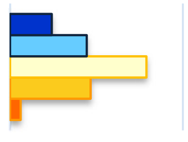
Take-home messages

- Emissions of ammonia and nitrous oxide are similar to the population;
- Manure management could be tuned to decrease the occurrence of methane (or ammonia) emissions higher than the emission factor

Outdoor temperature (°C)



Ventilation (m3 /hour /cow)



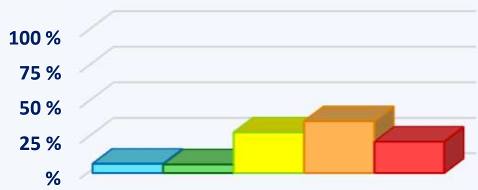
Observed emissions

Observations in all countries

► Ammonia emissions (g NH_3 /cow /day)

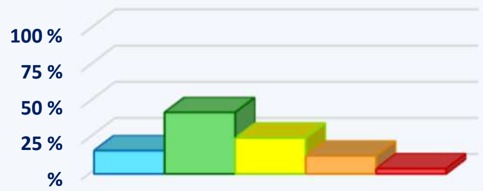
Reference emission factor: EF = 30 g NH_3 /cow /day

► kg CH_4 /cow /day (kg CH_4 /cow /day)



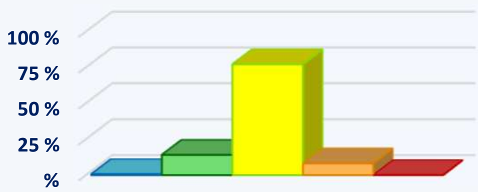
Reference emission factor: EF = 0,38 kg CH_4 /cow /day

► Nitrous oxide emissions (g N_2O /cow /day)



Reference emission factor: EF = 1,8 g N_2O /cow /day

► GHG emissions (kg eq CO_2 /L milk)

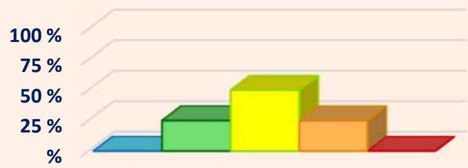


Reference emission factor: EF = 0,40 kg eq CO_2 /L milk

Observations in my farm

Outdoor temperature -1,3 - 33 °C

Ventilation 1 000 - 6600 m3 /hour /cow

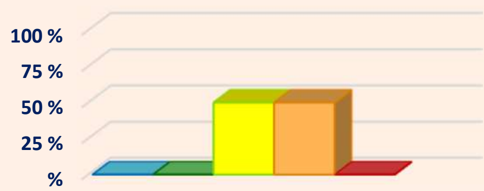


min: 8 g NH_3 /cow /day

max: 55 g NH_3 /cow /day

n: 8 emissions

min	max	min	max	min	max	min	max	min
0	4	4	15	15	45	45	101	101

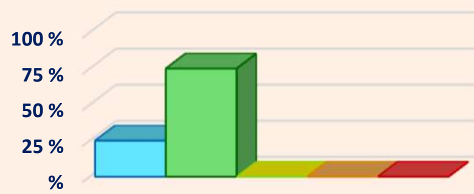


min: 0,3 kg CH_4 /cow /day

max: 0,6 kg CH_4 /cow /day

n: 8 emissions

min	max	min	max	min	max	min	max	min
0,00	0,19	0,19	0,30	0,30	0,45	0,45	0,65	0,65

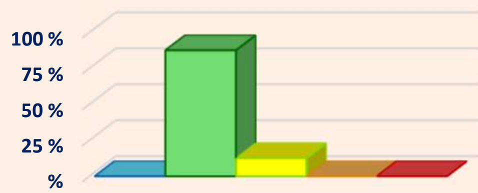


min: 0,2 g N_2O /cow /day

max: 0,8 g N_2O /cow /day

n: 8 emissions

min	max	min	max	min	max	min	max	min
0,00	0,23	0,23	0,91	0,91	2,73	2,73	6,14	6,14



min: 0,1 kg eq CO_2 /L milk

max: 0,2 kg eq CO_2 /L milk

min	max	min	max	min	max	min	max	min
0,00	0,05	0,05	0,20	0,20	0,61	0,61	1,36	1,36

Farm 3 (Poland)

Survey of housing emissions (2021 - 2023)

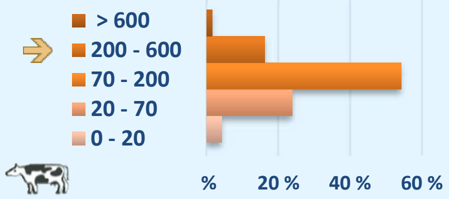
PULS

Farm visited by Adam Cieślak (2021 - 2022)

My farm vs the diversity of visited dairy units in all countries

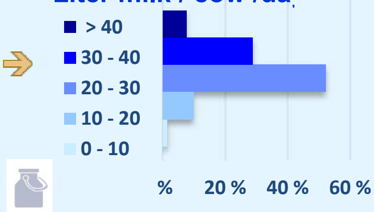
Tier	2b	2a	1	not used	total (3 gases)
nb obs.	0	12	0	0	12

lactating cows / house



143 - 235 cows

Liter milk / cow /day

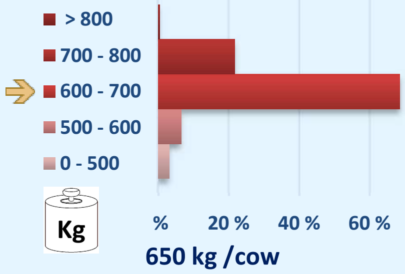


39 L milk /cow /day

The monitored dairy cows

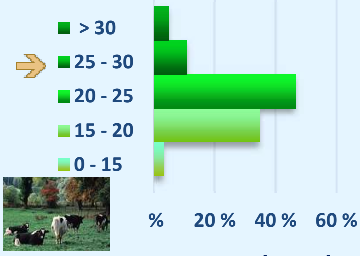
Farm 3

kg liveweight / cow



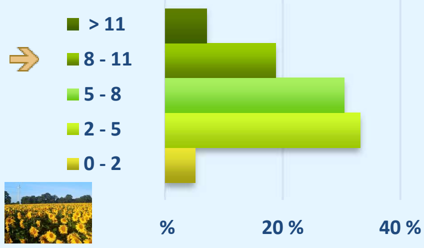
650 kg /cow

dry matter feed / cow /day



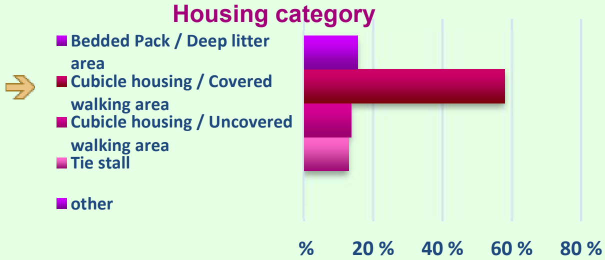
25 - 28 kg dry feed /cow /day

concentrate feed

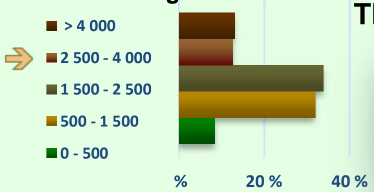


10 - 12 kg concentrate /cow /day

Housing category



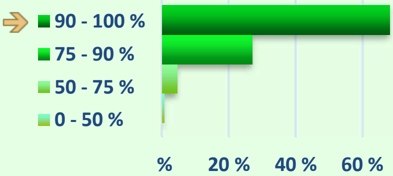
housing area



2491 - 4522 m² /house

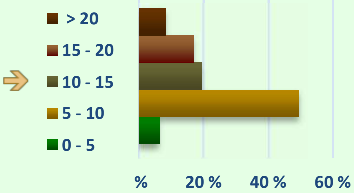
The monitored house

feed lactating cows (% feed all animals)



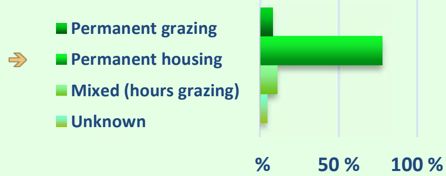
94 - 96 % total house

cow area

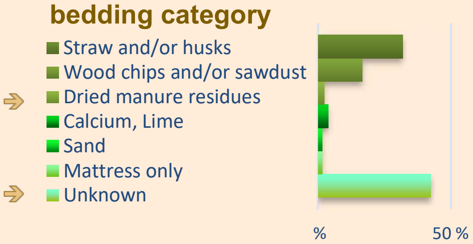


7,2 - 26,0 m² /lactating cow

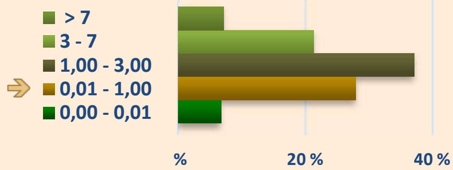
grazing option



bedding category



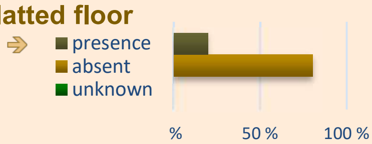
bedding input (kg bedding /cow /day)



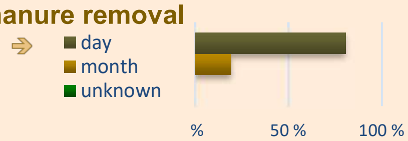
0,3 kg bedding /cow /day

The manure management

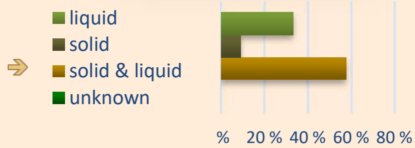
slatted floor



manure removal



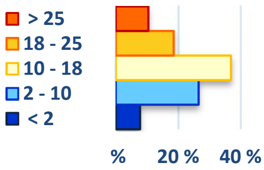
Manure output

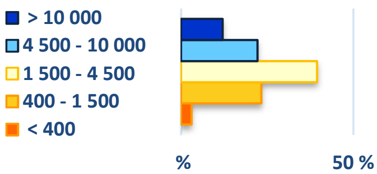


Farm 3 (Poland) PULS

Take-home messages

- Emissions of ammonia and methane higher than the population are occasionally observed;
- Conditions of these high emissions should be identified to decrease there occurrence while maintaining small nitrous oxide emissions





Observed emissions

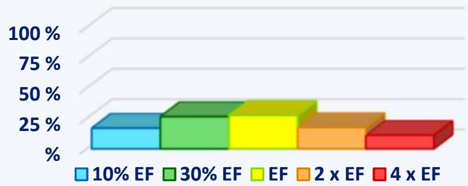
Observations in all countries

Observations in my farm

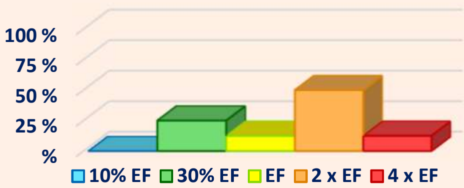
Outdoor temperature 1,3 - 32 °C

Ventilation 1 300 - 9600 m3 /hour /cow

► *Ammonia emissions (g NH3 /cow /day)*



Reference emission factor: EF = 30 g NH3 /cow /day



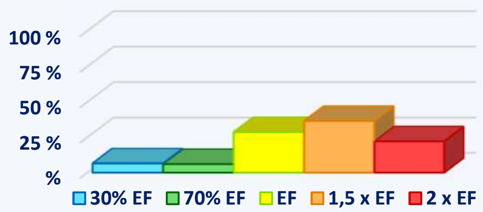
min: 5 g NH3 /cow /day

max: 110 g NH3 /cow /day

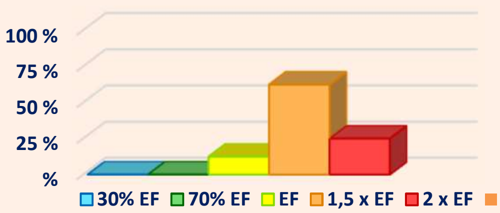
n: 8 emissions

min	max	min	max	min	max	min	max	min
0	4	4	15	15	45	45	101	101

► *kg CH4 /cow /day (kg CH4 /cow /day)*



Reference emission factor: EF = 0,38 kg CH4 /cow /day



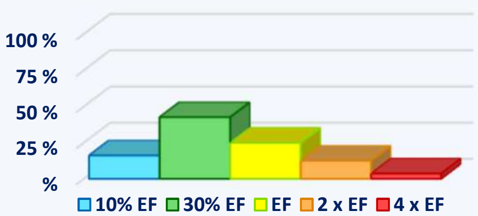
min: 0,4 kg CH4 /cow /day

max: 0,7 kg CH4 /cow /day

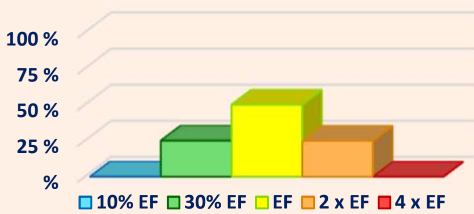
n: 8 emissions

min	max	min	max	min	max	min	max	min
0,00	0,19	0,19	0,30	0,30	0,45	0,45	0,65	0,65

► *Nitrous oxide emissions (g N2O /cow /day)*



Reference emission factor: EF = 1,8 g N2O /cow /day



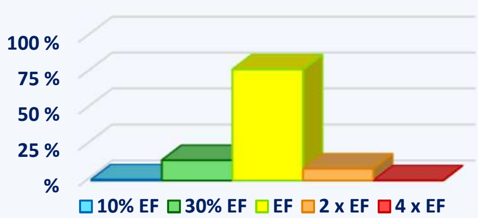
min: 0,8 g N2O /cow /day

max: 6 g N2O /cow /day

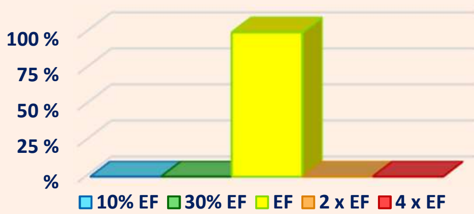
n: 8 emissions

min	max	min	max	min	max	min	max	min
0,00	0,23	0,23	0,91	0,91	2,73	2,73	6,14	6,14

► *GHG emissions (kg eq CO2 /L milk)*



Reference emission factor: EF = 0,40 kg eq CO2 /L milk



min: 0,2 kg eq CO2 /L milk

max: 0,4 kg eq CO2 /L milk

min	max	min	max	min	max	min	max	min
0,00	0,05	0,05	0,20	0,20	0,61	0,61	1,36	1,36

Farm 4 (Poland)

Survey of housing emissions (2021 - 2023)

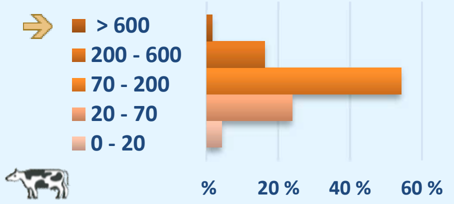
PULS

Farm visited by Adam Cieślak (2021 - 2022)

My farm vs the diversity of visited dairy units in all countries

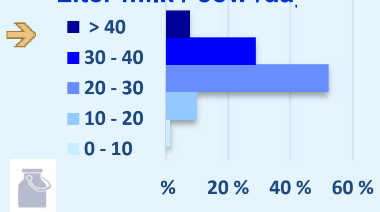
Tier	2b	2a	1	not used	total (3 gases)
nb obs.	7	0	2	3	12

lactating cows / house



970 - 1009 cows

Liter milk / cow /day

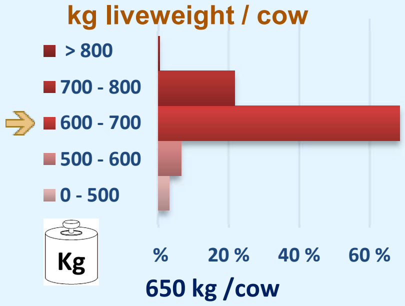


46 L milk /cow /day

The monitored dairy cows

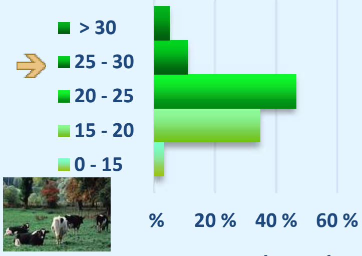
Farm 4

kg liveweight / cow



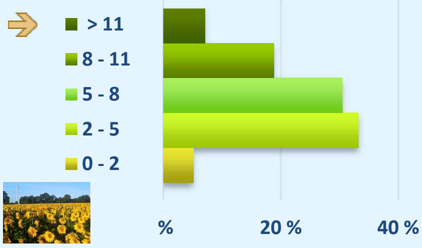
650 kg /cow

dry matter feed / cow /day



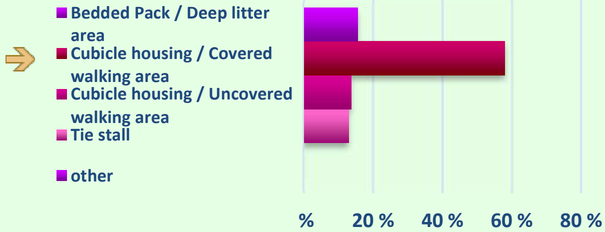
25 - 28 kg dry feed /cow /day

concentrate feed

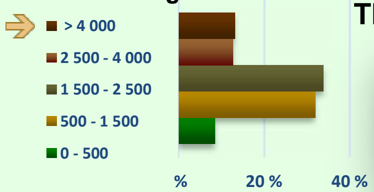


11 - 13 kg concentrate /cow /day

Housing category



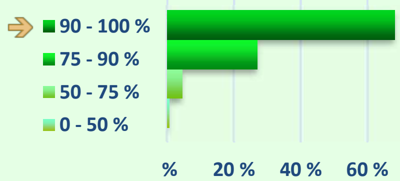
housing area



8248 m² /house

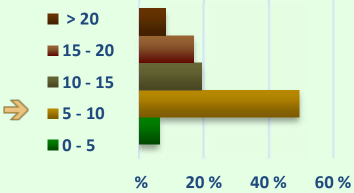
The monitored house

feed lactating cows (% feed all animals)



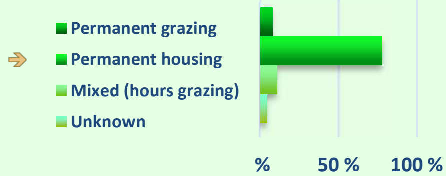
100 % total house

cow area

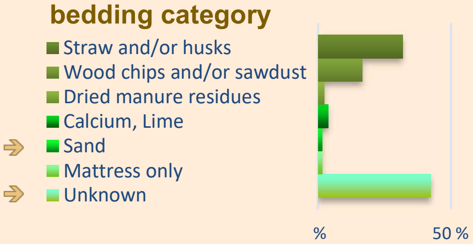


7,1 m² /lactating cow

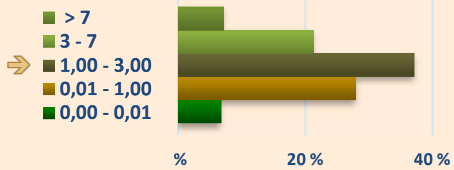
grazing option



bedding category



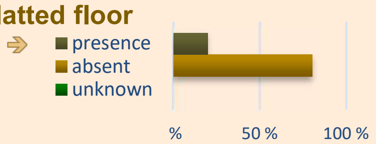
bedding input (kg bedding /cow /day)



