EuroSheep

European Knowledge Exchange

European Network for interactive and innovative knowledge exchange on animal health and nutrition between the **sheep** industry actors and stakeholders

Sustainability assessment of selected Best Practices

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 863056.

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Introduction

To help the end-users acceptance assessment (task 2.3), different analyses have been realized by STWGs and validated by NWs in each country on their best practices that were selected by the other countries.

Cost-benefit analyses have been realised by STWG and NW of each country for those Best Practices which were selected to be implemented in the other countries by stakeholders. This work has been done in strict connection with the task 2.3 (end-users assessment) in order to compare the "expected profitability" of the proposed Best Practice in the sheep system where it has been conceived with the profitability actually realised in the other different sheep systems.

This cost benefit analysis included the additional costs involved in implementing the identified Best Practices (BP) at farm level, and/or saving in production costs and monetary benefits in terms of quantity and quality of products (e.g. compositional value of the product).

The estimated impact of identified Best Practices on environmental issues, in particular greenhouse gas emissions, has also been appraised. The environmental sustainability analysis was developed as a complement to the cost-benefit analysis, because several indicators are common (energy consumption, farm inputs, productivity rates, etc.).

In addition, a complementary assessment of sustainability has been done on each identified BP. The effects of identified Best Practices on potential labour requirements have been quantified and the potential social and animal welfare issues (if any) to its implementation have been identified.

Methodology

1. Conception of the template for the sustainability analysis.

Agris discussed the first draft of the template with Enrico Vagnoni, project manager of the LIFE SheepToShip project. The final version was discussed with Sindy Throude, leader of the life GreenSheep, who participated in the NF meeting on 26th of September 2022. We finalised the cost-benefit analysis template and discussed the additional points which should be taken into account for sustainability analysis.

This task was also conditioned by some issues in addition to those already highlighted for the cost-benefit analysis (Deliverable 3.5):

- the lack of well-assessed and user-friendly methods to precisely quantify the environmental impact of Best Practices
- the lack of analytical data for most farms.

Thus, it was decided that the analysis would focus on 9 aspects (see below). For each aspect, the adoption of the Best Practice in the “Benchmark Farm” had to be assessed as have either a positive or a negative effect on the overall environmental impact.

The aspects included in the analysis were:

1) **Feed efficiency:** enteric methane emission represents the main environmental hotspot, by far, and it is strongly correlated with the diet composition and the efficient use of feed sources. The efficiency can be improved by 2 ways: increase the level of production with the same level of feeding, or reduce the level of feed input per level of production;
2) **Grazing efficiency**: enteric methane emission represents the main environmental hotspot, by far, and it is strongly correlated with the diet composition and the efficient use of feed sources. The efficiency can be improved with a better grazing management, reducing the level of feed and forage distributed per level of production;
3) **Output per ewe**: The farm productivity (lambs or liters of milk products per ewe) is very important. As the enteric methane emission represents the main environmental hotspot, increasing the production per ewe allows to reduce the level of enteric methane produce per unit of lambs or milk. The mass-unit productivity strongly affects the environmental impact of the farm;

4) **Manure/slurry production and storage**: Methane, dinitrogen monoxide, nitrous oxide, and ammonia emissions related to manure management represent a relevant environmental critical point. When animals are inside, the manure/slurry production has a higher impact on the environment than when animals are outside;
5) **Effluents production:** regarding the effluents (washing water, chemical products), this is a relevant environmental critical point;
6) **Feed self-sufficiency:** purchased feed, in particular soybean-based concentrate, represents an important source of environmental impacts. Reaching a self-sufficiency allows to reduce the environmental impacts of the concentrates production and transport;
7) **Use of fossil fuel**: on-farm feed based on intensive crops cultivation, that implies several agricultural operations such as deep ploughing, repeated soil mowing or fertilizer use, demand large fossil fuel consumption which represents an important environmental hotspot. Keeping the animals outside, with a low level of harvesting allows to reduce fuel consumption;
8) **Water consumption**: direct and indirect use of water represents a relevant environmental critical point both for global water scarcity and energy demand for water pumping and displacement;
9) **Electricity consumption**: As for all the energies, the use of electricity has an impact on the environmental impact. Nevertheless, the use of renewable energy sources could improve the environmental performances, in particular when impacts are referred to the whole farm.

Finally, the template asked to provide a general view of the Global Impact that the adoption of the BP could have on the Environment: Atmosphere (emissions and air quality); Water (Use and quality); Land (Soil quality and degradation); Materials and energy (Use, waste reduction and disposal) and Biodiversity.

A further section has been added to appraise potential labour requirements, and social and animal welfare issues (if any) to its implementation, as well as a short paragraph summarizing the main "Take Home Messages".

2. Workflow of sustainability analyses

For sustainability analyses, the following workflow has been adopted:

- Step 1: Farmers, advisors and researchers involved in the development of the BP drew up preliminary analyses.
- Step 2: The STWG revised the preliminary analyses and highlighted controversial and/or unclear points.

For most countries, two more steps were perfomed:

- Step 3 : Farmers, advisors and researchers involved in the application of the BP drew up new analyses including the observations of the STWG;
- Step 4: The NW discussed and approved all the analyses.

Summary of contents

Below we report for 49 of the 51 BP included in deliverable 3.4 - Translation and adaptation of each of the Best Practices that were selected by the other countries:

- the list of Sustainability analyses with the corresponding short summarising paragraph including “take home messages”.
- The complete sheet for each BP.

Due to an internal reorganization, Hungary was not able to provide sustainability analyses on time. A new version of this deliverable will be submitted in a couple of weeks.

Country	N of Best Practices	N of Sustainability analyses
France	7	7
Greece	4	4
Hungary	2	2
Ireland	9	9
Italy	7	7
Spain	9	9
Turkey	6	6
UK	7	7
Total	**51**	**49**

List and short summarising paragraphs of Sustainability analyses

With the vetch-oat combination, the farmer increases its forage production thus its feed self-efficiency. On-farm extra production decreases the purchase of forage and then environmental impacts of transport.

With the vetch-oat combination, there is no additional consumption of fuel at seeding by hectare, but an extra forage production. The fuel consumption/ton of forage is then reduced for the farmer. This has to be nuanced by extra fuel consumption for harvesting (see contractor charges).

No aspects of social sustainability have been identified.

This solution does not have any impact on fuel, electricity or water consumption, but allows for a better feeding management. But better feeding increases the emissions.

These solution does not have a high impact on the global environment, but if there is more meat production the weight of the animal is higher. The bigger animals causes a bit more emission. So the more production means more emissions (greenhouse gases, etc.) And bigger animals needs more water intake too.

This solution does not have any impact on fuel, electricity or water consumption, but the vaccination approves more biohazardous waste. These solution does not have a high impact on the global environment. The more production means more emissions (greenhouse gases, etc.), so the environment is a bit bigger impact. If our animal is larger their intake (feed, water etc.) will be slightly expanded.

Reducing lameness improves feed and grazing efficiency as the animals have an improved growth rate and are slaughtered earlier. Greenhouse gas emissions per kg of carcass is reduced due to improved animal performance. Slight increase in effluents production and water use due to disposal of footbath solution.

A reduction in flock lameness improves animal welfare, creates a better work environment and reduces physical labour, all of which has a positive effect on farmer image.

Reducing Clostridial and Pasteurella diseases reduces lamb and ewe mortality, thus increasing the number of animals drafted for slaughter and ewe productivity i.e. lambs reared per ewe joined.

A reduction in Clostridial and Pasteurella diseases improves animal welfare and creates a better work environment, all of which has a positive effect on farmer image.

Controlling external parasites improves feed efficiency as the animals have an improved growth rate and are slaughtered earlier. There is a slight increase in effluent production and water use due to disposal of the dipping solution.

A reduction in external parasites improves animal welfare, creates a better work environment and reduces physical labour, all of which have a positive effect on farmer image.