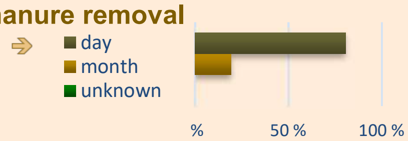
1,0 kg bedding /cow /day

The manure management

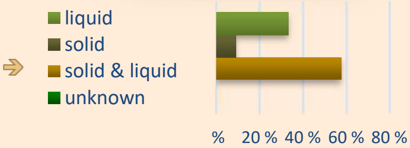
slatted floor



manure removal



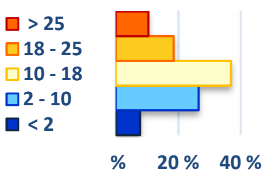
Manure output



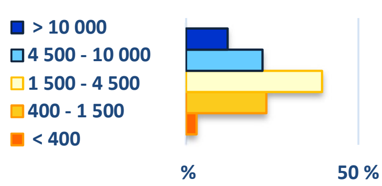
Farm 4 (Poland) PULS

Take-home messages
- Emissions of ammonia are higher than the population;
- Emissions of methane are lower than the population and nitrous oxide emissions similar;
- Manure management could be tuned to decrease ammonia emissions

Outdoor temperature (°C)



Ventilation (m3 /hour /cow)



Observed emissions

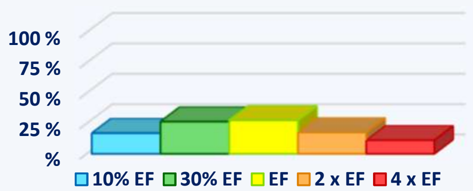
Observations in all countries

Observations in my farm

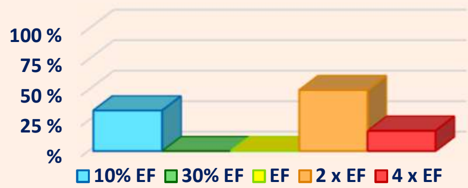
Outdoor temperature 2,3 - 32 °C

Ventilation 1 500 - 6500 m3 /hour /cow

► *Ammonia emissions (g NH_3 /cow /day)*



Reference emission factor: EF = 30 g NH_3 /cow /day



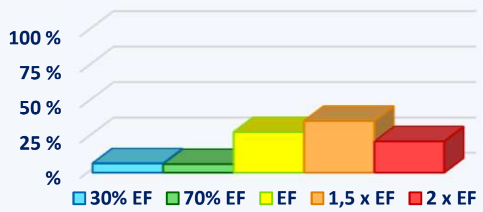
min: 2 g NH_3 /cow /day

max: 130 g NH_3 /cow /day

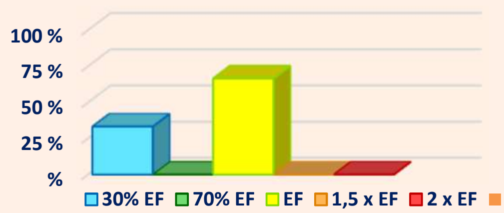
n: 6 emissions

min	max	min	max	min	max	min	max	min
0	4	4	15	15	45	45	101	101

► *kg CH_4 /cow /day (kg CH_4 /cow /day)*



Reference emission factor: EF = 0,38 kg CH_4 /cow /day



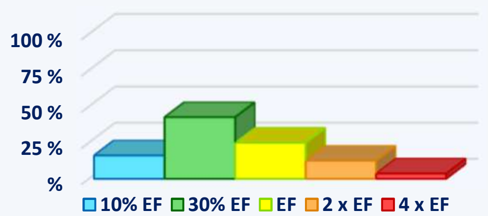
min: 0,1 kg CH_4 /cow /day

max: 0,4 kg CH_4 /cow /day

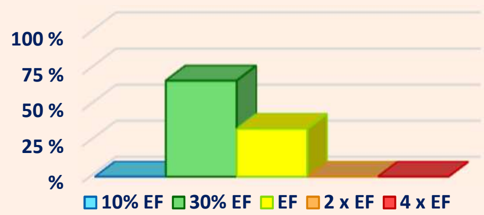
n: 6 emissions

min	max	min	max	min	max	min	max	min
0,00	0,19	0,19	0,30	0,30	0,45	0,45	0,65	0,65

► *Nitrous oxide emissions (g N_2O /cow /day)*



Reference emission factor: EF = 1,8 g N_2O /cow /day



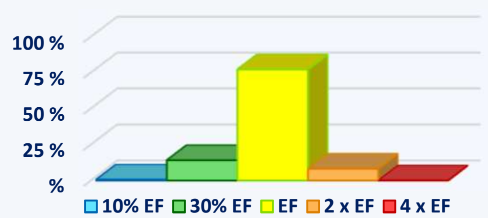
min: 0,3 g N_2O /cow /day

max: 1 g N_2O /cow /day

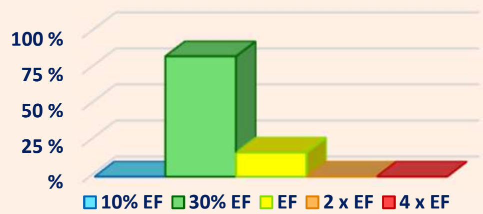
n: 6 emissions

min	max	min	max	min	max	min	max	min
0,00	0,23	0,23	0,91	0,91	2,73	2,73	6,14	6,14

► *GHG emissions (kg eq CO_2 /L milk)*



Reference emission factor: EF = 0,40 kg eq CO_2 /L milk



min: 0,07 kg eq CO_2 /L milk

max: 0,2 kg eq CO_2 /L milk

min	max	min	max	min	max	min	max	min
0,00	0,05	0,05	0,20	0,20	0,61	0,61	1,36	1,36

Farm 5 (Poland)

Survey of housing emissions (2021 - 2023)

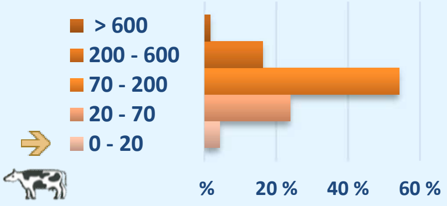
PULS

Farm visited by Adam Cieślak (2021 - 2022)

My farm vs the diversity of visited dairy units in all countries

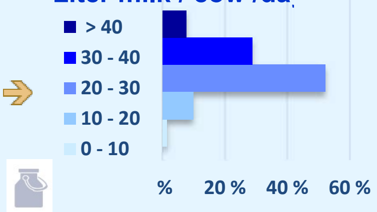
Tier	2b	2a	1	not used	total (3 gases)
nb obs.	6	3	0	3	12

lactating cows / house



11 - 13 cows

Liter milk / cow /day

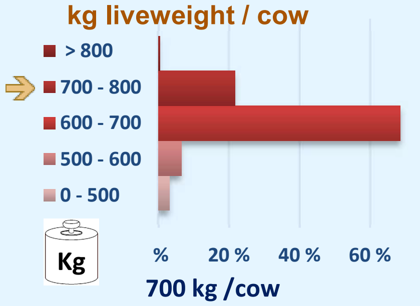


24 L milk /cow /day

The monitored dairy cows

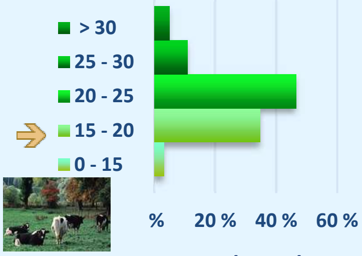
Farm 5

kg liveweight / cow



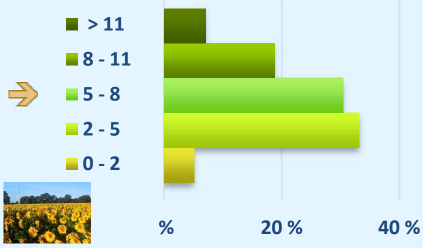
700 kg /cow

dry matter feed / cow /day



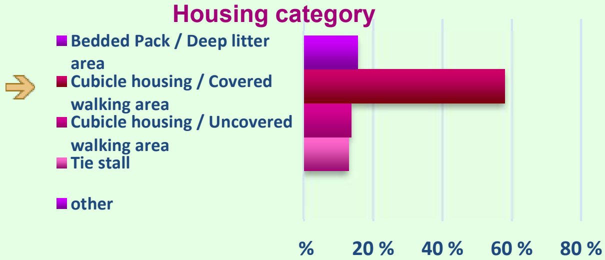
18 kg dry feed /cow /day

concentrate feed

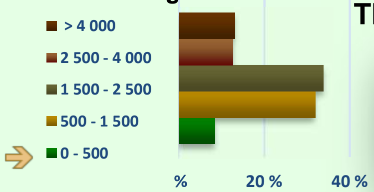


5 kg concentrate /cow /day

Housing category



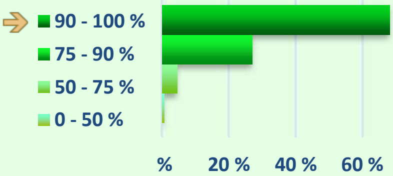
housing area



98 m² /house

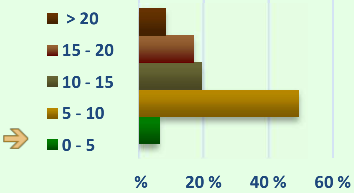
The monitored house

feed lactating cows (% feed all animals)



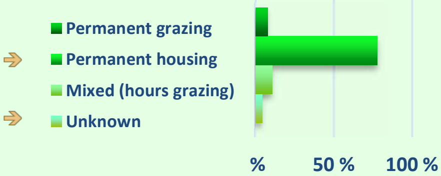
94 % total house

cow area

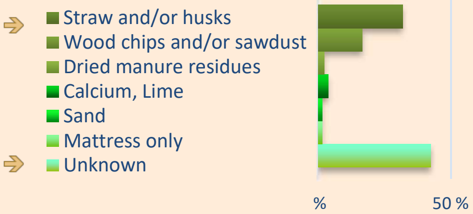


3,5 - 4,1 m² /lactating cow

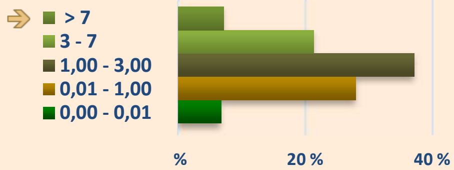
grazing option



bedding category



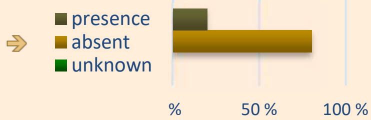
bedding input (kg bedding /cow /day)



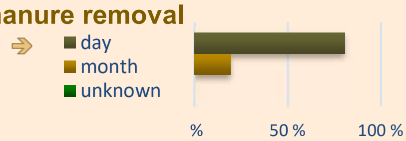
8,0 kg bedding /cow /day

The manure management

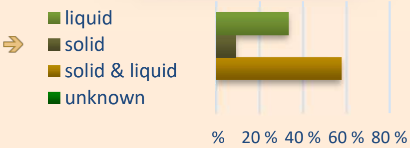
slatted floor



manure removal



Manure output



farming

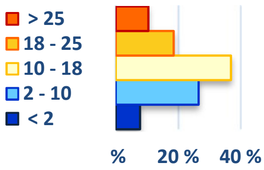
Farm 5 (Poland) PULS

FACCE ERA-GAS ERA-NET SUSAN ICT AGRI era-net

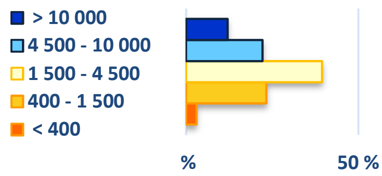
Take-home messages

- Emissions of ammonia and methane higher than the population are occasionally observed;
- Conditions of these high emissions should be identified to decrease there occurrence while maintaining small nitrous oxide emissions

Outdoor temperature (°C)



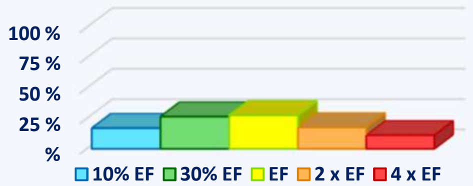
Ventilation (m3 /hour /cow)



Observed emissions

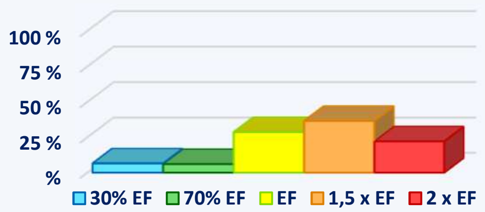
Observations in all countries

► *Ammonia emissions (g NH3 /cow /day)*



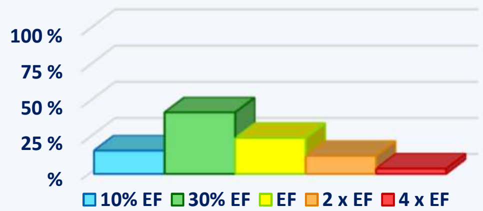
Reference emission factor: EF = 30 g NH3 /cow /day

► *kg CH4 /cow /day (kg CH4 /cow /day)*



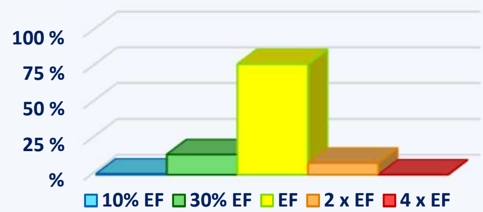
Reference emission factor: EF = 0,38 kg CH4 /cow /day

► *Nitrous oxide emissions (g N2O /cow /day)*



Reference emission factor: EF = 1,8 g N2O /cow /day

► *GHG emissions (kg eq CO2 /L milk)*

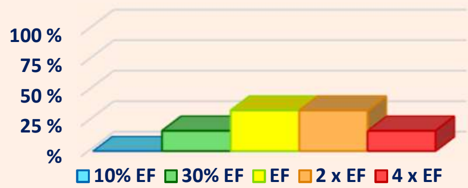


Reference emission factor: EF = 0,40 kg eq CO2 /L milk

Observations in my farm

Outdoor temperature -2,6 - 29 °C

Ventilation 500 - 8900 m3 /hour /cow

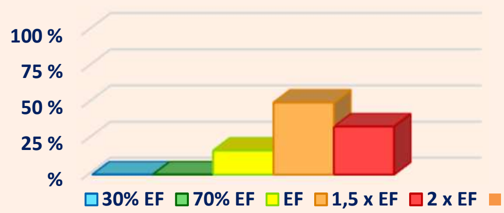


min: 10 g NH3 /cow /day

max: 180 g NH3 /cow /day

n: 6 emissions

min	max	min	max	min	max	min	max	min
0	4	4	15	15	45	45	101	101

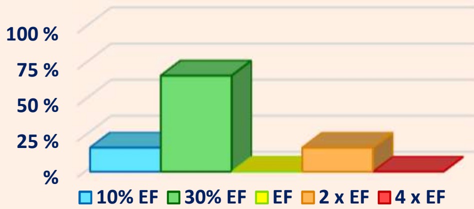


min: 0,4 kg CH4 /cow /day

max: 0,8 kg CH4 /cow /day

n: 6 emissions

min	max	min	max	min	max	min	max	min
0,00	0,19	0,19	0,30	0,30	0,45	0,45	0,65	0,65

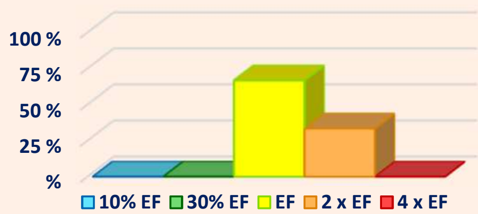


min: 0,08 g N2O /cow /day

max: 3 g N2O /cow /day

n: 6 emissions

min	max	min	max	min	max	min	max	min
0,00	0,23	0,23	0,91	0,91	2,73	2,73	6,14	6,14



min: 0,4 kg eq CO2 /L milk

max: 0,8 kg eq CO2 /L milk

min	max	min	max	min	max	min	max	min
0,00	0,05	0,05	0,20	0,20	0,61	0,61	1,36	1,36

Farm 6 (Poland)

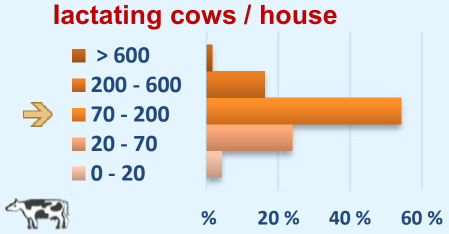
Survey of housing emissions (2021 - 2023)

PULS

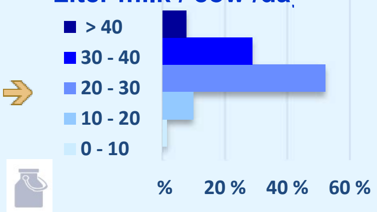
Farm visited by Adam Cieślak (2021 - 2022)