Other positive impacts are expected on the animal welfare, farmer “image”, work environment and physical labour.

The implementation of this solution leads to a better environmental condition due to a reduction in the ammonia load. Consequently, animals will have a better health status and a better feed efficiency as well. On the other hand, the good bedding management will produce a better manure quality more suitable for environmental practices. In addition, the more environmental conditions, the less ventilation power costs, therefore, this solution can save energy in buildings with mechanical ventilation devices.

As we have mentioned previously, the animal welfare goes up due to the better environmental conditions. It improves the labour in the farm and the image of the company, reducing bad smell and improving the landscape attraction.

A good management of the milking machine and equipment leads to an increase of the feeding efficiency and to a better animal welfare condition. Therefore, the implementation of this solution can improve the efficiency of the use of water and energy and the improvement of the environmental conditions.

In addition, the image of the farm is better and the work conditions are more suitable for the social sustainability.

The implementation of this solution leads to a better replacement planification with a reduction of the replacement period and a more accurate feeding schedule. Consequently, it means an increment of the feeding, grazing and feed-self efficiency.

Besides, the feeding plan set up the feeding schedule and the group of animals, therefore, the animal welfare is better. The planification allows the family to organise better the labour improving the social sustainability and the image of the company.

This solution generates a positive impact in terms of higher intake and efficiency in feed consumption and better grazing management, due to the reduction of lameness. However, it requires the use of more water and disinfectants, which implies the generation of waste from disinfectant containers. In terms of biodiversity, we consider that there may be an improvement due to the reduction of the presence of pathogens.

The lower incidence of footrot and lameness on the farm involves lower labour needs, and greater peace of mind for the farmer. In addition to the improvement of the image of the sector, and the overall benefit of reducing the use of antibiotics and analgesics, perfectly aligned with the "One Health" strategy.

A good deworming programme and the use of specific anthelmintic products improve feed conversion efficiency, decreases the parasite load of grasslands and reduce the number of plastic packages used. As a result of healthier sheep, the methane enteric emission is expected to decrease. Also, since the antiparasitic treatments are only applied when required (after

coprological analysis and only to infested group of sheep), the amount of residues generated is lower, and so the incidence on the soil microfauna.

Fewer but more effective anthelmintic treatments allow the farmer to have more leisure time, improve animal health and welfare, and reduce side effects on soil organisms caused by degradation products, improving biodiversity and functionality of pastures.

Improving animal health and welfare will improve feed conversion, body condition, ewe prolificity and milk production, and will be able to use pastures longer in the season. Healthier animals and more productive flocks, also allow decreasing the enteric methane emissions and the carbon footprint of the activity.

Preventive measures reduce the use of pest control products, allowing the farmer more free time, improving animal health and welfare and reducing side effects on soil organisms caused by degradation products, which decreases biodiversity and pasture functionality.

The implementation of this solution means higher use of medicines and vaccines, and therefore generates a significant environmental impact due to the production of waste, dirty water and plastic debris. However, its impact in terms of biodiversity and generation of high quality compost is very positive, as a consequence of the reduction in the use of medicines (antibiotics, anti-inflammatory treatments, etc.) that is expected with its application.

The prevention of the appearance of diseases in a flock is probably the factor that has the greatest economic and social impact both internally in the flock itself and in society in general, due to the impact it has on the image of the sector, as well as the implications on the health of the population in general. Any solution that prevents the use of drugs will be aligned with the “One health” strategy.

The implementation of cleaner milking routines means the utilisation of more hot water and disinfectant products both for the udder of the sheep and for the milking equipment (machine and deposits). In addition to higher water and energy consumption, more effluents (dirty water) are generated.

The implementation of preventive measurements around milking and the achievement of better sanitary status of the sheep, involves less incidence of mastitis and as a result less application of antibiotics and veterinary treatments. Therefore, this solution is aligned with the objectives of the “One Health” strategy. The incidences of hazards around milking should be less frequent, milking routines may become more regular and easier to be implemented, and as a result, more satisfaction for the farmer.

The implementation of this solution aims to improve the quality of home-produced forages, and therefore should lead to a lower dependence from concentrates and feeding inputs from abroad, and so to decrease the associated negative impacts (deforestation, transport, etc.). Also, the utilisation of higher quality forages is related to an improvement in the digestibility and lower methane emissions from ruminant fermentation. Since less poor-quality forages are made, in the case of plastic bales, less waste is generated.

Reducing stress at weaning benefits the welfare of the lambs.

This solution decreases the use of anthelmintic treatment and products, and only target the animals that do not cope with worm infection. It reduces the dejection of resistant worms on pastures, the leaching of anthelmintic treatments in the soil. Less product is used, so fewer plastic bottles to dispose of. It increases grazing efficiency as the approach requires the farmer to measure grass production regularly, thus informing on grass availability. It does not compromise lamb growth.

The solution reduces resistance to anthelmintic products, reduces farm labour, as there are less animals to treat, it improves animal welfare by only targeting animal that needs treatment, it improves farmer's image by reducing potential leaching of medicine in the environment, and improve the environment (better for the microbiofauna).

This solution does not have any impact on fuel, electricity or water consumption, but allows for a better grazing management and feeding of the animals, with a lower reliance on bought-in concentrates. In turn, the output from the animal is potentially increasing by 10%, due to a better feed management.

The solution does not have a major impact on the global environment, apart for perhaps a reduction in disposal of plastic, as less plastic bags of concentrates are needed, since the guidelines focus on using silage and grazing instead of concentrates.

Grazing efficiency is improved as animals that start being lame are being identified earlier. The water quality may be improved, as less footbath product is potentially released. There is less need for product disposal. This may improve biodiversity. It also has a beneficial effect on the animal productivity.

This solution also improves animal welfare, by targeting animals early, and by extension, improve farmer's image by using less treatment. It could also improve health and safety for farmers, as less footbath (and product) is potentially needed, and by extension reduces physical labour.

This solution improves feed efficiency per ewe, as Johnes disease will impact nutrient absorption in the gut. Less supplementary feed may also need to be given as ewes will retain body condition score better.

This solution improves feed efficiency per ewe, as Johnes disease will impact nutrient absorption in the gut. OPA will also impact the feed efficiency of ewes, by general debilitation. Less supplementary feed may also need to be given as ewes will retain body condition score better.

Solutions from France

Rationing ewe lambs for better udder development

Need/issue: Knowledge of nutritional requirements in different stages of development, Weaning transition management
Topic: Nutrition
Country: France
Dairy or/and meat sheep: Dairy
Category of Animal (ewe, replacement, lamb): Replacement

Short description of the "benchmark" farm for which the analysis is performed:
Dairy farm, lambing end of October, 30 % replacement rate.
Possibility of weighing the animals and putting ewe lambs into batches depending on their bodyweight.