My farm vs the diversity of visited dairy units in all countries

Tier	2b	2a	1	not used	total (3 gases)
nb obs.	3	3	3	3	12



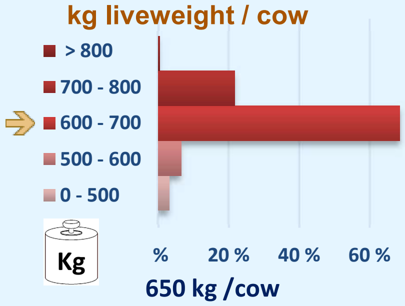
63 - 87 cows



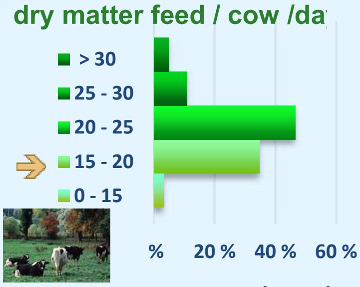
53 L milk /cow /day

The monitored dairy cows

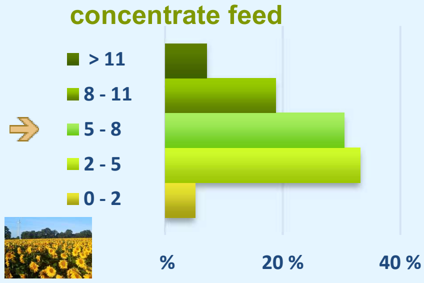
Farm 6



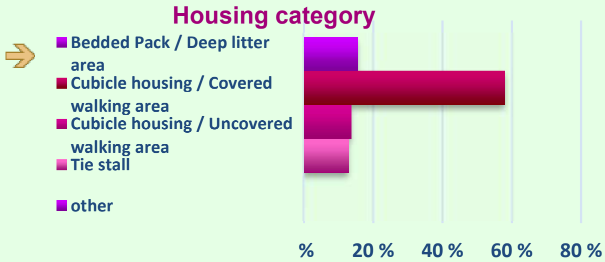
650 kg /cow

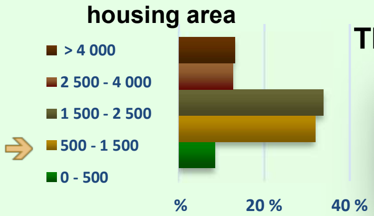


19 - 22 kg dry feed /cow /day



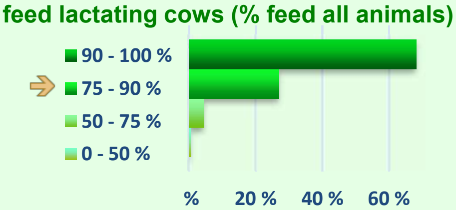
5 - 8 kg concentrate /cow /day



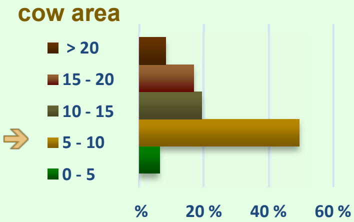


1068 m² /house

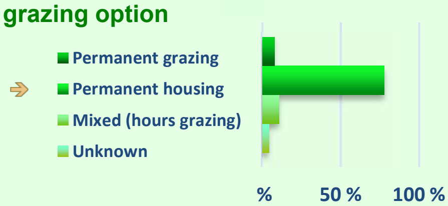
The monitored house

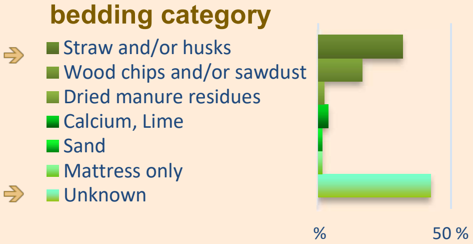


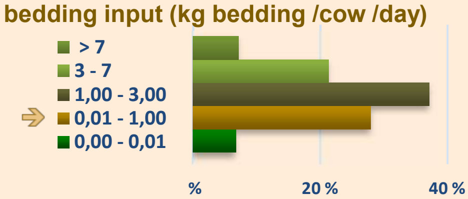
82 - 93 % total house



7,4 - 10,2 m² /lactating cow

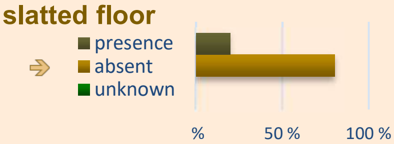


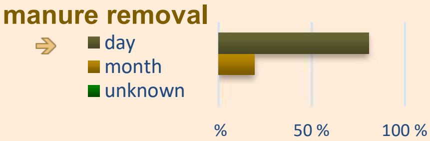


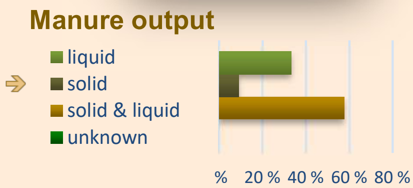


0,9 kg bedding /cow /day

The manure management





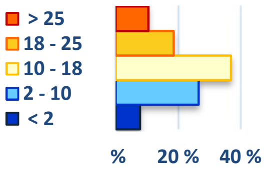


Farm 6 (Poland) PULS

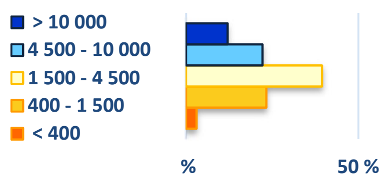
Take-home messages

- Emissions of ammonia and nitrous oxide are similar to the population;
- Methane emissions higher than emission factor can be due to the manure management

Outdoor temperature (°C)



Ventilation (m3 /hour /cow)



Observed emissions

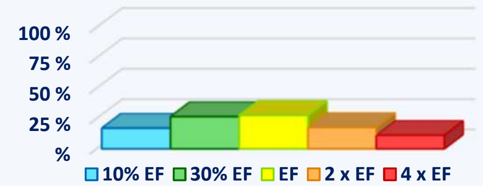
Observations in all countries

Observations in my farm

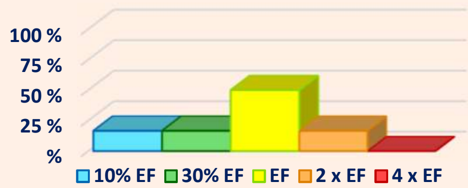
Outdoor temperature -3,2 - 31 °C

Ventilation 300 - 4400 m3 /hour /cow

► *Ammonia emissions (g NH3 /cow /day)*



Reference emission factor: EF = 30 g NH3 /cow /day



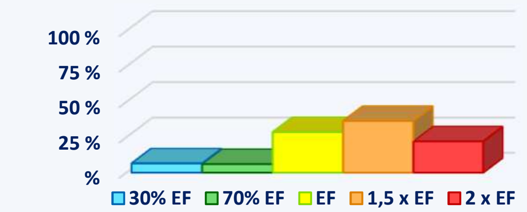
min: 2 g NH3 /cow /day

max: 50 g NH3 /cow /day

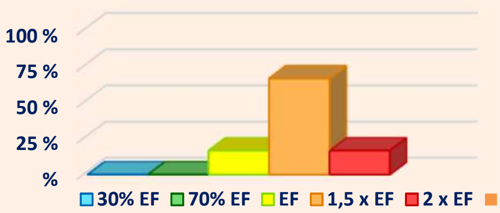
n: 6 emissions

min	max	min	max	min	max	min	max	min
0	4	4	15	15	45	45	101	101

► *kg CH4 /cow /day (kg CH4 /cow /day)*



Reference emission factor: EF = 0,38 kg CH4 /cow /day



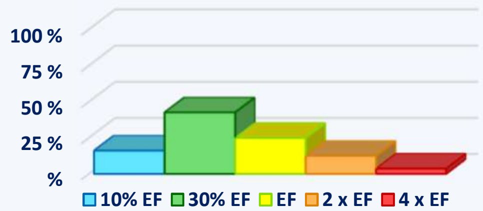
min: 0,4 kg CH4 /cow /day

max: 0,7 kg CH4 /cow /day

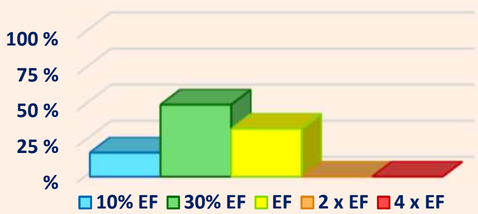
n: 6 emissions

min	max	min	max	min	max	min	max	min
0,00	0,19	0,19	0,30	0,30	0,45	0,45	0,65	0,65

► *Nitrous oxide emissions (g N2O /cow /day)*



Reference emission factor: EF = 1,8 g N2O /cow /day



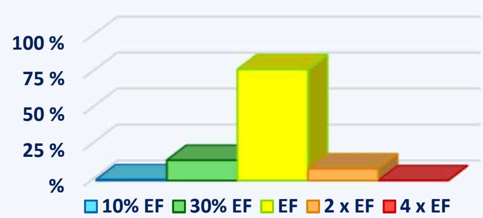
min: 0,2 g N2O /cow /day

max: 1 g N2O /cow /day

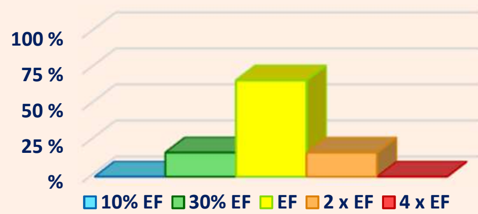
n: 6 emissions

min	max	min	max	min	max	min	max	min
0,00	0,23	0,23	0,91	0,91	2,73	2,73	6,14	6,14

► *GHG emissions (kg eq CO2 /L milk)*



Reference emission factor: EF = 0,40 kg eq CO2 /L milk



min: 0,2 kg eq CO2 /L milk

max: 0,6 kg eq CO2 /L milk

min	max	min	max	min	max	min	max	min
0,00	0,05	0,05	0,20	0,20	0,61	0,61	1,36	1,36

Farm 7 (Poland)

Survey of housing emissions
(2021 - 2023)

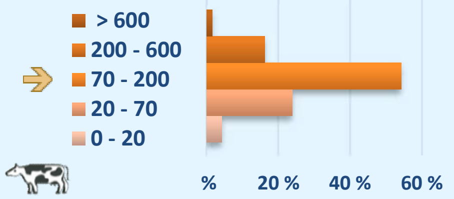
PULS

Farm visited by Adam Cieślak (2021 - 2022)

My farm vs the diversity of visited dairy units in all countries

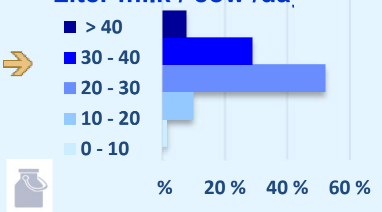
Tier	2b	2a	1	not used	total (3 gases)
nb obs.	5	2	5	0	12

lactating cows / house



104 - 141 cows

Liter milk / cow /day

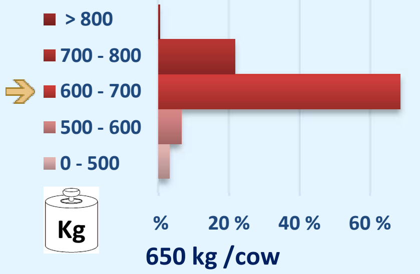


34 L milk /cow /day

The monitored dairy cows

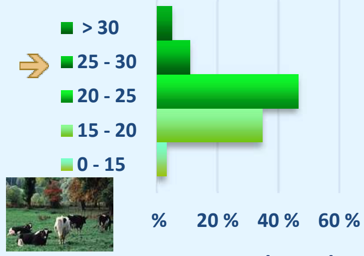
Farm 7

kg liveweight / cow



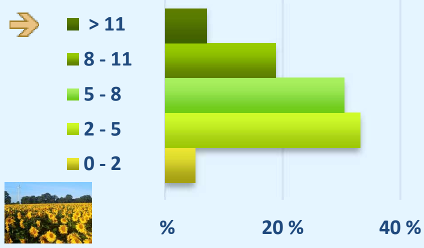
650 kg /cow

dry matter feed / cow /day



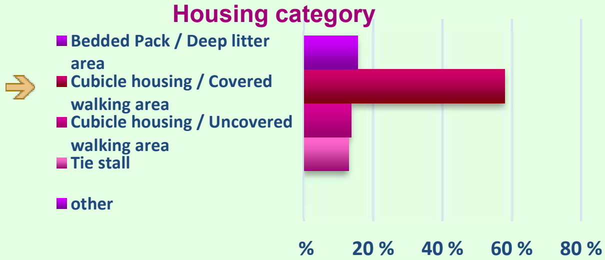
26 - 27 kg dry feed /cow /day

concentrate feed

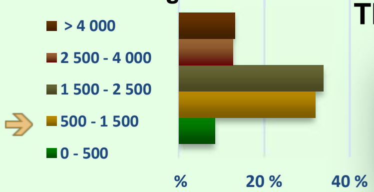


9 - 13 kg concentrate /cow /day

Housing category



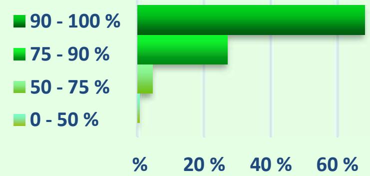
housing area



893 m² /house

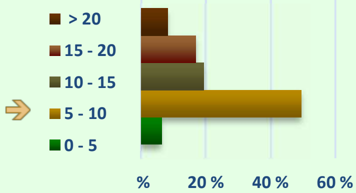
The monitored house

feed lactating cows (% feed all animals)



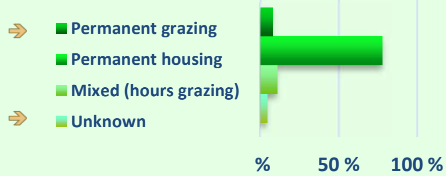
(no data)

cow area



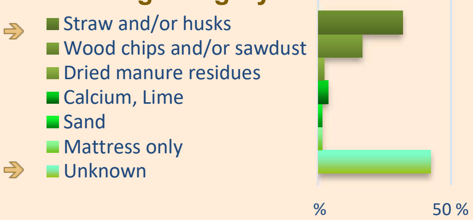
4,8 - 6,5 m² /lactating cow

grazing option

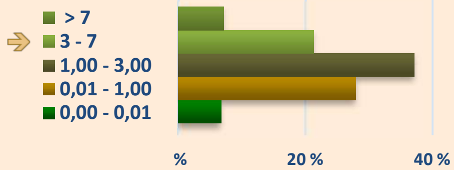


3 - 20 hours grazing /day

bedding category



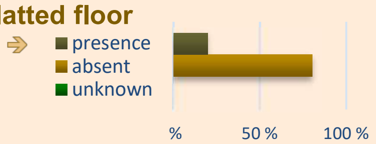
bedding input (kg bedding /cow /day)



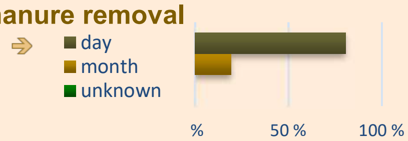
6,4 - 6,6 kg bedding /cow /day

The manure management

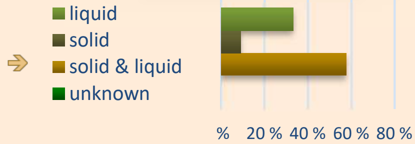
slatted floor



manure removal



Manure output

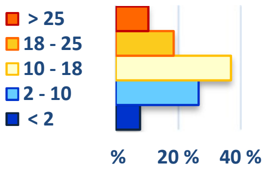


Farm 7 (Poland) PULS

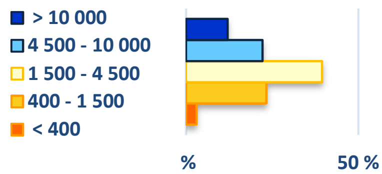
Take-home messages

- Emissions of ammonia and methane higher than the population are occasionally observed;
- Conditions of these high emissions should be identified to decrease there occurrence while maintaining small nitrous oxide emissions

Outdoor temperature (°C)



Ventilation (m3 /hour /cow)



Observed emissions

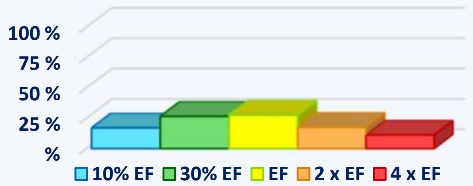
Observations in all countries

Observations in my farm

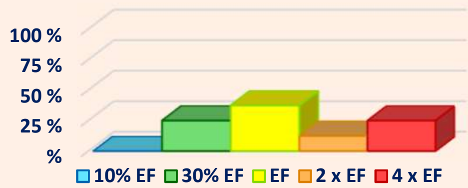
Outdoor temperature 1,7 - 32 °C

Ventilation 650 - 9200 m3 /hour /cow

► *Ammonia emissions (g NH3 /cow /day)*



Reference emission factor: EF = 30 g NH3 /cow /day



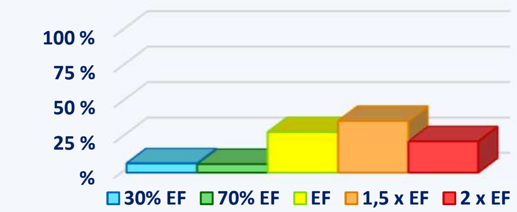
min: 8 g NH3 /cow /day

max: 210 g NH3 /cow /day

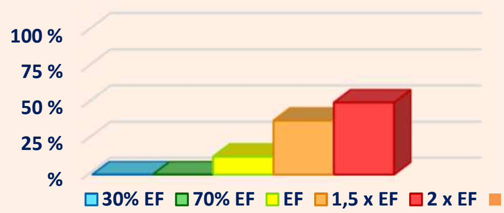
n: 8 emissions

min	max	min	max	min	max	min	max	min
0	4	4	15	15	45	45	101	101

► *kg CH4 /cow /day (kg CH4 /cow /day)*



Reference emission factor: EF = 0,38 kg CH4 /cow /day



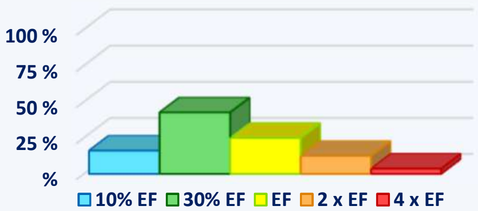
min: 0,3 kg CH4 /cow /day

max: 1,0 kg CH4 /cow /day

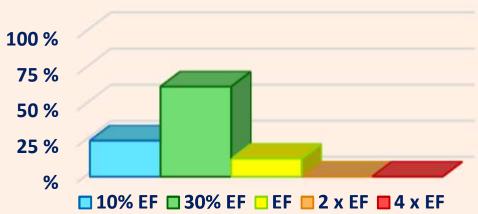
n: 8 emissions

min	max	min	max	min	max	min	max	min
0,00	0,19	0,19	0,30	0,30	0,45	0,45	0,65	0,65

► *Nitrous oxide emissions (g N2O /cow /day)*



Reference emission factor: EF = 1,8 g N2O /cow /day



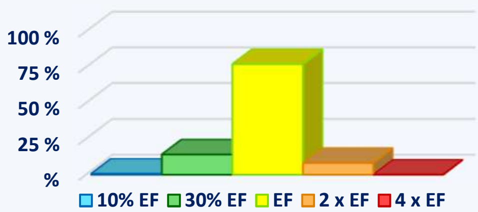
min: 0,08 g N2O /cow /day

max: 1 g N2O /cow /day

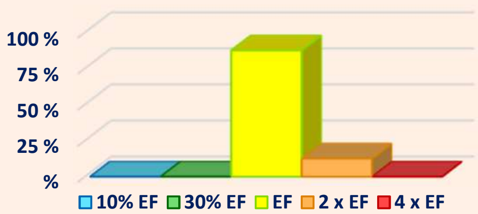
n: 8 emissions

min	max	min	max	min	max	min	max	min
0,00	0,23	0,23	0,91	0,91	2,73	2,73	6,14	6,14

► *GHG emissions (kg eq CO2 /L milk)*



Reference emission factor: EF = 0,40 kg eq CO2 /L milk



min: 0,2 kg eq CO2 /L milk

max: 0,7 kg eq CO2 /L milk

min	max	min	max	min	max	min	max	min
0,00	0,05	0,05	0,20	0,20	0,61	0,61	1,36	1,36

Farm 8 (Poland)