Cost benefit analysis

• **Additional Costs (in green, items related to environmental evaluation too)**				
	Increase	Decrease	Percentage	Euro
– Fuel	☐	☐	… %	… €
– Labour (man-hours)[1]	☒	☐	… %	… €
– Equipment/materials (e.g. weigh scales, formalin etc.)	☐	☐	… %	… €
– Feeding : concentrates[2]	☐	☒	… %	- 2 €/ewelamb
– Feeding : forages	☒	☐	… %	0.5-1 €/ewelamb
– Electricity	☐	☐	… %	… €
– Water (water, troughs, piping etc.)	☐	☐	… %	… €
– Seed	☐	☐	… %	… €
– Fertilizer	☐	☐	… %	… €
– Sprays (herbicides, pesticides etc.)	☐	☐	… %	… €
– Contractor charges (ploughing, spraying, harvesting etc.)	☐	☐	… %	… €
– Medicine (antibiotics, anthelmintics, vaccinations)	☐	☐	… %	… €
– Technical advise	☐	☐	… %	… €
– Vet services	☐	☐	… %	… €
– Lab services	☐	☐	… %	… €
– Other external services	☐	☐	… %	… €
- Others (specify):	☐	☐	… %	… €

Total	☐	☒		- 1 €/ewelamb
• **Additional Incomes**				
	Increase	Decrease	Percentage	Euro
– Output per ewe (e.g. meat, milk, wool)	☒	☐	… %	… €
– Quality bonus (carcass confirmation, fat and protein composition etc.)	☐	☐	… %	… €
– Farm schemes and direct payments	☐	☐	… %	… €
Others (specify): ……	☐	☐	… %	… €
Total	☒	☐		
Average increase in earning (per ewe, ha, etc.)			(€/…)	**… €**

Notes:

[1] depends on equipment, if there were batches already made or not, …
[2]30 days eating 600 g instead of 800 g or more = 200 g saved of concentrates costing about 350 € per ton. 0,2 kg * 30 days * 350 €/t = 2 €/ewe
[32]It has never been measured but there is a benefit of having less fat tissue in the udder along the career

Cost benefit analysis conclusion*:*

By dividing ewelambs into batches on their bodyweight, and rationing them on the concentrate level, they develop less fat tissue in the udder and more secretive tissue. On a career point of view, they produce more and longer. In the meantime, it allows to save some concentrate, the equivalent of 2 e per ewelamb in a 30 days period.

Sustainability analysis

Environmental indicators	Increase	Decrease	Not applicable
Feed efficiency	☒	☐	☐
Grazing efficiency	☐	☐	☒
Feed self-sufficiency	☒	☐	☐
Manure/slurry “production”	☐	☐	☒
Effluents “production” (water for washing milking machine or with chemical treatment for footbath)	☐	☐	☒
Waste (plastics, etc.)	☐	☐	☒

Global Environmental assessment	Positive	Negative	No change
Atmosphere (Emissions and air quality)	☐	☐	☒

Water (Use and quality)	☐	☐	☒
Land (Soil quality and degradation)	☐	☐	☒
Materials and energy (Use, waste reduction and disposal)	☐	☐	☒
Biodiversity	☐	☐	☒

Other benefits	
• More leisure/family time	☐
• Improved animal welfare	☐
• Improved farm/farmer "image" (social acceptance)	☐
• Better work environment	☐
• Improve health and safety for farmers	☐
• Less physical labour	☐
• Improve environment/landscape	☐
• Improve biodiversity	☐
• Other (specify) ……..	☐

Sustainability analysis conclusion

By rationing concentrates and introducing cereals instead of a commercial feed, feed self-sufficiency is improved. Udder is more efficient in producing milk and at the end the animals efficiency is then also improved.

No other benefit can be related.

Herbvalo - knowing the valorisation of grass on your grassland

Need/issue: Grassland and grazing management

Topic: Nutrition

Country: France

Dairy or/and meat sheep: Dairy and meat
Category of Animal (ewe, replacement, lamb): Ewes

Short description of the "benchmark" farm for which the analysis is performed:
Meat farm, 400 ewes, 1 lambing per year, classical rotational grazing.

Cost benefit analysis

• **Additional Costs (in green, items related to environmental evaluation too)**				
	Increase	Decrease	Percentage	Euro
– Fuel	☐	☐	… %	… €
– Labour (man-hours)[1]	☒	☐	3 %	… €
– Equipment/materials (e.g. weigh scales, formalin etc.)	☐	☐	… %	… €
– Feeding : concentrates	☐	☐	… %	… €
– Feeding : forages	☐	☐	… %	… €
– Electricity	☐	☐	… %	… €
– Water (water, troughs, piping etc.)	☐	☐	… %	… €
– Seed[2]	☒	☐	… %	… €
– Fertilizer[3]	☐	☒	… %	… €
– Sprays (herbicides, pesticides etc.)	☐	☐	… %	… €
– Contractor charges (ploughing, spraying, harvesting etc.)	☐	☐	… %	… €
– Medicine (antibiotics, anthelmintics, vaccinations)	☐	☐	… %	… €
– Technical advise[4]	☒	☐	… %	250 €/year
– Vet services	☐	☐	… %	… €
– Lab services	☐	☐	… %	… €
– Other external services	☐	☐	… %	… €
- Others (specify):	☐	☐	… %	… €
Total	☐	☐		
• **Additional Incomes**				
	Increase	Decrease	Percentage	Euro
– Output per ewe (e.g. meat, milk, wool)	☒	☐	… %	… €

– Quality bonus (carcass confirmation, fat and protein composition etc.)	☐	☐	… %	… €
– Farm schemes and direct payments	☐	☐	… %	… €
Others (specify): ……	☐	☐	… %	… €
Total	☐	☐		
Average increase in earning (per ewe, ha, etc.)			(€/…)	**…** €

Notes:

[1] 1h per week
[2] Possibly an increase the first years for various tests but stabilization after
[3] Optimization therefore decrease in use of fertilizer and less manure input
[4] 1 visit for technical advice per year = 250 €
[5] Depends on the system on which it is conducted and the possible margins of progress

Cost benefit analysis conclusion

Herbvalo aims to maximize the use of grass and then increase grazing. With a better gestion of parcels, it helps reducing the use of fertilizer and manure input. With one visit to discuss the results of the year, it quickly leads to a better use of resources. It takes more time at the beginning to get used to its use, but then it gets easier and more natural.

Sustainability analysis

Environmental indicators	Increase	Decrease	Not applicable
Feed efficiency	☐	☐	☒
Grazing efficiency	☒	☐	☐
Feed self-sufficiency	☒	☐	☐
Manure/slurry “production”	☐	☒	☐
Effluents “production” (water for washing milking machine or with chemical treatment for footbath)	☐	☐	☒
Waste (plastics, etc.)	☐	☐	☒

Global Environmental assessment	Positive	Negative	No change
Atmosphere (Emissions and air quality)	☒	☐	☐
Water (Use and quality)	☒	☐	☐
Land (Soil quality and degradation)	☐	☐	☒
Materials and energy (Use, waste reduction and disposal)	☐	☐	☒
Biodiversity	☒	☐	☐

Other benefits	
• More leisure/family time	☐
• Improved animal welfare	☐
• Improved farm/farmer “image” (social acceptance)	☒
• Better work environment	☐
• Improve health and safety for farmers	☐
• Less physical labour	☐
• Improve environment/landscape	☒
• Improve biodiversity	☒
• Other (specify) ……..	☐

Sustainability analysis conclusion

Using less fertilizer and manure is better for the environment and air quality. Furthermore, by using more grazing, feed self-sufficiency is improved.

It is good for society to see animals grazing and leads to a better image. Also, the use of Herbvalo can lead to the implantation of hedges on pastures. Hedges are good for biodiversity as it is a home for some small animals.

Milking machine maintenance

Need/issue: Milking management (milking management, handling and available information)

Topic: Health / Management

Country: France

Dairy or/and meat sheep: Dairy
Category of Animal (ewe, replacement, lamb): Ewe

Short description of the "benchmark" farm for which the analysis is performed:
Dairy farm, 600 ewes, semi-intensive, 160,000 l sold to dairy company, equipped with a milking machine 18 stations 36 places, milking from the back

Cost benefit analysis

• **Additional Costs (in green, items related to environmental evaluation too)**				
	Increase	Decrease	Percentage	Euro
– Fuel	☐	☐	… %	… €
– Labour (man-hours)[1]	☒	☐	1 %	… €
– Equipment/materials (e.g. weigh scales, formalin etc.)	☐	☐	… %	… €
– Feeding : concentrates	☐	☐	… %	… €
– Feeding : forages	☐	☐	… %	… €
– Electricity[2]	☐	☒	-10 %	… €
– Water (water, troughs, piping etc.)	☐	☐	… %	… €
– Seed	☐	☐	… %	… €
– Fertilizer	☐	☐	… %	… €
– Sprays (herbicides, pesticides etc.)	☐	☐	… %	… €
– Contractor charges (ploughing, spraying, harvesting etc.)	☐	☐	… %	… €
– Medicine (antibiotics, anthelmintics, vaccinations)	☐	☐	… %	… €
– Technical advise[3]	☒	☐	… %	200 €
– Vet services	☐	☐	… %	… €
– Lab services	☐	☐	… %	… €
– Other external services[3]	☒	☐	… %	200 €
- Others (specify): consumables[4]	☒	☐	… %	720 €
Total [5]	☒	☒		
• **Additional Incomes**				
	Increase	Decrease	Percentage	Euro

– Output per ewe (e.g. meat, milk, wool)	☐	☐	… %	… €
– Quality bonus (carcass confirmation, fat and protein composition etc.)[6]	☒	☐	… %	10 €/1000 l
– Farm schemes and direct payments	☐	☐	… %	… €
Others (specify): ……	☐	☐	… %	… €
Total	☒	☐		
Average increase in earning (per ewe, ha, etc.)			(€/…)	**… €**

Notes:

[1]Maintenance time estimated to 20 hours / year + a bit of training at the beginning

[2] Potential gain in milking time (abt 10 min) + better functioning of the vacuum pump = less electricity (electricity of the milking machine post only)

[3] 0,5 day for technical advice to learn how to make good gestures + 0,5 day/y for milking machine consultant for global maintenance

[4] On the basis of the replacement of 36 clusters paid 20 € each (720 €)

[5] Time and expenses well compensated

[6] Actual bonus gain for a better milk quality in terms of germs

Cost benefit analysis conclusion

A preventive maintenance of milking machine has many benefits. As any electronical and mechanical machine, it allows a longer service life. Also, replacing clusters is long but well compensated on less sanitary problems. In a medium term, it means a shorter milking time, less electricity a better health of the flock. It is recommended to be accompanied during the first complete maintenance of the machine but after that it is possible to be autonomous.

Sustainability analysis

Environmental indicators	Increase	Decrease	Not applicable
Feed efficiency	☐	☐	☒
Grazing efficiency	☐	☐	☒
Feed self-sufficiency	☐	☐	☒
Manure/slurry “production”	☐	☐	☒
Effluents “production” (water for washing milking machine or with chemical treatment for footbath)	☐	☒	☐
Waste (plastics, etc.)	☐	☐	☒

Global Environmental assessment	Positive	Negative	No change
Atmosphere (Emissions and air quality)	☐	☐	☒
Water (Use and quality)	☒	☐	☐
Land (Soil quality and degradation)	☐	☐	☒

Materials and energy (Use, waste reduction and disposal)	☒	☐	☐
Biodiversity	☐	☐	☒

Other benefits	
• More leisure/family time	☒
• Improved animal welfare[7]	☒
• Improved farm/farmer "image" (social acceptance)	☒
• Better work environment	☒
• Improve health and safety for farmers	☐
• Less physical labour	☐
• Improve environment/landscape	☐
• Improve biodiversity	☐
• Other (specify) ……..	☐

[7]One welfare : farmer welfare + animal welfare : virtuous circle of maintenance

Sustainability analysis conclusion

A better maintenance of the milking machine means a shorter milking time and a better efficiency of the machine that both lead to less electricity used. The efficiency of cleaning is also improved and is leading to less water used and less effluents in the meantime.

A shorter milking time has an impact on workload, at early hours of the day which can be significant. Some health problems can be avoided by a better efficiency of the machine which means a better animal welfare, in a virtuous context of One Welfare.

Coprology control after antiparasite treatment

Need/issue: Internal parasitism (e.g. Liver Fluke, Gastrointestinal, Haemonchus, Coccidiosis, Cryptosporidiosis, worms, etc.)

Topic: Health/Management

Country: France

Dairy or/and meat sheep:
Category of Animal (ewe, replacement, lamb): All

Short description of the "benchmark" farm for which the analysis is performed:
Meat sheep farm, 400 ewes, semi-intensive, 2 lambing period, grazing all the year.

Cost benefit analysis

• **Additional Costs (in green, items related to environmental evaluation too)**				
	Increase	Decrease	Percentage	Euro
– Fuel	☐	☐	… %	… €
– Labour (man-hours) [1]	☒	☐	1,5 %	… €
– Equipment/materials (e.g. weigh scales, formalin etc.) [2]	☒	☐	… %	2 € / analysis
– Feeding : concentrates [3]	☐	☒	… %	… €
– Feeding : forages	☐	☐	… %	… €
– Electricity	☐	☐	… %	… €
– Water (water, troughs, piping etc.)	☐	☐	… %	… €
– Seed	☐	☐	… %	… €
– Fertilizer	☐	☐	… %	… €
– Sprays (herbicides, pesticides etc.)	☐	☐	… %	… €
– Contractor charges (ploughing, spraying, harvesting etc.)	☐	☐	… %	… €
– Medicine (antibiotics, anthelmintics, vaccinations) [4]	☐	☒	… %	-1 €/ ewe
– Technical advise	☐	☐	… %	… €
– Vet services [5]	☒	☐	… %	200 €
– Lab services [6]	☒	☐	… %	60 €
– Other external services	☐	☐	… %	… €
- Others (specify):	☐	☐	… %	… €
Total	☐	☐		
• **Additional Incomes**				
	Increase	Decrease	Percentage	Euro
– Output per ewe (e.g. meat, milk, wool)	☐	☐	… %	… €

– Quality bonus (carcass confirmation, fat and protein composition etc.) [7]	☒	☐	… %	… €
– Farm schemes and direct payments	☐	☐	… %	… €
Others (specify): ……	☐	☐	… %	… €
Total	☐	☐		
Average increase in earning (per ewe, ha, etc.)			(€/…)	**… €**

Notes:

[1] Time to identify ewes per group, time to collect samples at day 0 and mix them, time to treat one of the groups with the drug to test, time to collect samples at day 14 and mix them, time to discuss the results = 10 h (calculated on 2200 h of work hours)
[2] small material = small plastic bags 0,05 €/bag, 20 ewes to collect * 2 rounds of samples = 2 € for the protocol
[3] Not measurable but if ewes are well treated, they will globally have a better health and then be more efficient (eat less and valorise everything better)
[4] When you know a medicine is not efficient any more you are not treating animals unnecessarily. On the basis of one treatment of the all flock not realized, 1 €/ewe = 400 €
[5] Vet visit and advice = 200 € per protocol
[6] 15 € per analysis, 2 analysis per group
[7] If parasitism is better managed, animals treated when they need, they can be ready sooner

Cost benefit analysis conclusion:

It's difficult to analyze the cost benefit ratio for this solution. The main objective of this solution is to have a better knowledge of the efficiency of a medicine on the pathogens you encounter in your farm and especially, to identify any resistance to the products usually used.

The additional costs identified are : 10h labor to collect the samples and discuss the results, 2€ of plastic bags or gloves, 200€ for the visit of the vet and 60€ for the analysis (4 analysis, 15€ each).

To have a better knowledge of the products which are efficient will allow to have a better health management so a better quality of the products, a better feed efficiency and a reduction of useless treatment. Those benefits are difficult to evaluate.

Sustainability analysis

Environmental indicators	Increase	Decrease	Not applicable
Feed efficiency	☒	☐	☐
Grazing efficiency	☒	☐	☐
Feed self-sufficiency	☐	☐	☒
Manure/slurry "production"	☐	☐	☒

Effluents "production" (water for washing milking machine or with chemical treatment for footbath)	☐	☐	☒
Waste (plastics, etc.)	☐	☐	☒

Global Environmental assessment	Positive	Negative	No change
Atmosphere (Emissions and air quality)	☐	☐	☒
Water (Use and quality)	☐	☐	☒
Land (Soil quality and degradation)	☒	☐	☐
Materials and energy (Use, waste reduction and disposal)	☐	☐	☒
Biodiversity	☒	☐	☐

Other benefits	
• More leisure/family time	☐
• Improved animal welfare	☒
• Improved farm/farmer "image" (social acceptance) [8]	☒
• Better work environment	☐
• Improve health and safety for farmers	☐
• Less physical labour	☐
• Improve environment/landscape	☐
• Improve biodiversity	☒
• Other (specify) ……..	☐

Notes: [8] This solution aims to a better knowledge of treatment efficiency, so animals are beneficiating of this, are in better health and using less treatment is good from social point of view.