Survey of housing emissions (2021 - 2023)

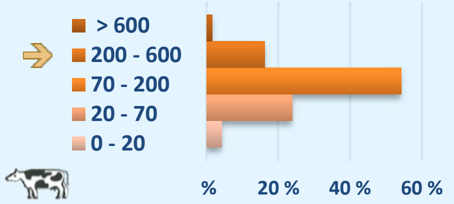
PULS

Farm visited by Adam Cieślak (2021 - 2022)

My farm vs the diversity of visited dairy units in all countries

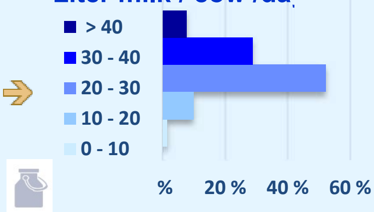
Tier	2b	2a	1	not used	total (3 gases)
nb obs.	3	2	3	4	12

lactating cows / house



196 - 291 cows

Liter milk / cow /day

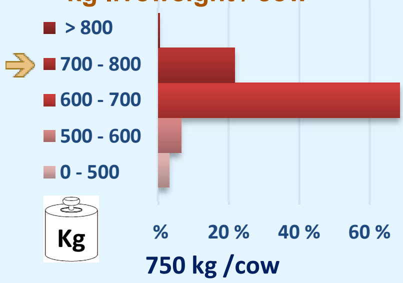


23 L milk /cow /day

The monitored dairy cows

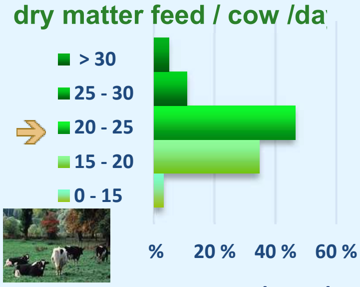
Farm 8

kg liveweight / cow



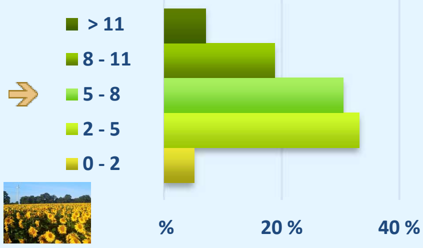
750 kg /cow

dry matter feed / cow /day



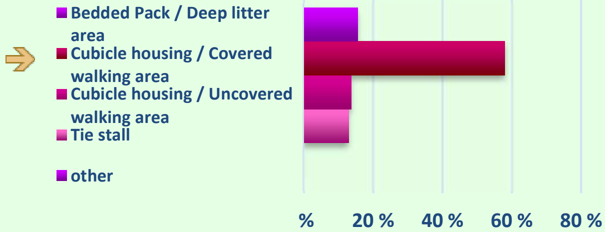
22 - 25 kg dry feed /cow /day

concentrate feed

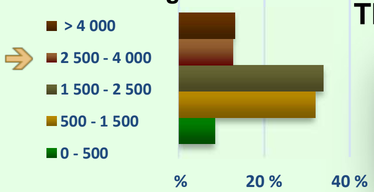


5 - 7 kg concentrate /cow /day

Housing category



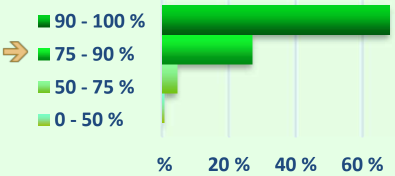
housing area



3732 - 3895 m² /house

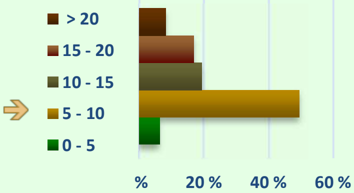
The monitored house

feed lactating cows (% feed all animals)



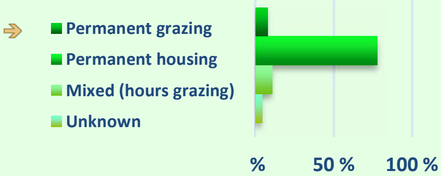
89 - 90 % total house

cow area



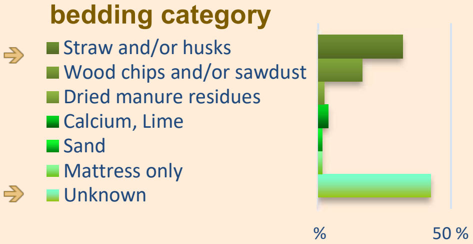
6,7 - 10,0 m² /lactating cow

grazing option

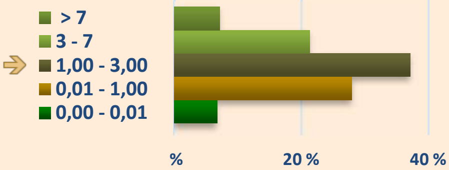


16 - 20 hours grazing /day

bedding category



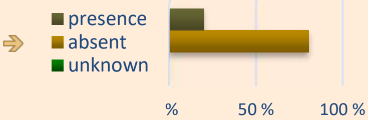
bedding input (kg bedding /cow /day)



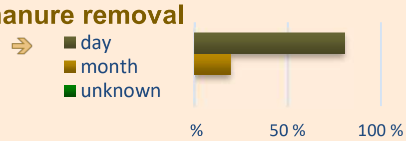
2,0 - 2,4 kg bedding /cow /day

The manure management

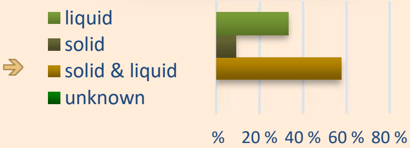
slatted floor



manure removal



Manure output



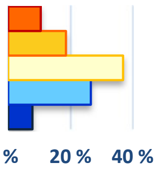
Farm 8 (Poland) PULS

FACCE ERA-GAS · ERA-NET SUSAN · ICT-AGRI era-net

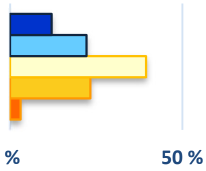
Take-home messages

- Emissions of ammonia and methane higher than the population are occasionally observed;
- Conditions of these high emissions should be identified to decrease there occurrence while maintaining small nitrous oxide emissions

Outdoor temperature (°C)



Ventilation (m3 /hour /cow)



Observed emissions

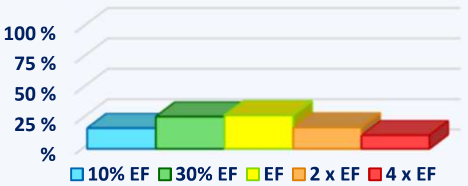
Observations in all countries

Observations in my farm

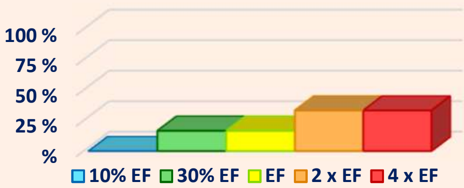
Outdoor temperature 1,1 - 31 °C

Ventilation 2 000 - 9200 m3 /hour /cow

► *Ammonia emissions (g NH3 /cow /day)*



Reference emission factor: EF = 30 g NH3 /cow /day



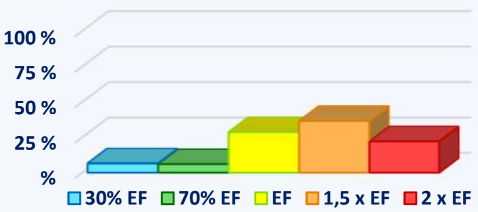
min: 8 g NH3 /cow /day

max: 220 g NH3 /cow /day

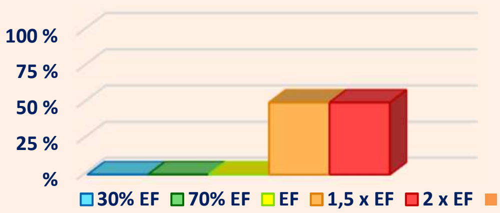
n: 6 emissions

min	max	min	max	min	max	min	max	min
0	4	4	15	15	45	45	101	101

► *kg CH4 /cow /day (kg CH4 /cow /day)*



Reference emission factor: EF = 0,38 kg CH4 /cow /day



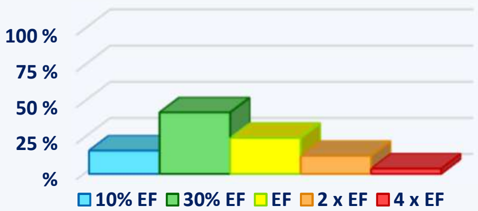
min: 0,5 kg CH4 /cow /day

max: 0,8 kg CH4 /cow /day

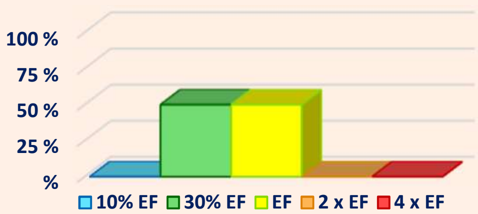
n: 4 emissions

min	max	min	max	min	max	min	max	min
0,00	0,19	0,19	0,30	0,30	0,45	0,45	0,65	0,65

► *Nitrous oxide emissions (g N2O /cow /day)*



Reference emission factor: EF = 1,8 g N2O /cow /day



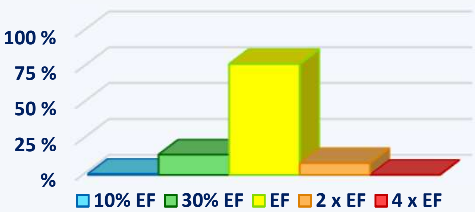
min: 0,3 g N2O /cow /day

max: 1 g N2O /cow /day

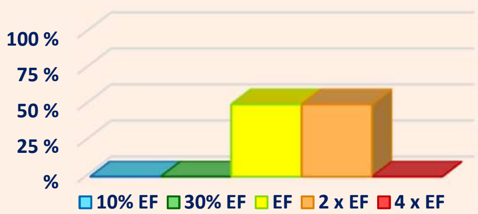
n: 6 emissions

min	max	min	max	min	max	min	max	min
0,00	0,23	0,23	0,91	0,91	2,73	2,73	6,14	6,14

► *GHG emissions (kg eq CO2 /L milk)*



Reference emission factor: EF = 0,40 kg eq CO2 /L milk



min: 0,5 kg eq CO2 /L milk

max: 0,7 kg eq CO2 /L milk

min	max	min	max	min	max	min	max	min
0,00	0,05	0,05	0,20	0,20	0,61	0,61	1,36	1,36

Farm 1 (Scotland)

Survey of housing emissions (2021 - 2023)

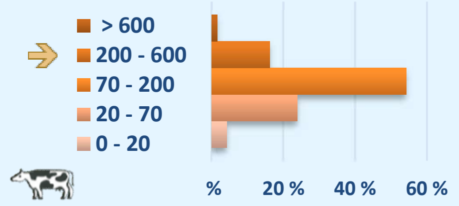
SRUC

Farm visited by Paul Hargreaves (2022)

My farm vs the diversity of visited dairy units in all countries

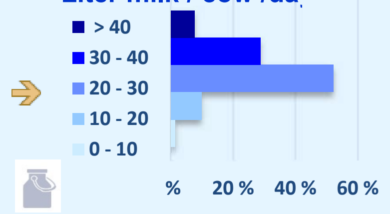
Tier	2b	2a	1	not used	total (3 gases)
nb obs.	10	0	0	2	12

lactating cows / house



207 - 217 cows

Liter milk / cow /day

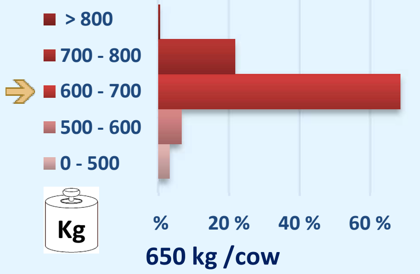


29 L milk /cow /day

The monitored dairy cows

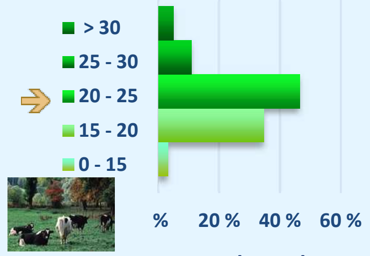
Farm 1

kg liveweight / cow



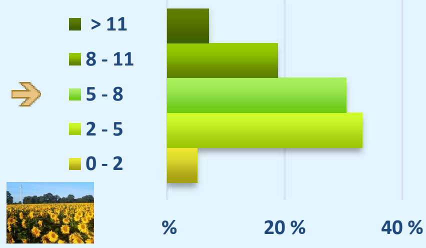
650 kg /cow

dry matter feed / cow /day



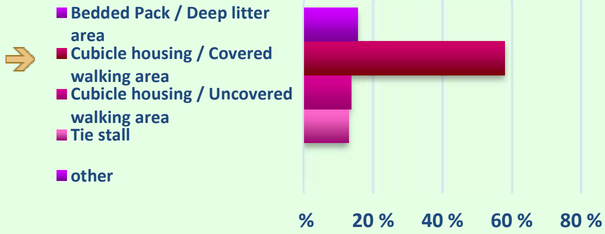
22 kg dry feed /cow /day

concentrate feed

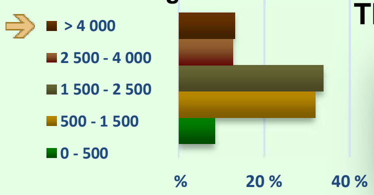


6 kg concentrate /cow /day

Housing category



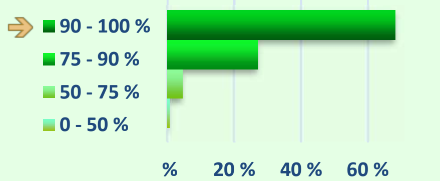
housing area



4655 m² /house

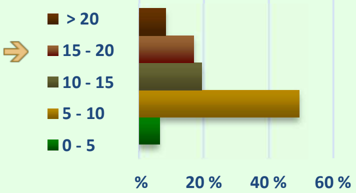
The monitored house

feed lactating cows (% feed all animals)



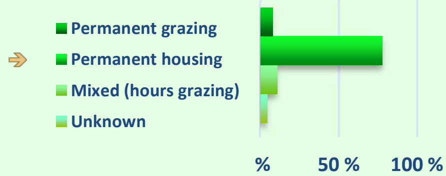
100 % total house

cow area

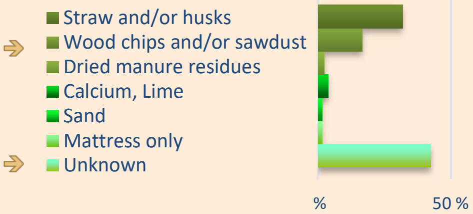


17,9 - 18,7 m² /lactating cow

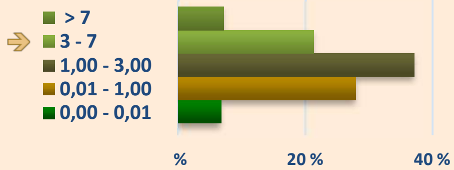
grazing option



bedding category



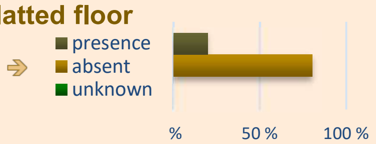
bedding input (kg bedding /cow /day)



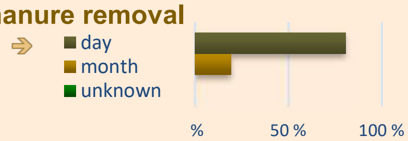
3,0 kg bedding /cow /day

The manure management

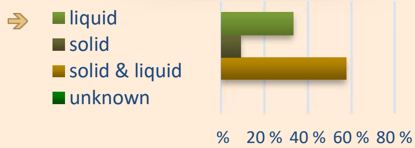
slatted floor



manure removal



Manure output

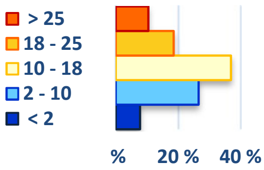


Farm 1 (Scotland) SRUC

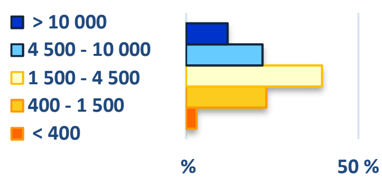
Take-home messages

- Emissions of ammonia and methane higher than the population are occasionally observed;
- Conditions of these high emissions should be identified to decrease there occurrence while maintaining small nitrous oxide emissions

Outdoor temperature (°C)



Ventilation (m3 /hour /cow)