Sustainability analysis conclusion

A better feed efficiency will improve the global environmental impact and reduce the level of GHG per product unit. A reduction of the useless medicines used will allow a reduction of the discharges on the soil and reduce the impacts on the soil biodiversity.

Regarding the social indicators, this solution will allow a better animal welfare with an improvement of the health level of the flock and a better image of the farm with the reduction of the chemical products used.

When and how to bring minerals?

Need/issue: Minerals and vitamins supplementation

Topic: Nutrition

Country: France

Dairy or/and meat sheep: Meat
Category of Animal (ewe, replacement, lamb): Ewes

Short description of the "benchmark" farm for which the analysis is performed:
Flock of 400 heads, semi-intensive.

Cost benefit analysis

• **Additional Costs (in green, items related to environmental evaluation too)**				
	Increase	Decrease	Percentage	Euro
– Fuel	☐	☐	… %	… €
– Labour (man-hours)	☐	☐	… %	… €
– Equipment/materials (e.g. weigh scales, formalin etc.)	☐	☐	… %	… €
– Feeding : concentrates	☐	☐	… %	… €
– Feeding : forages	☐	☐	… %	… €
– Electricity	☐	☐	… %	… €
– Water (water, troughs, piping etc.)	☐	☐	… %	… €
– Seed	☐	☐	… %	… €
– Fertilizer	☐	☐	… %	… €
– Sprays (herbicides, pesticides etc.)	☐	☐	… %	… €
– Contractor charges (ploughing, spraying, harvesting etc.)	☐	☐	… %	… €
– Medicine (antibiotics, anthelmintics, vaccinations) [1]	☐	☒	-5 %	… €
– Technical advise	☐	☐	… %	… €
– Vet services	☐	☐	… %	… €
– Lab services	☐	☐	… %	… €
– Other external services	☐	☐	… %	… €
- Others (specify): minerals [2]	☒	☐	… %	3 € / ewe
Total	☐	☐		
• **Additional Incomes**				
	Increase	Decrease	Percentage	Euro
– Output per ewe (e.g. meat, milk, wool) [3]	☒	☐	… %	… €

– Quality bonus (carcass confirmation, fat and protein composition etc.)	☐	☐	… %	… €
– Farm schemes and direct payments	☐	☐	… %	… €
Others (specify): ……	☐	☐	… %	… €
Total	☐	☐		
Average increase in earning (per ewe, ha, etc.)			(€/…)	**… €**

Notes:

[1] Moins d'antibios sur les agneaux
[2] On the basis of 1 call to the vet not made because the flock is in better global health
[3] Animals without deficiencies have a better growth and are ready sooner. Better flock fertility

Cost benefit analysis conclusion

Improve the level of mineral income will cost approximately 3€ per ewe (French reference), but can reduce the medicine cost by 5% because the flock will be in better health. A good level of mineral input will allow a better fertility of the ewes and a better productivity of the flock.

Sustainability analysis

Environmental indicators	Increase	Decrease	Not applicable
Feed efficiency	☒	☐	☐
Grazing efficiency	☒	☐	☐
Feed self-sufficiency	☐	☐	☒
Manure/slurry "production"	☐	☐	☒
Effluents "production" (water for washing milking machine or with chemical treatment for footbath)	☐	☐	☒
Waste (plastics, etc.)	☐	☐	☒

Global Environmental assessment	Positive	Negative	No change
Atmosphere (Emissions and air quality)	☐	☐	☒
Water (Use and quality)	☐	☐	☒
Land (Soil quality and degradation) [4]	☒	☐	☐
Materials and energy (Use, waste reduction and disposal)	☐	☐	☒
Biodiversity [4]	☒	☐	☐

Other benefits	
• More leisure/family time	☐
• Improved animal welfare	☒

• Improved farm/farmer “image” (social acceptance)	☐
• Better work environment	☐
• Improve health and safety for farmers	☐
• Less physical labour	☐
• Improve environment/landscape	☐
• Improve biodiversity	☒
• Other (specify) ……..	☐

[4] minerals are not totally assimilated by the ewe and go back to the soil, with a potential positive impact on biodiversity.

Sustainability analysis conclusion

A good mineral complementation will allow a better flock efficiency, so a reduction of the GHG emission per product unit. As minerals are not totally assimilated by the ewe and go back to the soil, it can generate a potential positive impact on biodiversity.

Regarding the social indicators, with a good mineral complementation, animals are in better health, so the welfare of the flock is improved.

Mixed grazing of cattle and sheep to limit parasite infestation

Need/issue: Internal parasitism (e.g. Liver Fluke, Gastrointestinal, Haemonchus, Coccidiosis, Cryptosporidiosis, worms, etc.)

Topic: Health / management

Country: France

Dairy or/and meat sheep: dairy and meat
Category of Animal (ewe, replacement, lamb): Ewe

Short description of the "benchmark" farm for which the analysis is performed:
Farm with 500 ewes – 80 cows, semi extensive.

Cost benefit analysis

• **Additional Costs (in green, items related to environmental evaluation too)**				
	Increase	Decrease	Percentage	Euro
– Fuel	☐	☐	… %	… €
– Labour (man-hours)	☐	☐	… %	… €
– Equipment/materials (e.g. weigh scales, formalin etc.) [1]	☒	☐	10 %	0.25 €/ewe/y
– Feeding : concentrates [2]	☐	☒	-15 %	-4€ / ewe/y
– Feeding : forages	☐	☐	… %	… €
– Electricity	☐	☐	… %	… €
– Water (water, troughs, piping etc.)	☐	☐	… %	… €
– Seed	☐	☐	… %	… €
– Fertilizer	☐	☐	… %	… €
– Sprays (herbicides, pesticides etc.)	☐	☐	… %	… €
– Contractor charges (ploughing, spraying, harvesting etc.)	☐	☐	… %	… €
– Medicine (antibiotics, anthelmintics, vaccinations) [3]	☐	☒	-15 %	- 0,1 €/ewe
– Technical advise	☐	☐	… %	… €
– Vet services	☐	☐	… %	… €
– Lab services	☐	☐	… %	… €
– Other external services	☐	☐	… %	… €
- Others (specify):	☐	☐	… %	… €
Total	☐	☒		- 4,25 €/ewe
• **Additional Incomes**				
	Increase	Decrease	Percentage	Euro
– Output per ewe (e.g. meat, milk, wool) [4]	☒	☐	3 %	… €

– Quality bonus (carcass confirmation, fat and protein composition etc.)	☐	☐	… %	… €
– Farm schemes and direct payments	☐	☐	… %	… €
Others (specify): ……	☐	☐	… %	… €
Total	☐	☐		
Average increase in earning (per ewe, ha, etc.)			(€/…)	**… €**

Notes:

[1] Amortization of fence-related expenses : 10,000 m fence for 500 ewes = 20 m/ewe. Additional cost per meter = 0,20 €/m = 0,25 €/ewe/year

[2] Less lambs finished inside, less competition for the grass at mating period. In a recent study, a bit more than 10 kg/ewe/y of concentrates saved (-15 % in the experiment)

[3] Less anthelmintic treatments against gastrointestinal worms (-0,5 tt/ewe/year)

[4] Carcass weight increased by 3 % in the study

Cost benefit analysis conclusion

This solution needs that all the fences are adapted to the sheep. To implement it, it can require installing new fences. With the amortisation, we estimate an additional cost of 0.25€ per ewe and per year. On the other hand, less lambs will be finished inside, which will allow to reduce the concentrates consumption by 10kg or 4€ per ewe and per year. A reduction of anthelmintic treatment will allow a saving of 0.1€ per ewe.