Observed emissions

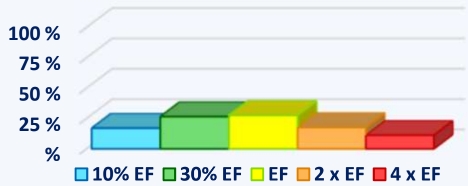
Observations in all countries

Observations

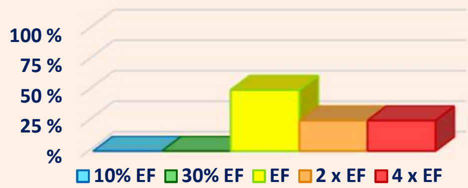
Outdoor temperature 6,6 - 20 °C

Ventilation 910 - 18000 m3 /hour /cow

► ***Ammonia emissions (g NH3 /cow /day)***



Reference emission factor: EF = 30 g NH3 /cow /day



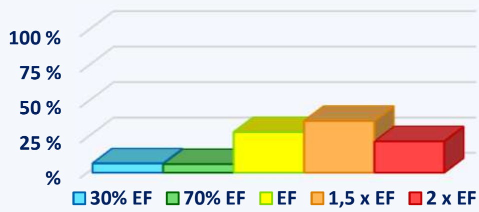
min: 16 g NH3 /cow /day

max: 190 g NH3 /cow /day

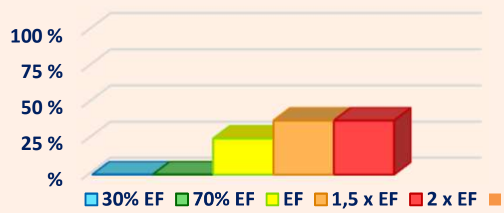
n: 8 emissions

min	max	min	max	min	max	min	max	min
0	4	4	15	15	45	45	101	101

► ***kg CH4 /cow /day (kg CH4 /cow /day)***



Reference emission factor: EF = 0,38 kg CH4 /cow /day



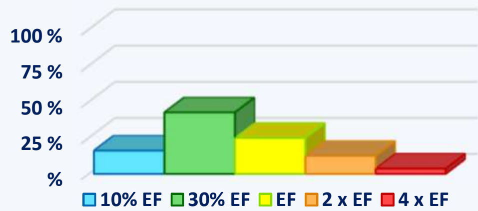
min: 0,3 kg CH4 /cow /day

max: 0,9 kg CH4 /cow /day

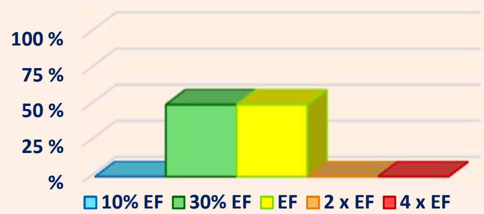
n: 8 emissions

min	max	min	max	min	max	min	max	min
0,00	0,19	0,19	0,30	0,30	0,45	0,45	0,65	0,65

► ***Nitrous oxide emissions (g N2O /cow /day)***



Reference emission factor: EF = 1,8 g N2O /cow /day



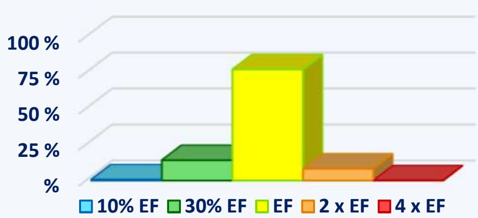
min: 0,2 g N2O /cow /day

max: 1 g N2O /cow /day

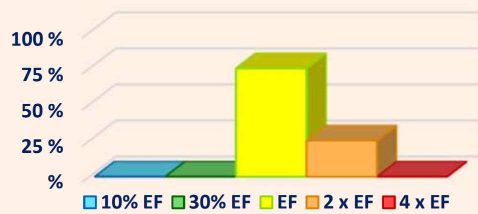
n: 4 emissions

min	max	min	max	min	max	min	max	min
0,00	0,23	0,23	0,91	0,91	2,73	2,73	6,14	6,14

► ***GHG emissions (kg eq CO2 /L milk)***



Reference emission factor: EF = 0,40 kg eq CO2 /L milk



min: 0,2 kg eq CO2 /L milk

max: 0,6 kg eq CO2 /L milk

min	max	min	max	min	max	min	max	min
0,00	0,05	0,05	0,20	0,20	0,61	0,61	1,36	1,36

Farm 2 (Scotland)

Survey of housing emissions (2021 - 2023)

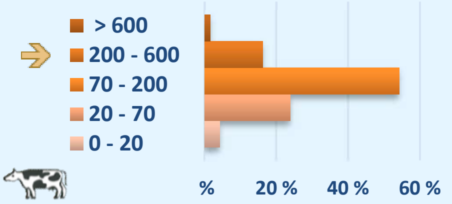
SRUC

Farm visited by Paul Hargreaves (2022)

My farm vs the diversity of visited dairy units in all countries

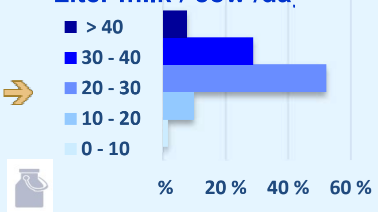
Tier	2b	2a	1	not used	total (3 gases)
nb obs.	8	0	2	2	12

lactating cows / house



212 - 242 cows

Liter milk / cow /day

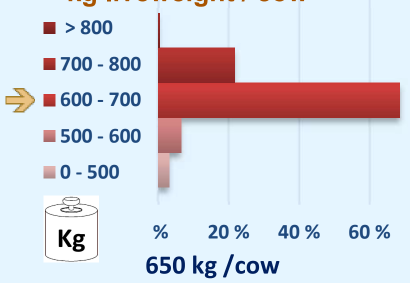


30 L milk /cow /day

The monitored dairy cows

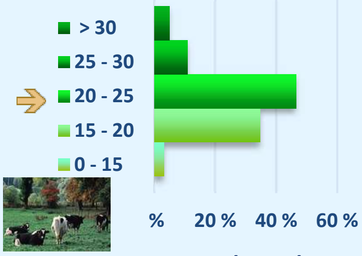
Farm 2

kg liveweight / cow



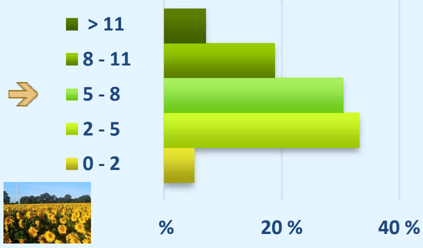
650 kg /cow

dry matter feed / cow /day



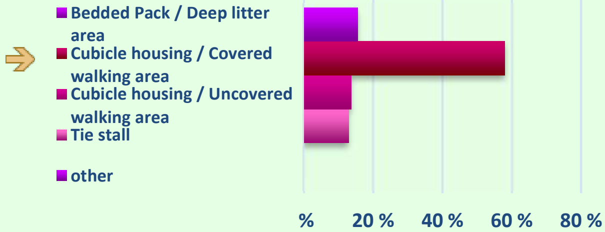
24 kg dry feed /cow /day

concentrate feed

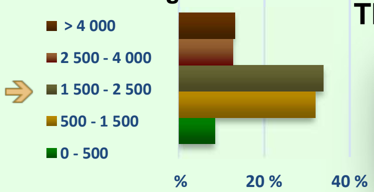


7 kg concentrate /cow /day

Housing category



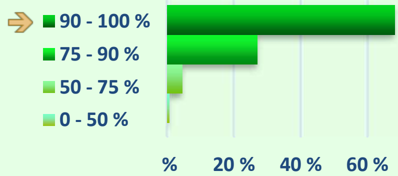
housing area



2030 m² /house

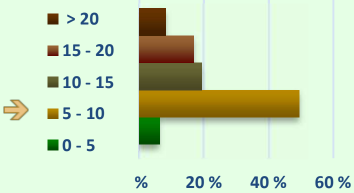
The monitored house

feed lactating cows (% feed all animals)



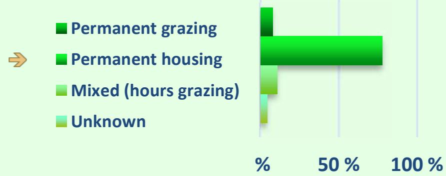
100 % total house

cow area

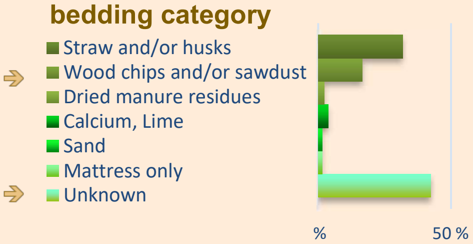


6,5 - 7,5 m² /lactating cow

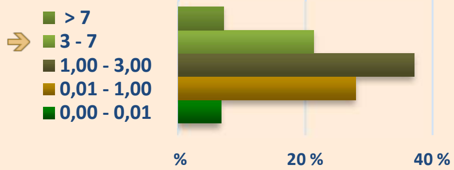
grazing option



bedding category



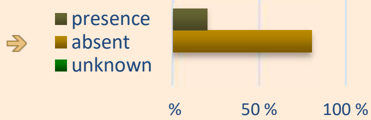
bedding input (kg bedding /cow /day)



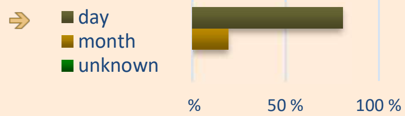
3,0 kg bedding /cow /day

The manure management

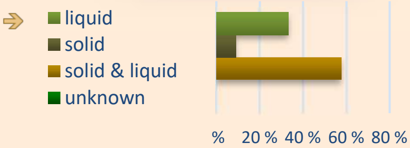
slatted floor



manure removal



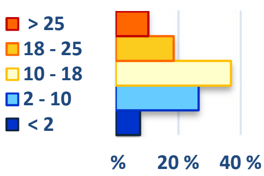
Manure output

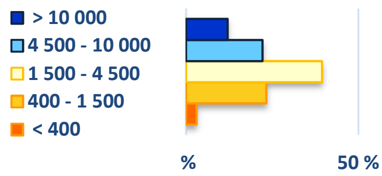


Farm 2 (Scotland) SRUC

Take-home messages

- Emissions of ammonia and methane are higher than the population;
- Manure management could be tuned to decrease these emissions





Observed emissions

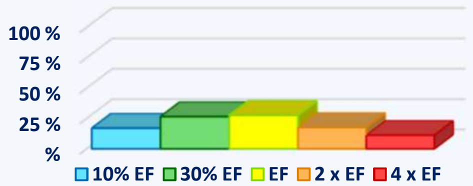
Observations in all countries

Observations

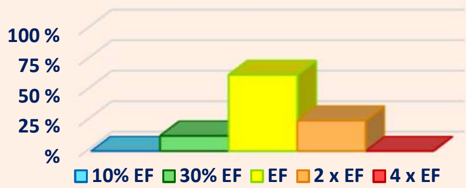
Outdoor temperature 6,4 - 22 °C

Ventilation 630 - 7900 m3 /hour /cow

► ***Ammonia emissions (g NH3 /cow /day)***



Reference emission factor: EF = 30 g NH3 /cow /day



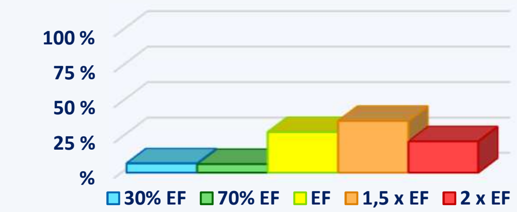
min: 7 g NH3 /cow /day

max: 100 g NH3 /cow /day

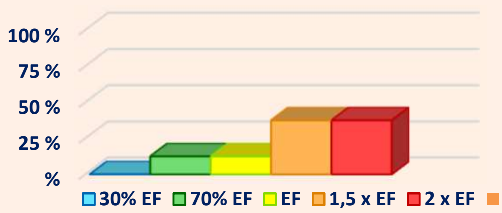
n: 8 emissions

min	max	min	max	min	max	min	max	min
0	4	4	15	15	45	45	101	101

► ***kg CH4 /cow /day (kg CH4 /cow /day)***



Reference emission factor: EF = 0,38 kg CH4 /cow /day



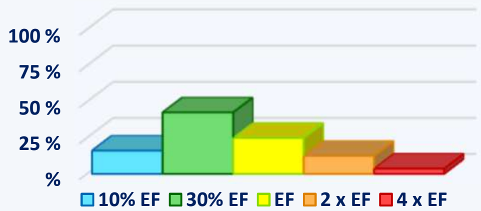
min: 0,2 kg CH4 /cow /day

max: 1,0 kg CH4 /cow /day

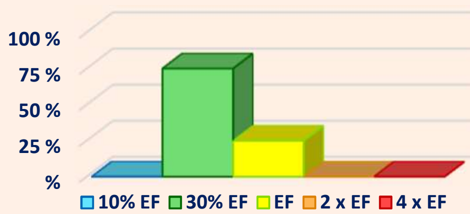
n: 8 emissions

min	max	min	max	min	max	min	max	min
0,00	0,19	0,19	0,30	0,30	0,45	0,45	0,65	0,65

► ***Nitrous oxide emissions (g N2O /cow /day)***



Reference emission factor: EF = 1,8 g N2O /cow /day



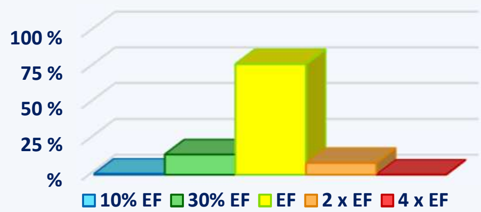
min: 0,4 g N2O /cow /day

max: 0,9 g N2O /cow /day

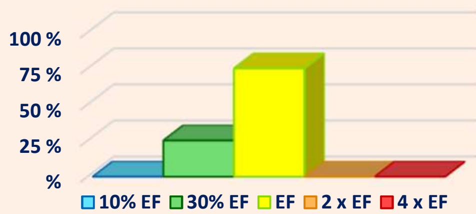
n: 4 emissions

min	max	min	max	min	max	min	max	min
0,00	0,23	0,23	0,91	0,91	2,73	2,73	6,14	6,14

► ***GHG emissions (kg eq CO2 /L milk)***



Reference emission factor: EF = 0,40 kg eq CO2 /L milk



min: 0,2 kg eq CO2 /L milk

max: 0,5 kg eq CO2 /L milk

min	max	min	max	min	max	min	max	min
0,00	0,05	0,05	0,20	0,20	0,61	0,61	1,36	1,36

Farm 3 (Scotland)

Survey of housing emissions
(2021 - 2023)

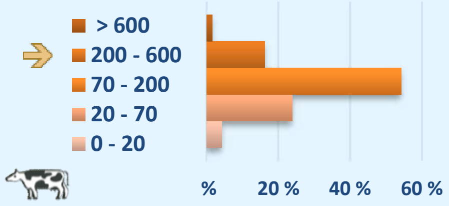
SRUC

Farm visited by Paul
Hargreaves (2022)

My farm vs the diversity of visited dairy units in all countries

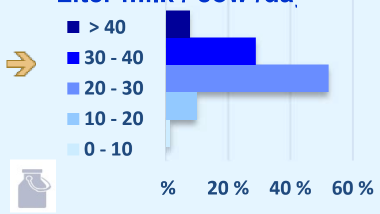
Tier	2b	2a	1	not used	total (3 gases)
nb obs.	6	0	2	4	12

lactating cows / house



324 - 341 cows

Liter milk / cow /day

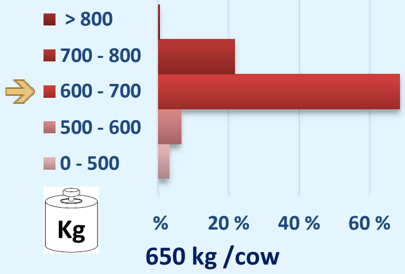


33 L milk /cow /day

The monitored dairy cows

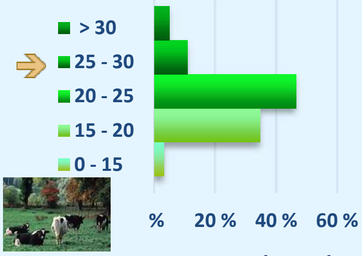
Farm 3

kg liveweight / cow



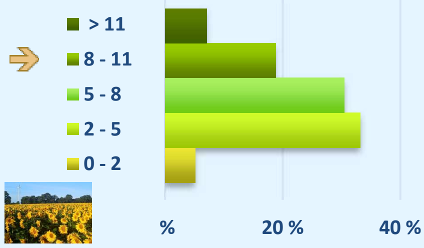
650 kg /cow

dry matter feed / cow /day



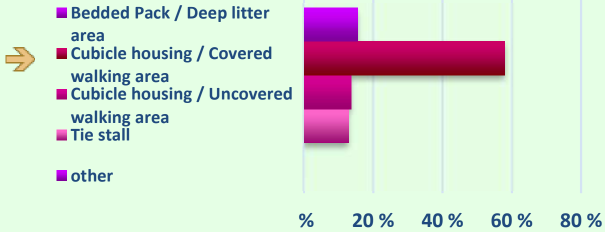
28 - 30 kg dry feed /cow /day

concentrate feed

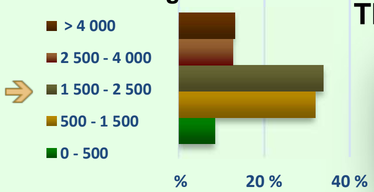


9 - 10 kg concentrate /cow /day

Housing category



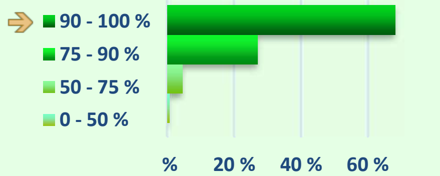
housing area



2100 m² /house

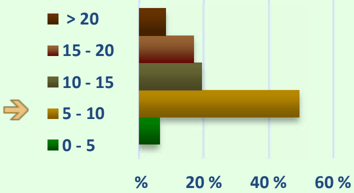
The monitored house

feed lactating cows (% feed all animals)



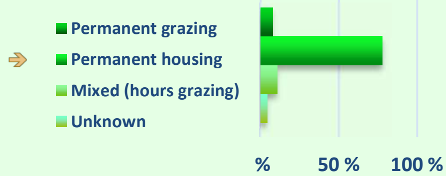
100 % total house

cow area

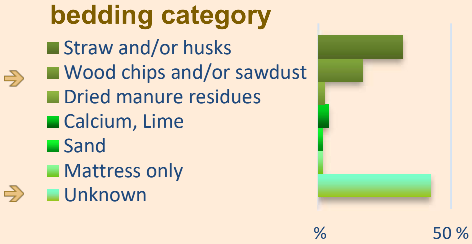


4,9 - 5,2 m² /lactating cow

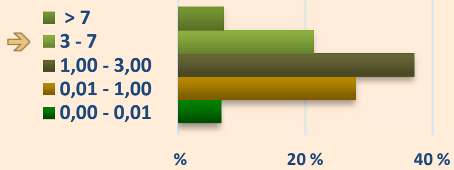
grazing option



bedding category



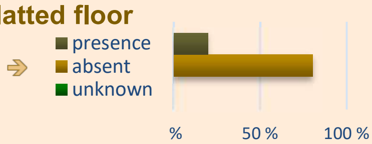
bedding input (kg bedding /cow /day)



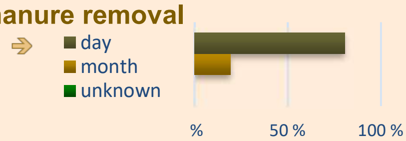
4,0 kg bedding /cow /day

The manure management

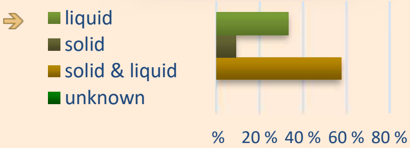
slatted floor



manure removal



Manure output

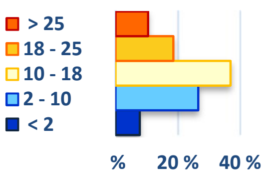


Farm 3 (Scotland) SRUC

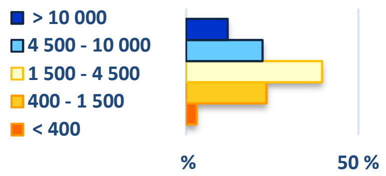
Take-home messages

- Emissions of ammonia and methane are higher than the population;
- Manure management could be tuned to decrease these emissions

Outdoor temperature (°C)