Sustainability analysis

Environmental indicators	Increase	Decrease	Not applicable
Feed efficiency	☒	☐	☐
Grazing efficiency	☒	☐	☐
Feed self-sufficiency	☒	☐	☐
Manure/slurry “production”	☐	☒	☐
Effluents “production” (water for washing milking machine or with chemical treatment for footbath)	☐	☐	☐
Waste (plastics, etc.)	☐	☐	☐

Global Environmental assessment	Positive	Negative	No change
Atmosphere (Emissions and air quality)	☒	☐	☐
Water (Use and quality)	☐	☐	☐
Land (Soil quality and degradation)	☒	☐	☐
Materials and energy (Use, waste reduction and disposal)	☐	☐	☐
Biodiversity	☒	☐	☐

Other benefits	
• More leisure/family time	☐
• Improved animal welfare	☒
• Improved farm/farmer "image" (social acceptance)	☒
• Better work environment	☒
• Improve health and safety for farmers	☐
• Less physical labour	☐
• Improve environment/landscape	☐
• Improve biodiversity	☐
• Other (specify) ……..	☐

Sustainability analysis conclusion

With a better feed efficiency, and a reduction of manure produced, because lambs can be finished outside, we estimated this solution reduces the GHG emissions per kg carcass by 13% regarding a specialised system. A reduction of the use of anthelmintic will have a positive impact on the soils and the biodiversity.

Regarding the social impacts, this solution can improve the welfare of the flock, improving the health of the animals. And with less animals inside, it will improve the image of the farm and the work environment.

Well ventilated sheds

Need/issue: Sheep shed management (e.g. ventilation, temperature, space/ewe,…), Respiratory problems (e.g. pneumonia, coughing, breathing noise, etc.)

Topic: Heath and management

Country: France

Dairy or/and meat sheep: both
Category of Animal (ewe, replacement, lamb): all catégories

Short description of the "benchmark" farm for which the analysis is performed:
Sheep shed for ewes in lactation and fattening lambs, with adjustable offset cladding

Cost benefit analysis

• **Additional Costs (in green, items related to environmental evaluation too)**				
	Increase	Decrease	Percentage	Euro
– Fuel	☐	☐	… %	… €
– Labour (man-hours)	☐	☐	… %	… €
– Equipment/materials : adjustable offset cladding	☒	☐	… %	55 €/ewe for cladding
– Feeding : concentrates	☐	☐	… %	… €
– Feeding : forages	☐	☐	… %	… €
– Electricity	☐	☐	… %	… €
– Water (water, troughs, piping etc.)	☐	☐	… %	… €
– Seed	☐	☐	… %	… €
– Fertilizer	☐	☐	… %	… €
– Sprays (herbicides, pesticides etc.)	☐	☐	… %	… €
– Contractor charges (ploughing, spraying, harvesting etc.)	☐	☐	… %	… €
– Medicine (antibiotics, anthelmintics, vaccinations) [2]	☐	☒	… %	… €
– Technical advise	☐	☐	… %	… €
– Vet services	☐	☐	… %	… €
– Lab services	☐	☐	… %	… €
– Other external services	☐	☐	… %	… €
- Others (specify):	☐	☐	… %	… €
Total	☐	☐		+55€ / ewe
• **Additional Incomes**				
	Increase	Decrease	Percentage	Euro

– Output per ewe (e.g. meat, milk, wool) [2]	☒	☐	… %	… €
– Quality bonus (carcass confirmation, fat and protein composition etc.)	☐	☐	… %	… €
– Farm schemes and direct payments	☐	☐	… %	… €
Others (specify): ……	☐	☐	… %	… €
Total	☐	☐		
Average increase in earning (per ewe, ha, etc.)			(€/…)	**… €**

Notes:

[1] over cost of the adjustable cladding regarding classical cladding

[2] a good ventilation will generate a better sanitary status of the flock, especially regarding respiratory health. It will allow a reduction of the use of medicines and an increase of the productivity (in kg produce per ewe or in liter per ewe). This reduction of medicine and the increase of productivity are not measurable. (no reference in literature)

Cost benefit analysis conclusion

Allowing a better sanitary status, a good ventilation of the sheep shed will reduce the use and the costs of medicines and will increase the production per ewe. Those benefits are not measurable and depend of the farm and the local context. In France, the over cost for an adjustable offset cladding regarding a classical cladding is approximately 55€ per ewe housed.

Sustainability analysis

Environmental indicators	Increase	Decrease	Not applicable
Feed efficiency	☒	☐	☐
Grazing efficiency	☐	☐	☐
Feed self-sufficiency	☐	☐	☐
Manure/slurry “production”	☐	☐	☐
Effluents “production” (water for washing milking machine or with chemical treatment for footbath)	☐	☐	☐
Waste (plastics, etc.)	☐	☐	☐

Global Environmental assessment	Positive	Negative	No change
Atmosphere (Emissions and air quality)	☐	☐	☐
Water (Use and quality)	☐	☐	☒
Land (Soil quality and degradation)	☐	☐	☒
Materials and energy (Use, waste reduction and disposal)	☐	☐	☒
Biodiversity	☐	☐	☒

Other benefits	
• More leisure/family time	☐
• Improved animal welfare	☒
• Improved farm/farmer "image" (social acceptance)	☒
• Better work environment	☐
• Improve health and safety for farmers	☐
• Less physical labour	☐
• Improve environment/landscape	☐
• Improve biodiversity	☐
• Other (specify) ……..	☐

Sustainability analysis conclusion

Increasing the production per ewe, a good ventilation will allow a reduction of the environmental impact (GHG especially) per unit of production and a better feed efficiency. Regarding the ammoniac production, a too strong ventilation can increase the ammoniac production of the manure in the shed, transferred in the atmosphere.

Improving the health of the flock, a good ventilation will improve the welfare of the animals. The reduction of the medicines will participate to a better image of sheep farming and a better social acceptance.

Solutions from Greece

Methods to calculate vitamin and mineral content of feeds and pastures

Need/issue: Minerals and vitamins supplementation

Topic: Nutrition

Country: Greece

Dairy or/and meat sheep: Dairy
Category of Animal (ewe, replacement, lamb): Ewe

Short description of the "benchmark" farm for which the analysis is performed:
Dairy sheep farm of 300 ewes of 300 lt mean milk yield. Ewes' nutrition is based on pastures and self-produced feedstuffs (grains and hay) and purchased protein feedstuffs (soyabean meal, sunflower meal or cottonseed meal). Vitamins and mineral supplementation is based on fixed commercial premixes. Vitamin and mineral content of feeds and pastures are not known. Animals' vitamins and minerals requirements are known based on data base according to ewes' body weight, milk yield and grazing period. It is proposed that the farmer in order to ensure vitamins and minerals daily intake to meet ewes' requirements, proceed to chemical analysis in a laboratory, so as to know the precise mineral and vitamin content of the available feeds and pastures, at least once a year for grains (e.g. corn, barley, wheat), protein feedstuffs (e.g. soyabean meal, sunflower meal or cottonseed meal) and hay and twice a year for pastures samples. Then according to the data obtained, a supplementation program (unique premix for this farm) is created with the instructions and recommendation of the nutritionist to meet ewes' vitamins and minerals requirements. Cost is calculated for a reference of one (1) ewe per year.