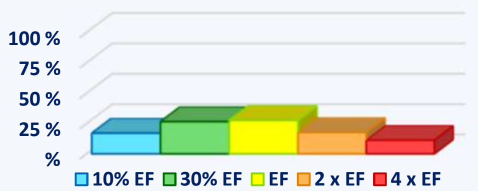
Ventilation (m3 /hour /cow)



Observed emissions

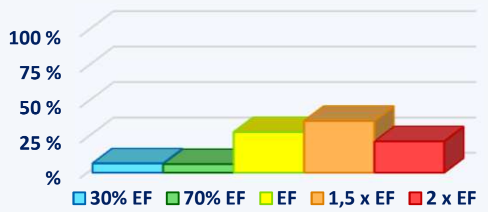
Observations in all countries

► *Ammonia emissions (g NH3 /cow /day)*



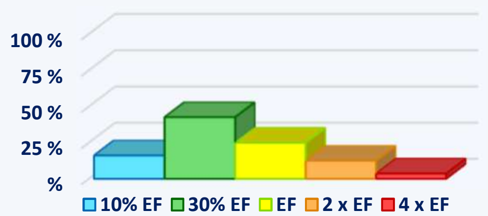
Reference emission factor: EF = 30 g NH3 /cow /day

► *kg CH4 /cow /day (kg CH4 /cow /day)*



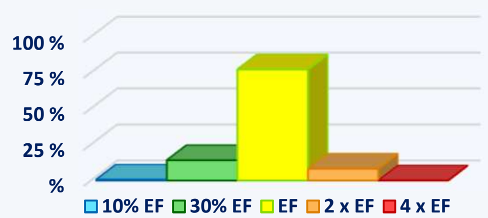
Reference emission factor: EF = 0,38 kg CH4 /cow /day

► *Nitrous oxide emissions (g N2O /cow /day)*



Reference emission factor: EF = 1,8 g N2O /cow /day

► *GHG emissions (kg eq CO2 /L milk)*

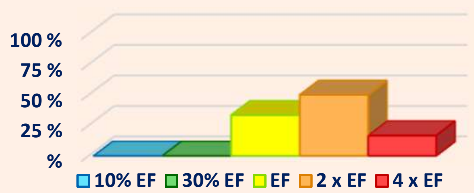


Reference emission factor: EF = 0,40 kg eq CO2 /L milk

Observations

Outdoor temperature 7,2 - 24 °C

Ventilation 2 400 - 8700 m3 /hour /cow

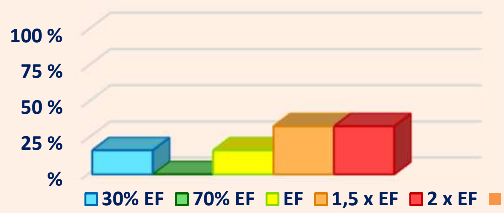


min: 23 g NH3 /cow /day

max: 130 g NH3 /cow /day

n: 6 emissions

min	max	min	max	min	max	min	max	min
0	4	4	15	15	45	45	101	101

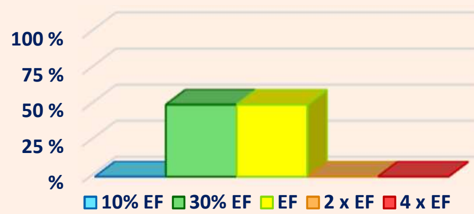


min: 0,2 kg CH4 /cow /day

max: 1,0 kg CH4 /cow /day

n: 6 emissions

min	max	min	max	min	max	min	max	min
0,00	0,19	0,19	0,30	0,30	0,45	0,45	0,65	0,65

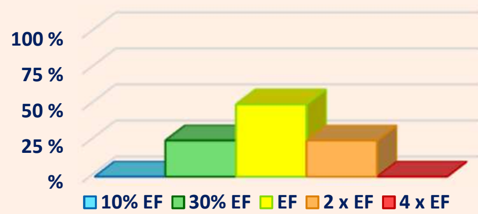


min: 0,6 g N2O /cow /day

max: 1,0 g N2O /cow /day

n: 4 emissions

min	max	min	max	min	max	min	max	min
0,00	0,23	0,23	0,91	0,91	2,73	2,73	6,14	6,14



min: 0,1 kg eq CO2 /L milk

max: 0,6 kg eq CO2 /L milk

min	max	min	max	min	max	min	max	min
0,00	0,05	0,05	0,20	0,20	0,61	0,61	1,36	1,36

Farm 4 (Scotland)

Survey of housing emissions
(2021 - 2023)

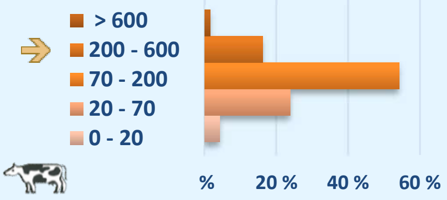
SRUC

Farm visited by Paul Hargreaves (2022)

My farm vs the diversity of visited dairy units in all countries

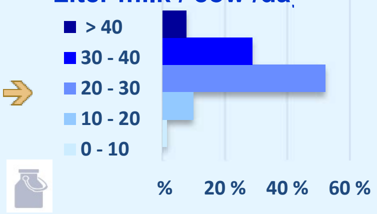
Tier	2b	2a	1	not used	total (3 gases)
nb obs.	4	0	4	4	12

lactating cows / house



341 - 356 cows

Liter milk / cow /day

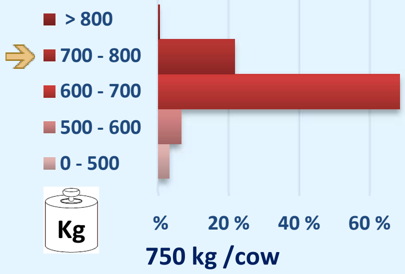


26 L milk /cow /day

The monitored dairy cows

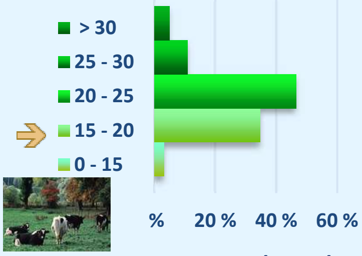
Farm 4

kg liveweight / cow



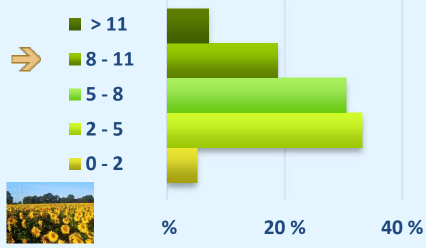
750 kg /cow

dry matter feed / cow /day



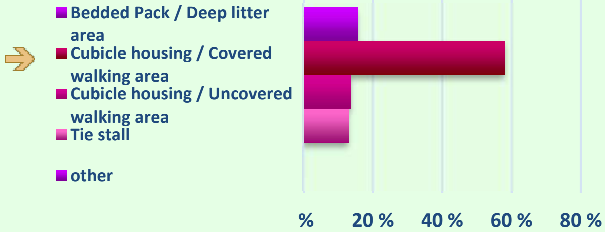
18 - 20 kg dry feed /cow /day

concentrate feed

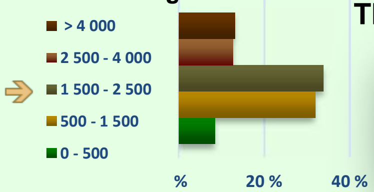


8 kg concentrate /cow /day

Housing category



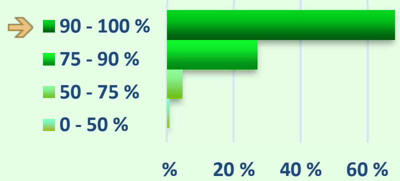
housing area



2400 m² /house

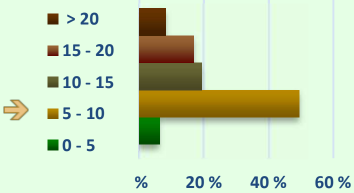
The monitored house

feed lactating cows (% feed all animals)



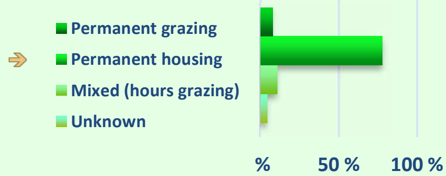
100 % total house

cow area

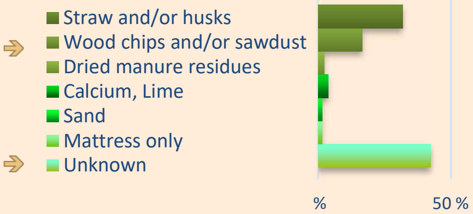


5,7 m² /lactating cow

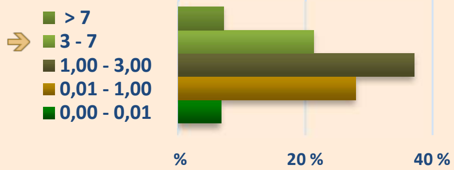
grazing option



bedding category



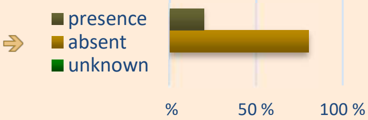
bedding input (kg bedding /cow /day)



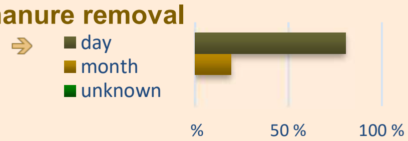
5,0 kg bedding /cow /day

The manure management

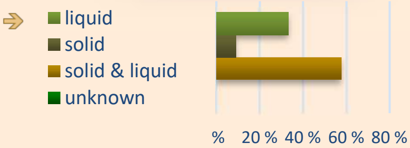
slatted floor



manure removal



Manure output

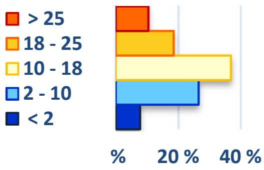


Farm 4 (Scotland) SRUC

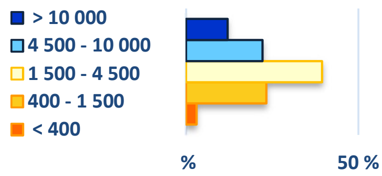
Take-home messages

- Emissions of ammonia and methane higher than the population are occasionally observed;
- Conditions of these high emissions should be identified to decrease there occurrence while maintaining small nitrous oxide emissions

Outdoor temperature (°C)



Ventilation (m3 /hour /cow)



Observed emissions

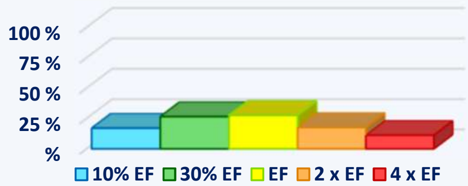
Observations in all countries

Observations

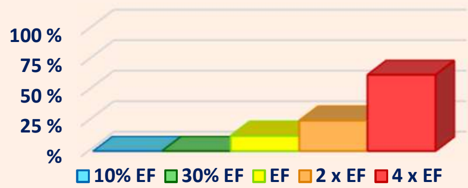
Outdoor temperature 6,5 - 19 °C

Ventilation 2 300 - 30000 m3 /hour /cow

► ***Ammonia emissions (g NH3 /cow /day)***



Reference emission factor: EF = 30 g NH3 /cow /day



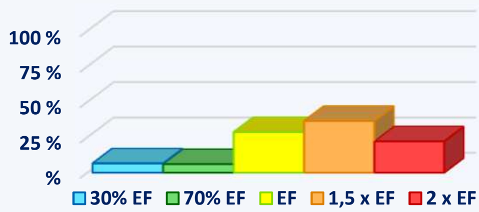
min: 43 g NH3 /cow /day

max: 550 g NH3 /cow /day

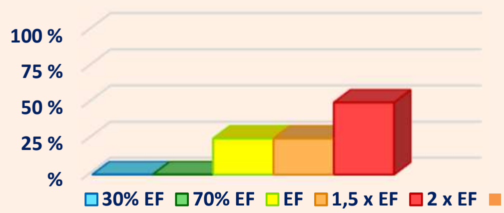
n: 8 emissions

min	max	min	max	min	max	min	max	min
0	4	4	15	15	45	45	101	101

► ***kg CH4 /cow /day (kg CH4 /cow /day)***



Reference emission factor: EF = 0,38 kg CH4 /cow /day



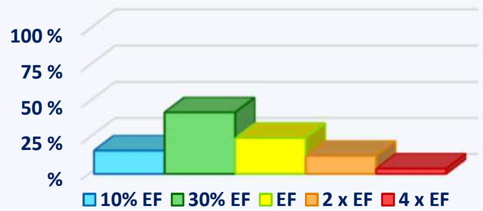
min: 0,3 kg CH4 /cow /day

max: 1 kg CH4 /cow /day

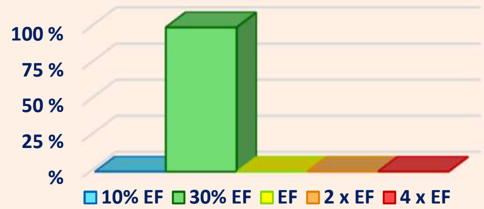
n: 4 emissions

min	max	min	max	min	max	min	max	min
0,00	0,19	0,19	0,30	0,30	0,45	0,45	0,65	0,65

► ***Nitrous oxide emissions (g N2O /cow /day)***



Reference emission factor: EF = 1,8 g N2O /cow /day



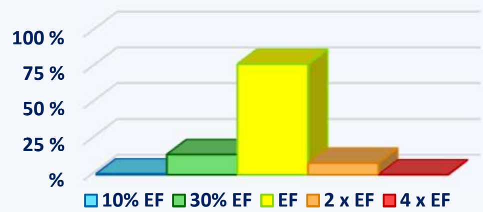
min: 0,4 g N2O /cow /day

max: 0,8 g N2O /cow /day

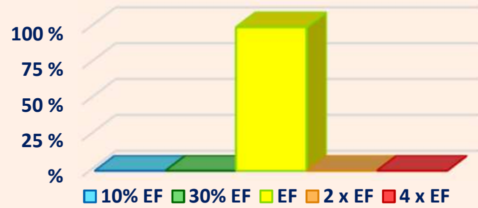
n: 4 emissions

min	max	min	max	min	max	min	max	min
0,00	0,23	0,23	0,91	0,91	2,73	2,73	6,14	6,14

► ***GHG emissions (kg eq CO2 /L milk)***



Reference emission factor: EF = 0,40 kg eq CO2 /L milk



min: 0,4 kg eq CO2 /L milk

max: 0,5 kg eq CO2 /L milk

min	max	min	max	min	max	min	max	min
0,00	0,05	0,05	0,20	0,20	0,61	0,61	1,36	1,36

farming

Farm 5 (Scotland)

Survey of housing emissions (2021 - 2023)

SRUC

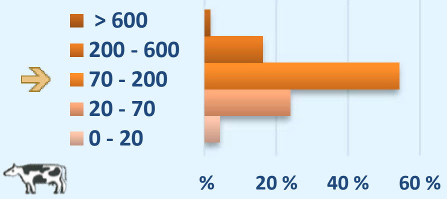
Farm visited by Paul Hargreaves (2022)

FACCE ERA-GAS · ERA-NET SUSAN · ICT-AGRI era-net

My farm vs the diversity of visited dairy units in all countries

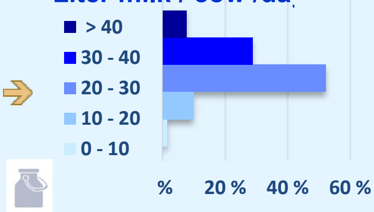
Tier	2b	2a	1	not used	total (3 gases)
nb obs.	0	0	5	7	12

lactating cows / house



137 cows

Liter milk / cow /day

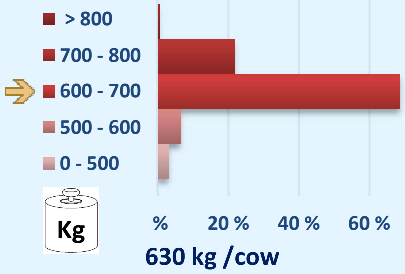


24 L milk /cow /day

The monitored dairy cows

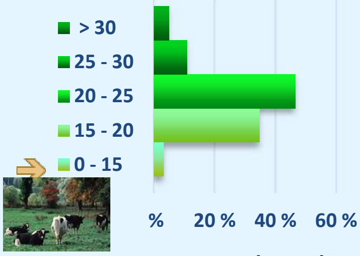
Farm 5

kg liveweight / cow



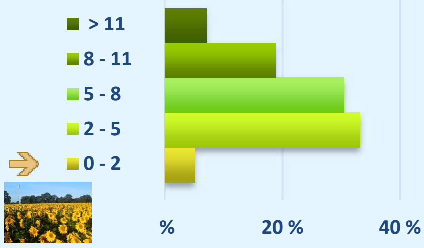
630 kg /cow

dry matter feed / cow /day



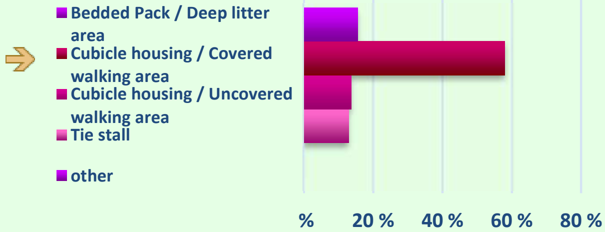
6 - 24 kg dry feed /cow /day

concentrate feed

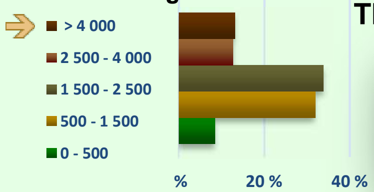


0 - 2 kg concentrate /cow /day

Housing category



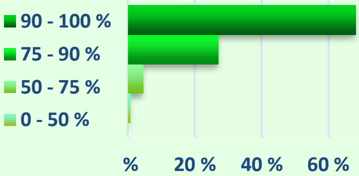
housing area



4051 m² /house

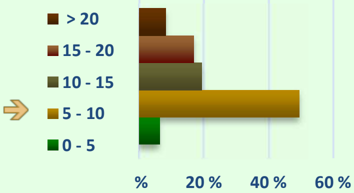
The monitored house

feed lactating cows (% feed all animals)



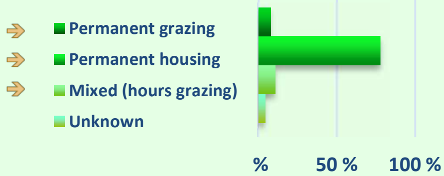
(no data)

cow area



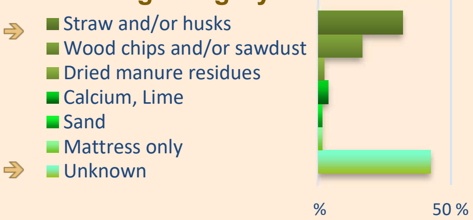
5,3 m² /lactating cow

grazing option

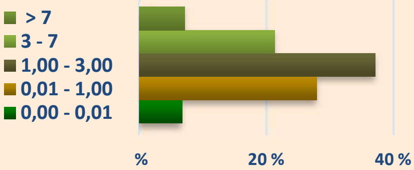


0 - 20 hours grazing /day

bedding category



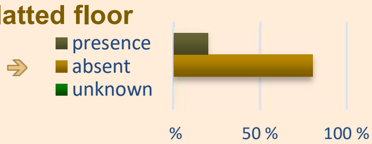
bedding input (kg bedding /cow /day)



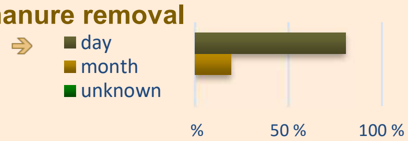
no data

The manure management

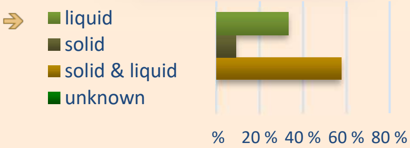
slatted floor



manure removal



Manure output

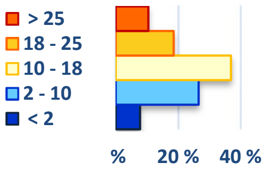


Farm 5 (Scotland) SRUC

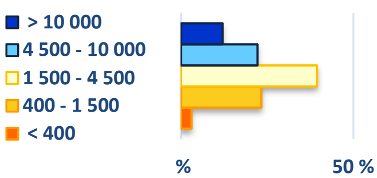
Take-home messages

- Emissions of ammonia, methane and nitrous oxide are similar to the population;
- Methane emissions higher than emission factor can be due to the manure management

Outdoor temperature (°C)



Ventilation (m3 /hour /cow)



Observed emissions

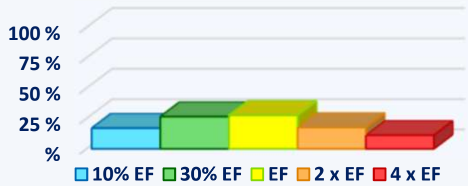
Observations in all countries

Observations

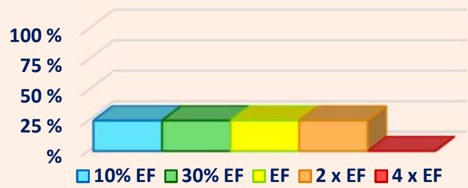
Outdoor temperature 12 - 19 °C

Ventilation 3 100 - 10000 m3 /hour /cow

► Ammonia emissions (g NH3 /cow /day)



Reference emission factor: EF = 30 g NH3 /cow /day



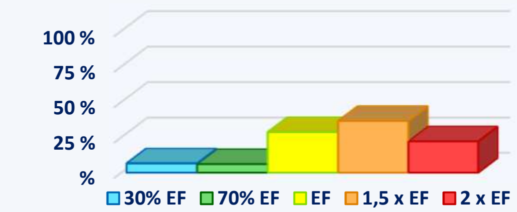
min: 4 g NH3 /cow /day

max: 71 g NH3 /cow /day

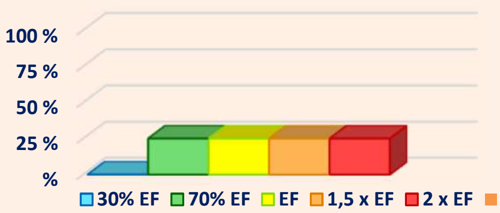
n: 4 emissions

min	max	min	max	min	max	min	max	min
0	4	4	15	15	45	45	101	101

► kg CH4 /cow /day (kg CH4 /cow /day)



Reference emission factor: EF = 0,38 kg CH4 /cow /day



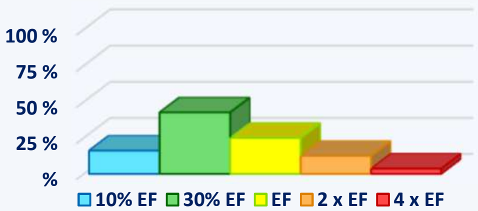
min: 0,3 kg CH4 /cow /day

max: 0,7 kg CH4 /cow /day

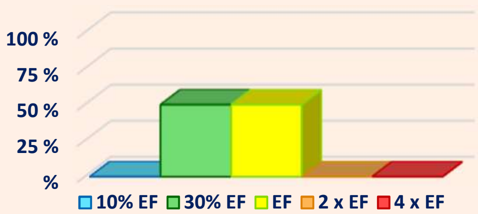
n: 4 emissions

min	max	min	max	min	max	min	max	min
0,00	0,19	0,19	0,30	0,30	0,45	0,45	0,65	0,65

► Nitrous oxide emissions (g N2O /cow /day)



Reference emission factor: EF = 1,8 g N2O /cow /day



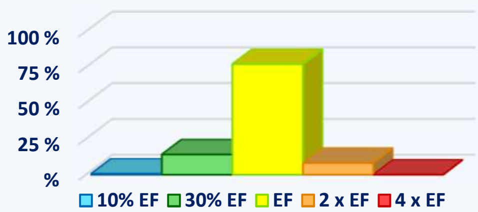
min: 0,5 g N2O /cow /day

max: 2 g N2O /cow /day

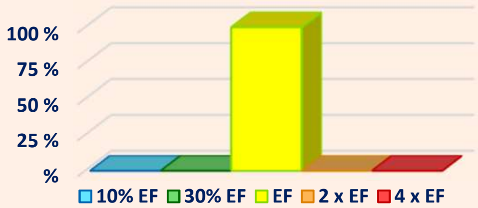
n: 2 emissions

min	max	min	max	min	max	min	max	min
0,00	0,23	0,23	0,91	0,91	2,73	2,73	6,14	6,14

► GHG emissions (kg eq CO2 /L milk)



Reference emission factor: EF = 0,40 kg eq CO2 /L milk



min: 0,2 kg eq CO2 /L milk

max: 0,4 kg eq CO2 /L milk

min	max	min	max	min	max	min	max	min
0,00	0,05	0,05	0,20	0,20	0,61	0,61	1,36	1,36

Farm 6 (Scotland)

Survey of housing emissions (2021 - 2023)

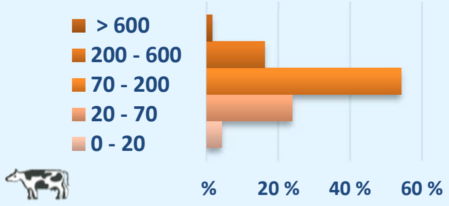
SRUC

Farm visited by Paul Hargreaves (2022)

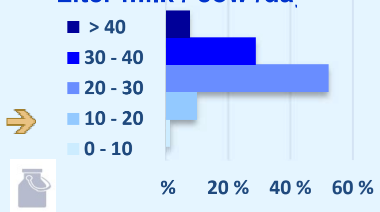
My farm vs the diversity of visited dairy units in all countries

Tier	2b	2a	1	not used	total (3 gases)
nb obs.	0	0	8	4	12

lactating cows / house



Liter milk / cow /day

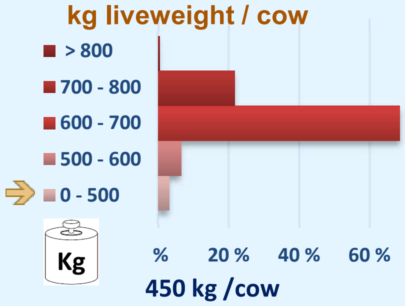


20 L milk /cow /day

The monitored dairy cows

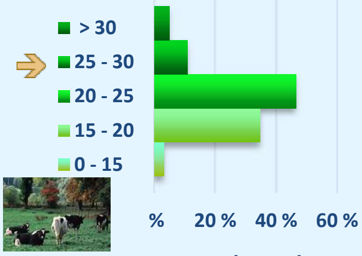
Farm 6

kg liveweight / cow



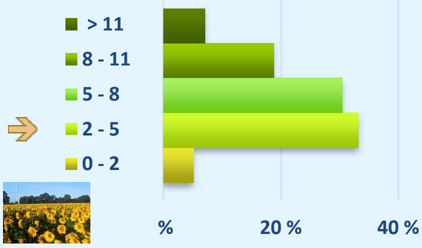
450 kg /cow

dry matter feed / cow /day



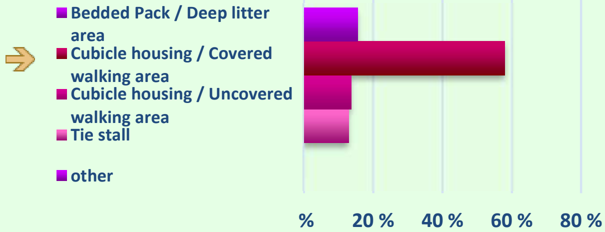
29 kg dry feed /cow /day

concentrate feed

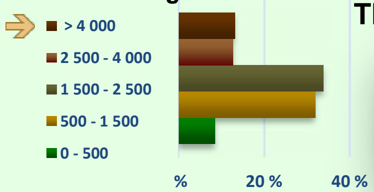


0 - 9 kg concentrate /cow /day

Housing category



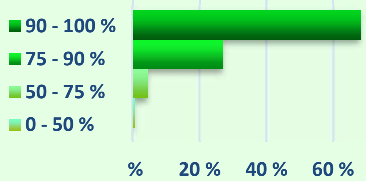
housing area



4800 m² /house

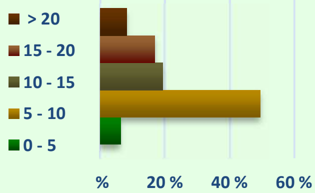
The monitored house

feed lactating cows (% feed all animals)



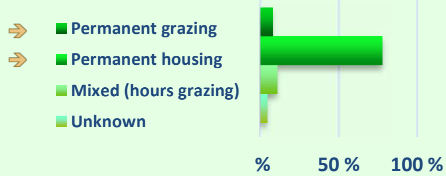
(no data)

cow area



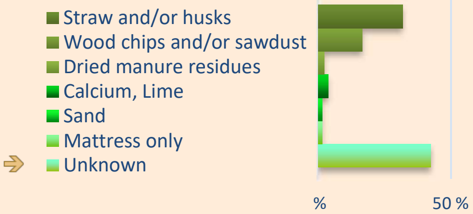
(no data)

grazing option

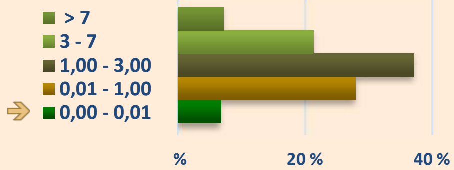


0 - 20 hours grazing /day

bedding category



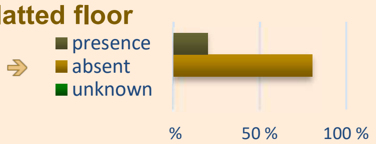
bedding input (kg bedding /cow /day)



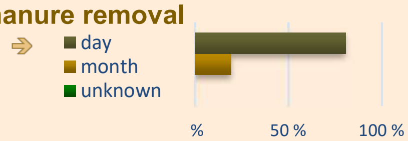
0 kg bedding /cow /day

The manure management

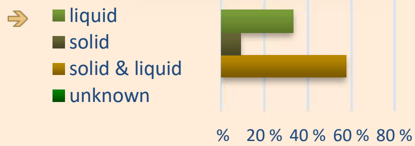
slatted floor



manure removal



Manure output

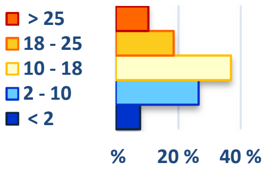


Farm 6 (Scotland) SRUC

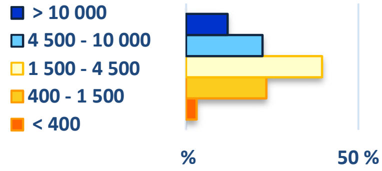
Take-home messages

- Emissions of ammonia and nitrous oxide are lower than the population;
- The reasons of occasional higher methane emissions should be understood to further improve the overall good quality of emissions

Outdoor temperature (°C)



Ventilation (m3 /hour /cow)



Observed emissions

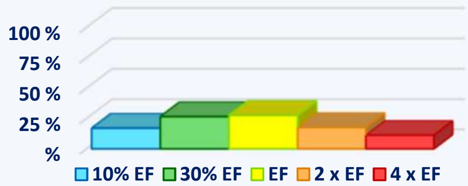
Observations in all countries

Observations

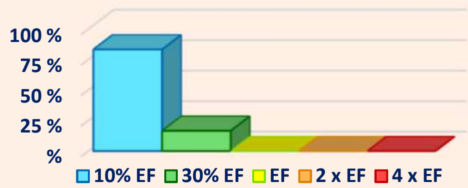
Outdoor temperature 6,8 - 20 °C

Ventilation 1 100 - 9000 m3 /hour /cow

► *Ammonia emissions (g NH3 /cow /day)*



Reference emission factor: EF = 30 g NH3 /cow /day



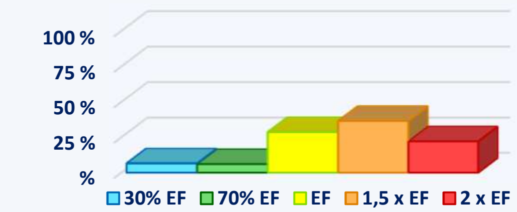
min: 1 g NH3 /cow /day

max: 6 g NH3 /cow /day

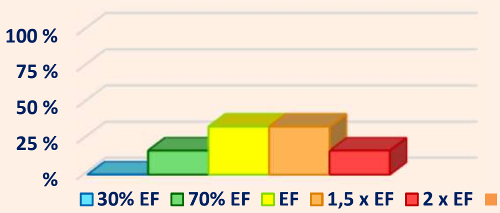
n: 6 emissions

min	max	min	max	min	max	min	max	min
0	4	4	15	15	45	45	101	101

► *kg CH4 /cow /day (kg CH4 /cow /day)*



Reference emission factor: EF = 0,38 kg CH4 /cow /day



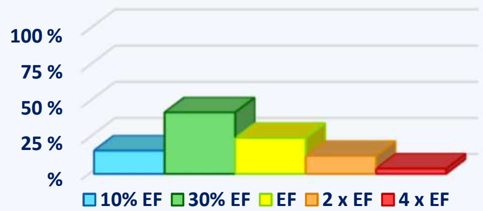
min: 0,3 kg CH4 /cow /day

max: 0,9 kg CH4 /cow /day

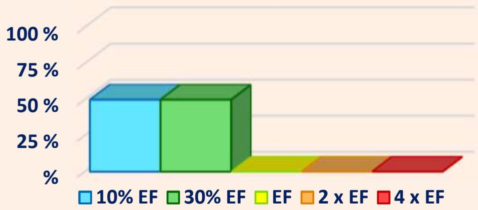
n: 6 emissions

min	max	min	max	min	max	min	max	min
0,00	0,19	0,19	0,30	0,30	0,45	0,45	0,65	0,65

► *Nitrous oxide emissions (g N2O /cow /day)*



Reference emission factor: EF = 1,8 g N2O /cow /day



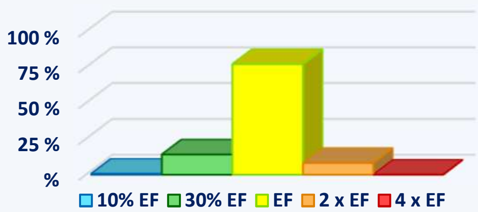
min: 0,2 g N2O /cow /day

max: 0,4 g N2O /cow /day

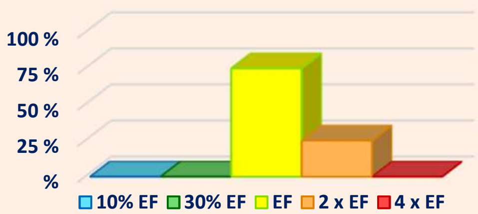
n: 4 emissions

min	max	min	max	min	max	min	max	min
0,00	0,23	0,23	0,91	0,91	2,73	2,73	6,14	6,14

► *GHG emissions (kg eq CO2 /L milk)*



Reference emission factor: EF = 0,40 kg eq CO2 /L milk



min: 0,3 kg eq CO2 /L milk

max: 0,7 kg eq CO2 /L milk

min	max	min	max	min	max	min	max	min
0,00	0,05	0,05	0,20	0,20	0,61	0,61	1,36	1,36

farming

Farm 7 (Scotland)

Survey of housing emissions (2021 - 2023)

SRUC

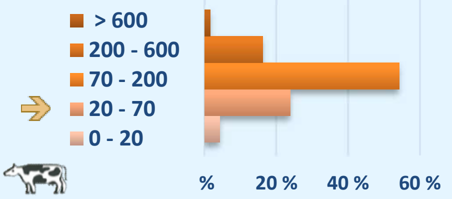
Farm visited by Paul Hargreaves (2022)

FACCE ERA-GAS ERA-NET SUSAN ICT AGRI era-net

My farm vs the diversity of visited dairy units in all countries

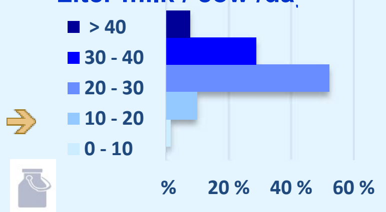
Tier	2b	2a	1	not used	total (3 gases)
nb obs.	0	0	9	3	12

lactating cows / house



24 cows

Liter milk / cow /day

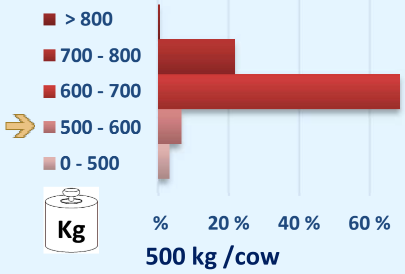


10 L milk /cow /day

The monitored dairy cows

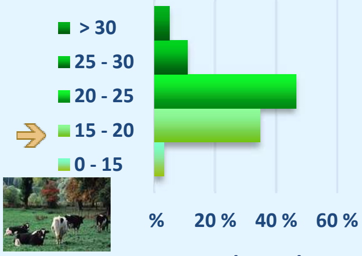
Farm 7

kg liveweight / cow



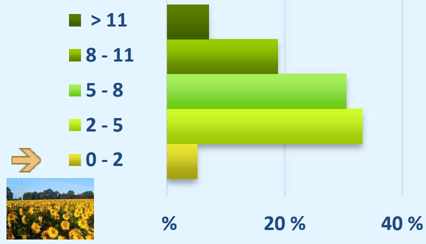
500 kg /cow

dry matter feed / cow /day



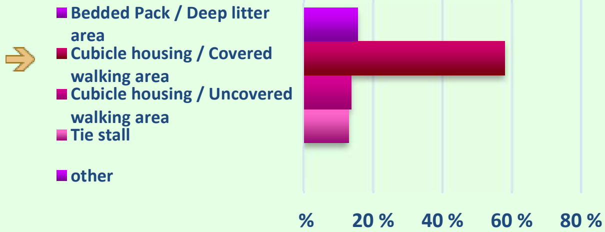
17 kg dry feed /cow /day

concentrate feed

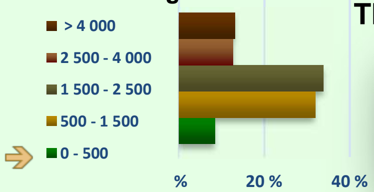


0 - 6 kg concentrate /cow /day

Housing category



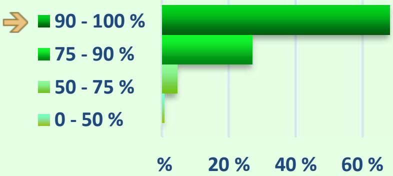
housing area



280 m² /house

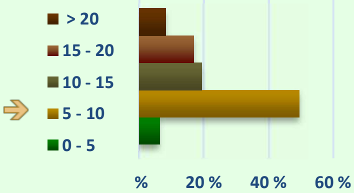
The monitored house

feed lactating cows (% feed all animals)