Cost-benefit analysis

● **Additional Costs[1] (in green, items related to environmental evaluation too)**				
	Increase	Decrease	Percentage	Euro
– Fuel	☐	☐		.
– Labour (man-hours)	☐	☐		

[1] *It is estimated that vitamins and crucial macro-minerals (Ca, P, Mg, Na) and trace minerals (Se, I, Mn, Co, Zn, Fe) determination in feeds costs in a national laboratory 500,00€. Total cost 4.000,00. Cost per ewe: 4.000,00/300=13,33€.*
[2] *Percentage of increased the mean feed cost per ewe per year (200€/ewe) due to cost of lab services for vitamins and minerals determination in feeds.*
[3] *No published data concerning the actual cost benefits of vitamins and mineral supplementation exist. Literature refers to productive benefits from balanced vitamins and minerals supplementation that could increase farm profitability.*

– Equipment/materials (e.g. weigh scales, formalin etc.)	☐	☐		
– Feeding: concentrates	☐	☐		
– Feeding : forages	☐	☐		
– Electricity	☐	☐		
– Water (water, troughs, piping etc.)	☐	☐		
– Seed	☐	☐		
– Fertilizer	☐	☐		
– Sprays (herbicides, pesticides etc.)	☐	☐		
– Contractor charges (ploughing, spraying, harvesting etc.)	☐	☐		
– Medicine (antibiotics, anthelmintics, vaccinations)	☐	☐		
– Technical advise	☐	☐		
– Vet services	☐	☐		
– Lab services	☒	☐	6,66%[2]	13,33€/ewe[1]
– Other external services	☐	☐		
- Others (specify): ……	☐	☐		
Total	☒	☐	6,66%	13,33€/ewe

- **Additional Incomes**

	Increase	Decrease	Percentage	Euro
– Output (*improve ewes' reproduction efficiency, reduce the average number of days from lambing to re-breeding, increase lambs' survival, reduce the number of lambs treated for illness due to poor immunity early in life, increase the total weight of lambs weaned and ewes' milk yield, lower incidences of lameness, reduce energy and protein supplementation costs, and increase whole-farm profitability potential.*)[3]	☒	☐		
– Quality bonus *(ameliorate ewes' immune response, attenuates heat stress, diminished minerals & vitamins deficiencies, and minerals antagonism)*	☒	☐		
– Farm schemes and direct payments	☐	☐		
Others: *avoid minerals and vitamins excess – reduce cost for vitamins & minerals supplementation, avoid animal health problems*[3]	☒	☐		

TOTAL	☒	☐		
Average increase in earning (per ewe, ha, etc.)			(€/ewe)	

Cost benefit analysis conclusion

Regarding the cost, it increases due to mineral laboratory analyses needed, however the data collected from them allows for the information to be utilised for optimising ration formulation, decreasing feed costs, meet the actual needs of animals to minerals, improve flock reproductive and productive efficiency, improve animal health, translated to actual income for the farm.

Sustainability analysis

Environmental indicators	Increase	Decrease	Not applicable
Feed efficiency	☒	☐	☐
Grazing efficiency	☐	☐	☒
Feed self-sufficiency	☐	☐	☒
Manure/slurry "production"	☐	☒	☐
Effluents "production" (water for washing milking machine or with chemical treatment for footbath)	☐	☐	☒
Waste (plastics, etc.)	☐	☐	☒

Global Environmental assessment	Positive	Negative	No change
Atmosphere (Emissions and air quality)	☐	☐	☒
Water (Use and quality)	☐	☐	☒
Land (Soil quality and degradation)	☐	☐	☒
Materials and energy (Use, waste reduction and disposal)[2]	☐	☐	☒
Biodiversity	☐	☐	☒

Other benefits	
• More leisure/family time	☐
• Improved animal welfare	☒
• Improved farm/farmer "image" (social acceptance)	☐
• Better work environment (appeals to new entrants)	☐
• Less physical labour (suitable for females and aging farmers)	☐
• Improve environment/landscape	☐

2

● Improved animal health	☒

Sustainability analysis conclusion

Precise mineral nutrition avoids unnecessary mineral supplementation and costs. Additionally improves feed efficiency and animal productivity and decreases mineral loads in manure and potential environmental burden.

Optimal mineral nutrition has been proved to improve animal welfare and health by optimizing digestion processes, limiting lameness, controlling immune response and ameliorating heat stress.

Online history of grazing routes to remember and improve grazing routes in the next year.

Need/issue: Grassland and grazing management

Topic: Nutrition & Management

Country: Greece

Dairy or/and meat sheep: Both
Category of Animal (ewe, replacement, lamb): All

Short description of the "benchmark" farm for which the analysis is performed:
Dairy sheep farm, 1200 adult ewes, 100 ha of communal rangelands divided in 3 plots. Three groups of milked ewes (corresponding to 3 lambing periods) graze during 2h – 2h30 on the rangelands, from February until mid-May. Each group grazes on a different plot and is shepherded by a different person. In order to avoid mixing of flocks at grazing, each animal group leaves the sheep-barn at 20 minutes interval.

Cost-benefit analysis

• **Additional Costs**				
	Increase	Decrease	Percentage	Euro
– Fuel	☐	☐	… %	… €
– Labour (man-hours)	☒	☐	0.1 %1	… €
– Equipment/materials (e.g. weigh scales, formalin etc.)	☒	☐	0,05 %2	… €
– Feeding : concentrates	☐	☐	… %	… €
– Feeding : forages			… %	… €
– Electricity	☐	☐	… %	… €
– Water (water, troughs, piping etc.)	☐	☐	… %	… €
– Seed	☐	☐	… %	… €
– Fertilizer	☐	☐	… %	… €
– Sprays (herbicides, pesticides etc.)	☐	☐	… %	… €
– Contractor charges (ploughing, spraying, harvesting etc.)	☐	☐	… %	… €
– Medicine (antibiotics, anthelmintics, vaccinations)	☐	☐	… %	… €
– Technical advise	☐	☐	… %	… €
– Vet services	☐	☐	… %	… €
– Lab services	☐	☐	… %	… €
– Other external services	☐	☐	… %	… €
- Others (specify): ……	☐	☐	… %	… €
Total	☐	☐		

• **Additional Incomes**				
	Increase	Decrease	Percentage	Euro
– Output per ewe (e.g. meat, milk, wool)	☐	☐	… %	… €
– Quality bonus (carcass confirmation, fat and protein composition etc.)	☐	☐	… %	… €
– Farm schemes and direct payments	☐	☐	… %	… €
Others (specify): ……	☐	☐	… %	… €
Total	☐	☐		
Average increase in earning (per ewe, ha, etc.)			(€/…)	**… €**

Other benefits	
• More leisure/family time	☐
• Improved animal welfare3	☒
• Improved farm/farmer "image" (social acceptance)4	☒
• Better work environment (appeals to new entrants)	☐
• Less physical labour (suitable for females and aging farmers)	☐
• Improve environment/landscape5	☒
• Other: Better grazing management.	☒
• Other: multi-flock management and cooperation.	☒

Notes:

1 Farmer or farmers will initially need time to get to know the technology. Additionally, if farmers on the same grazing area cooperate to improve their grazing routes, they will need time to combine their track information and discuss possible solutions.
2 Cost of smartphone (if it doesn't exist) and possible telecommunication costs (if the farmer doesn't have a house internet connection or a mobile data plan)
3 By improving grazing routes
4 Through the use of modern technologies
5 By reducing over-grazing

Cost benefit analysis conclusion

The extra costs involving the purchase of a smartphone or the possible communication costs are small and in most cases the farmers already have both. The extra time needed for the farmer to learn the technology is negligible. The use of the technology can potentially cover the costs and increase the income by improving the grazing routes of the flock.