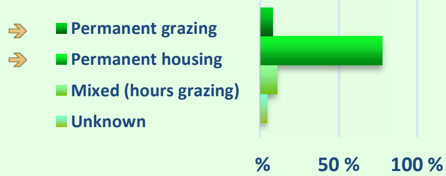
100 % total house

cow area



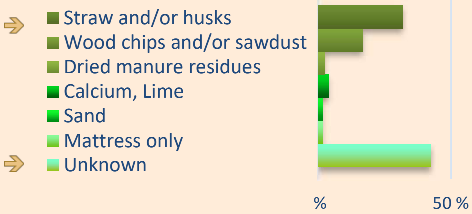
7,9 m² /lactating cow

grazing option

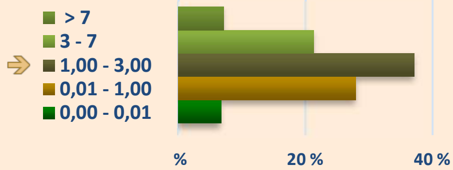


0 - 20 hours grazing /day

bedding category



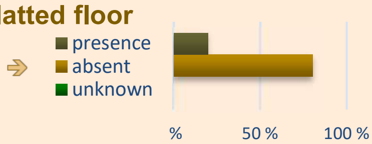
bedding input (kg bedding /cow /day)



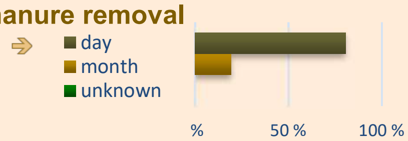
0,3 - 10,0 kg bedding /cow /day

The manure management

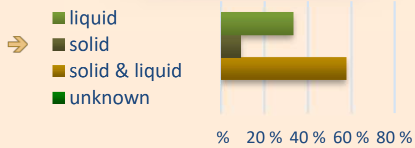
slatted floor



manure removal



Manure output

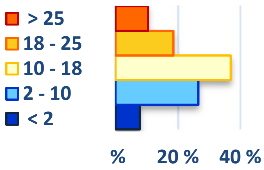


Farm 7 (Scotland) SRUC

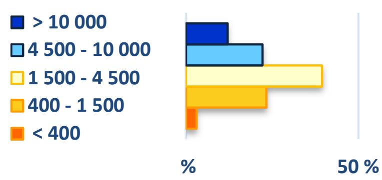
Take-home messages

- Emissions of ammonia and nitrous oxide are lower than the population;
- The reasons of occasional higher methane emissions should be understood to further improve the overall good quality of emissions

Outdoor temperature (°C)



Ventilation (m3 /hour /cow)



Observed emissions

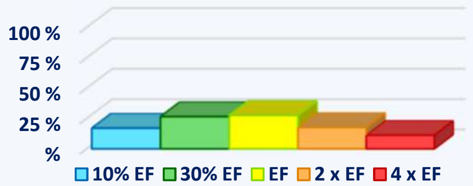
Observations in all countries

Observations

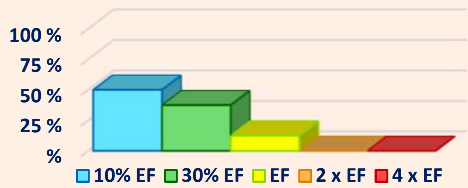
Outdoor temperature 7,8 - 17 °C

Ventilation 700 - 9000 m3 /hour /cow

► *Ammonia emissions (g NH3 /cow /day)*



Reference emission factor: EF = 30 g NH3 /cow /day



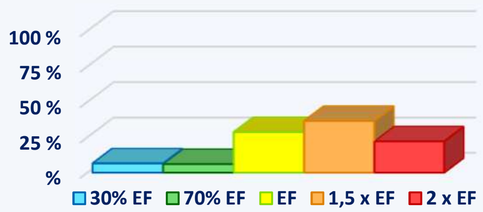
min: 1 g NH3 /cow /day

max: 25 g NH3 /cow /day

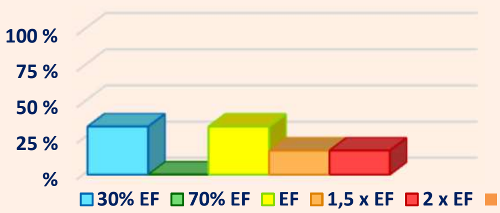
n: 8 emissions

min	max	min	max	min	max	min	max	min
0	4	4	15	15	45	45	101	101

► *kg CH4 /cow /day (kg CH4 /cow /day)*



Reference emission factor: EF = 0,38 kg CH4 /cow /day



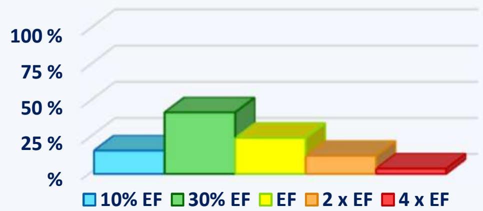
min: 0,06 kg CH4 /cow /day

max: 0,8 kg CH4 /cow /day

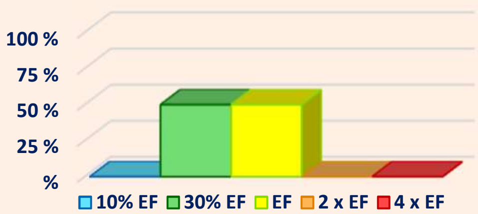
n: 6 emissions

min	max	min	max	min	max	min	max	min
0,00	0,19	0,19	0,30	0,30	0,45	0,45	0,65	0,65

► *Nitrous oxide emissions (g N2O /cow /day)*



Reference emission factor: EF = 1,8 g N2O /cow /day



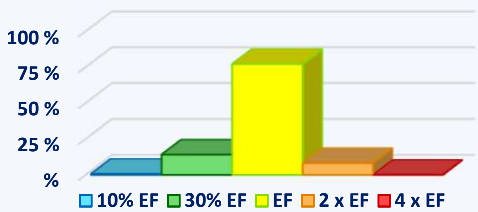
min: 0,6 g N2O /cow /day

max: 1 g N2O /cow /day

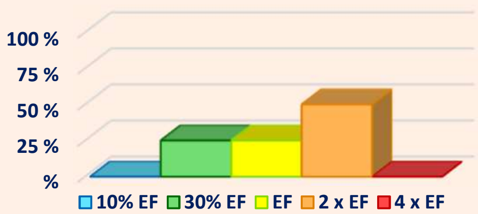
n: 4 emissions

min	max	min	max	min	max	min	max	min
0,00	0,23	0,23	0,91	0,91	2,73	2,73	6,14	6,14

► *GHG emissions (kg eq CO2 /L milk)*



Reference emission factor: EF = 0,40 kg eq CO2 /L milk



min: 0,1 kg eq CO2 /L milk

max: 0,8 kg eq CO2 /L milk

min	max	min	max	min	max	min	max	min
0,00	0,05	0,05	0,20	0,20	0,61	0,61	1,36	1,36

Farm 8 (Scotland)

Survey of housing emissions
(2021 - 2023)

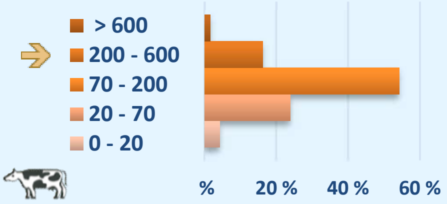
SRUC

Farm visited by Paul
Hargreaves (2022)

My farm vs the diversity of visited dairy units in all countries

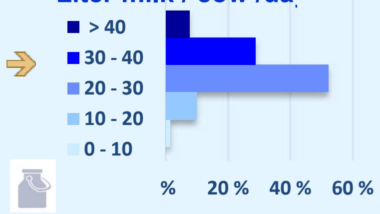
Tier	2b	2a	1	not used	total (3 gases)
nb obs.	8	0	2	2	12

lactating cows / house



335 - 352 cows

Liter milk / cow /day

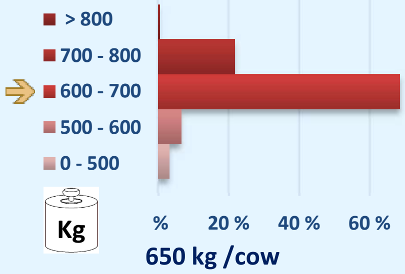


31 L milk /cow /day

The monitored dairy cows

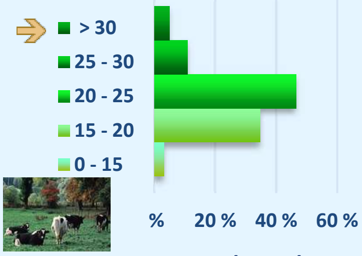
Farm 8

kg liveweight / cow



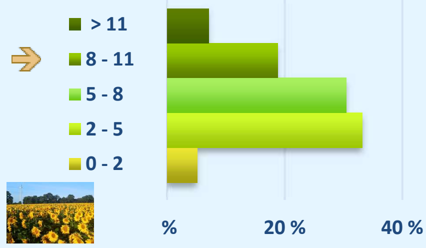
650 kg /cow

dry matter feed / cow /day



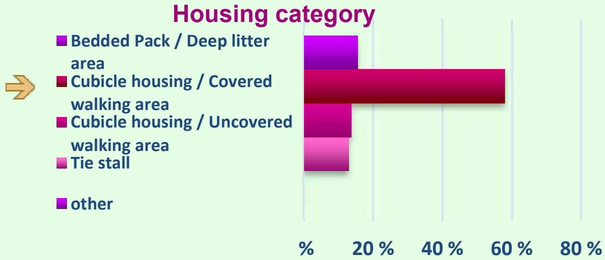
31 kg dry feed /cow /day

concentrate feed

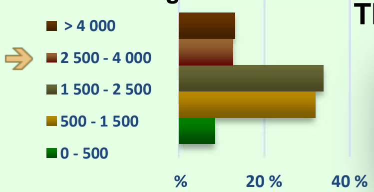


10 kg concentrate /cow /day

Housing category



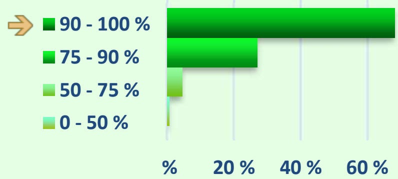
housing area



3500 m² /house

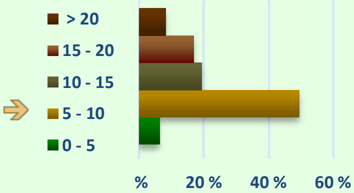
The monitored house

feed lactating cows (% feed all animals)



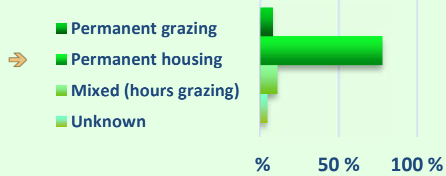
100 % total house

cow area

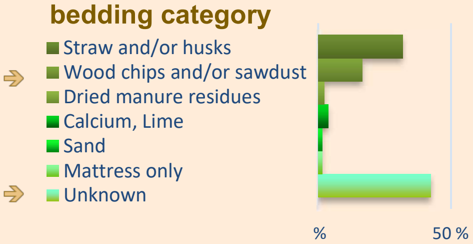


8,9 - 9,4 m² /lactating cow

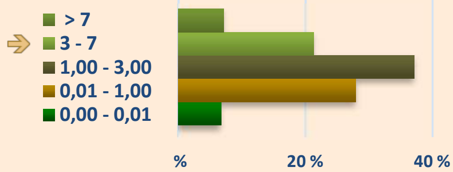
grazing option



bedding category



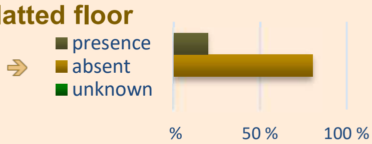
bedding input (kg bedding /cow /day)



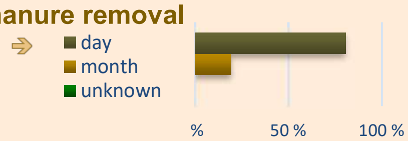
6,0 - 7,0 kg bedding /cow /day

The manure management

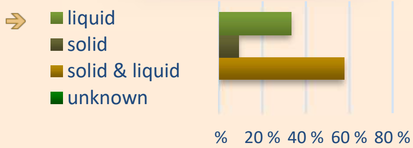
slatted floor



manure removal



Manure output



farming

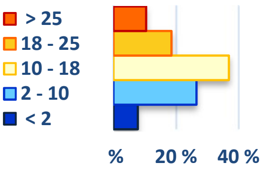
Farm 8 (Scotland) SRUC

FACCE ERA-GAS ERA-NET SUSAN ICT AGRI era-net

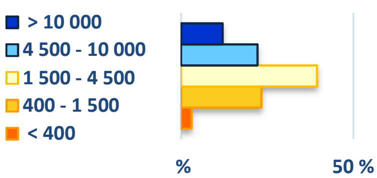
Take-home messages

- Emissions of ammonia and nitrous oxide are lower than the population;
- The reasons of occasional higher methane emissions should be understood to further improve the overall good quality of emissions

Outdoor temperature (°C)



Ventilation (m3 /hour /cow)



Observed emissions

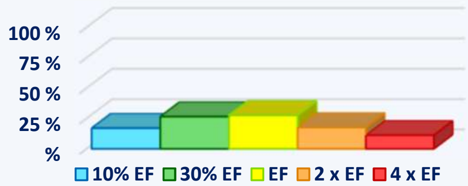
Observations in all countries

Observations

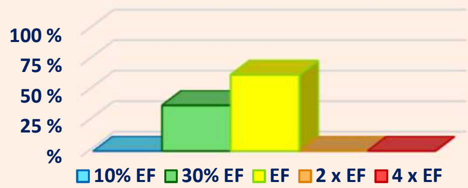
Outdoor temperature 6,3 - 22 °C

Ventilation 850 - 4500 m3 /hour /cow

► *Ammonia emissions (g NH3 /cow /day)*



Reference emission factor: EF = 30 g NH3 /cow /day



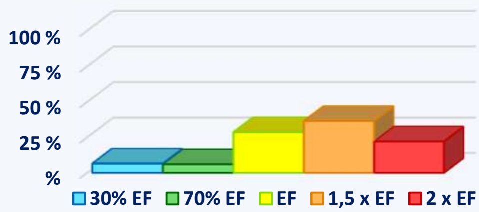
min: 9 g NH3 /cow /day

max: 43 g NH3 /cow /day

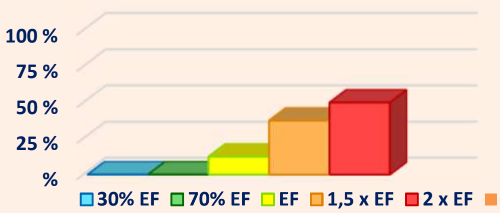
n: 8 emissions

min	max	min	max	min	max	min	max	min
0	4	4	15	15	45	45	101	101

► *kg CH4 /cow /day (kg CH4 /cow /day)*



Reference emission factor: EF = 0,38 kg CH4 /cow /day



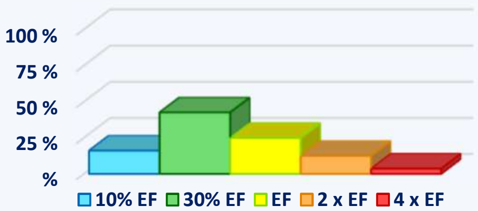
min: 0,4 kg CH4 /cow /day

max: 0,9 kg CH4 /cow /day

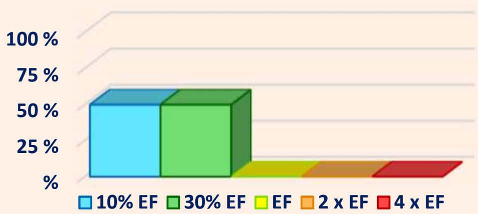
n: 8 emissions

min	max	min	max	min	max	min	max	min
0,00	0,19	0,19	0,30	0,30	0,45	0,45	0,65	0,65

► *Nitrous oxide emissions (g N2O /cow /day)*



Reference emission factor: EF = 1,8 g N2O /cow /day



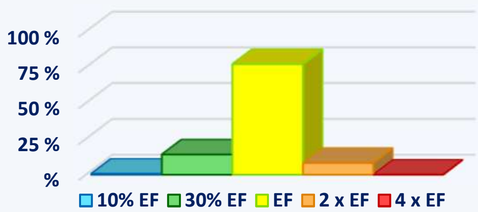
min: 0,2 g N2O /cow /day

max: 0,3 g N2O /cow /day

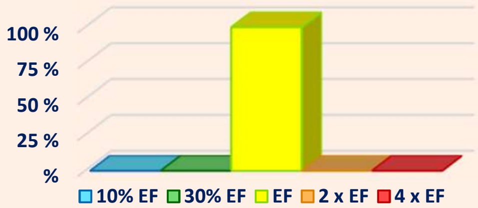
n: 4 emissions

min	max	min	max	min	max	min	max	min
0,00	0,23	0,23	0,91	0,91	2,73	2,73	6,14	6,14

► *GHG emissions (kg eq CO2 /L milk)*



Reference emission factor: EF = 0,40 kg eq CO2 /L milk



min: 0,3 kg eq CO2 /L milk

max: 0,5 kg eq CO2 /L milk

min	max	min	max	min	max	min	max	min
0,00	0,05	0,05	0,20	0,20	0,61	0,61	1,36	1,36