Sustainability analysis

Environmental indicators	Increase	Decrease	Not applicable

Feed efficiency	☐	☐	☒
Grazing efficiency	☒	☐	☐
Feed self-sufficiency	☐	☐	☒
Manure/slurry "production"	☐	☐	☒
Effluents "production" (water for washing milking machine or with chemical treatment for footbath)	☐	☐	☒
Waste (plastics, etc.)	☐	☐	☒

Global Environmental assessment	Positive	Negative	No change
Atmosphere (Emissions and air quality)	☐	☐	☒
Water (Use and quality)	☒	☐	☐
Land (Soil quality and degradation)	☒	☐	☐
Materials and energy (Use, waste reduction and disposal)	☐	☐	☒
Biodiversity	☒	☐	☐

Other benefits	
• More leisure/family time	☐
• Improved animal welfare	☒
• Improved farm/farmer "image" (social acceptance)	☒
• Better work environment	☐
• Improve health and safety for farmers	☒
• Less physical labour	☐
• Improve environment/landscape	☒
• Improve biodiversity	☒
• Other (specify) ……..	☐

Sustainability analysis conclusion

The technology brings no additional consumption of fuel, electricity, water etc. and thus having no negative environmental impact. The use of the method can potentially improve the productivity of the flocks by improving the grazing efficiency.

Besides improving the grazing efficiency of the flocks, the monitoring of the grazing routes and cooperation between farmers grazing in the same area can have positive environmental impact on the area. The landscape can be better utilised by the different flocks to minimise the negative grazing impact on soil and local biodiversity. Data on grazing routes from former years can also be used to better plan the present grazing routes considering the landscape protection and efficient use of the resources. Planned management of water sources in grazing areas is also possible to minimise water scarcity.

Control of Ovine Progressive Pneumonia (Maedi Visna) at farm level

Need/issue: Ovine Progressive Pneumonia (Maedi/Visna) belongs to the group of Iceberg diseases. Since there is no treatment or vaccine, the only way to control the disease is to apply specific management strategies at farm level.

Topic: HEALTH

Country: Greece

Dairy or/and meat sheep: dairy
Category of Animal (ewe, replacement, lamb): adult ewes and lambs

Short description of the "benchmark" farm for which the analysis is performed:
We compare:

- the case of an infected flock (more than 10% of the ewes) of Central Greece, with natural milk feeding of lambs, on which no corrective measures have been applied

- with the case of the same infected flock, on which corrective measures have been applied and artificial feeding of lambs and oestrus synchronization have been implemented in the frame of the control/eradication protocol.

In both cases weaning age is 45 days. The control /eradication protocol could be performed into any flock of ewes if the infected animals are >10%. The extra cost is for artificial feeding of new-born lambs (calculated for 100 lambs) and the synchronization of oestrous cycle and lambing (calculated by adult ewe).

Cost-benefit analysis

• **Additional Costs**				
	Increase	Decrease	Percentage	Euro
– Fuel	☐	☐	… %	… €
– Labour (man-hours)*	☐	☐	…. %	… €
– Equipment/materials (e.g. weigh scales, formalin etc.)**	☒	☐	… %	… €
– Feeding : concentrates	☐	☐	… %	… €
– Feeding : forages			… %	… €
– Electricity	☒	☐	< 10 %	… €
– Water (water, troughs, piping etc.)	☒	☐	< 10 %	… €
– Seed	☐	☐	… %	… €
– Fertilizer	☐	☐	… %	… €
– Sprays (herbicides, pesticides etc.)	☐	☐	… %	… €
– Contractor charges (ploughing, spraying, harvesting etc.)	☐	☐	… %	… €
– Medicine (antibiotics, anthelmintics, vaccinations)***	☒	☐	… %	6-10 € per ewe in GR
– Technical advice****	☒	☐	… %	… €

– Vet services****	☒	☐	… %	… €
– Lab services****	☒	☐	… %	~5 € per sample in GR
– Other external services	☐	☐	… %	… €
- Others (specify): ……..	☐	☐	… %	… €
Total	☐	☐		
• **Additional Incomes**				
	Increase	Decrease	Percentage	Euro
– Output (e.g. meat, milk, wool)	☒	☐	>50 %	… €
– Quality bonus (carcass confirmation, fat and protein composition etc.)	☐	☐	… %	… €
– Farm schemes and direct payments	☒	☐	… %	… €
Others (specify): selling of breeding males	☒	☐	100 %	… €
Total	☐	☐		
Average increase in earning (per ewe, ha, etc.)			(€/…)	**…** €

Notes:

1. The cost for artificial feeding machine and the milk powder can be covered from the extra milk that be shelled during artificial feeding.
2. The increased outputs can be estimated only roughly. However, from results on Chios farm (after the eradication program) milk production has been increased more than 50%. Additional outcome is generated by the selling of breeding animals. Obviously, the farm outcomes depend on many other factors.

* Due to estrous and lambing synchronization the increased labour at lambing can be limited in a few days (about 3) per week per groups of 50-100 ewes (depending on the farm capabilities).
** The cost for equipment will be increased because a feeding machine and milk powder must be bought. The cost for a feeding machine is evaluated to 6000 euros without VAT, while the cost for milk powder is evaluated to 2700€ for every 100 lambs fed during 45 days. The colostrum could be taken from safe cow farms (free from infectious diseases). It is difficult to evaluate the extra cost for water and electricity. In the case of Central Greece, the extra incomes (due to selling of milk instead of its consumption by lambs) exceeded extra costs for artificial feeding (including the purchase of the feeding machine) from the first year of implementation.
*** Estrous and lambing synchronization will be necessary for three years to reduce labour. No extra Vaccinations or anthelminthics are needed, except of those given routinely in the flock. Then, the cost for estrus synchronization and antibiotics will be decreased.
**** The cost for technical advice, vet and lab services will be increased during eradication / control program, but it will be reduced after the eradication of the flock. At least 2 extra visits for technical advice and vet services will be needed. As concern lab expenses, a percentage of animals must be checked before the eradication /control to find out the infection rate. After

eradication / control program all ewes must be checked and the infected and their offspring (infection rate less than 10%) musted be culled.

Cost benefit analysis conclusion

The Maedi Visna eradication / control program is expected to increase the milk yield and the farmer's income. The extra costs for the artificial feeding, estrous and lambing synchronization, technical advice and vet services are overcovered by the additional income that the farmer achieves.

Sustainability analysis

Environmental indicators	Increase	Decrease	Not applicable
Feed efficiency	☒	☐	☐
Grazing efficiency	☐	☐	☒
Feed self-sufficiency	☐	☐	☒
Manure/slurry "production"	☐	☐	☒
Effluents "production" (water for washing milking machine or with chemical treatment for footbath)	☐	☐	☒
Waste (plastics, etc.)	☐	☐	☒

Global Environmental assessment	Positive	Negative	No change
Atmosphere (Emissions and air quality)	☒	☐	☐
Water (Use and quality)	☐	☐	☒
Land (Soil quality and degradation)	☐	☐	☒
Materials and energy (Use, waste reduction and disposal)	☐	☐	☒
Biodiversity	☐	☐	☒

Other benefits	
• More leisure/family time	☐
• Improved animal welfare	☒
• Improved farm/farmer "image" (social acceptance)	☒
• Better work environment	☒
• Improve health and safety for farmers	☐
• Less physical labour	☐
• Improve environment/landscape	☒
• Improve biodiversity	☐
• Other (specify) ……..	☐

Sustainability analysis conclusion

As a consequence of the increase of milk production after Maedi Visna eradication/control, the farmers could decrease the numbers of animals and the environmental indicators, and the atmosphere could be benefit by this reduction in the flock number. The improvement of the environmental indicators could be additionally enforced from the reduction of the animal antibiotic consumption.

Concerning the other benefits, the animal welfare, the “image” of the farmer and the environment will be also improved after eradication/control of Maedi Visna, because the farmers that will apply the eradication protocol will have a healthy and more productive flock at the end, that gives them the opportunity to increase the production with less animals.

Two successful combinations of legume/cereal winter forage crops

Need/issue: Forage crops
Topic: Nutrition

Country: Greece

Dairy or/and meat sheep: Dairy
Category of Animal (ewe, replacement, lamb): Ewe

Short description of the "benchmark" farm for which the analysis is performed: Dairy sheep farm, 1200 ewes, 30 ha of forage crops for hay or silage production (bales), in lowllands of high productive potential, in Central Greece. The holding is equipped with tractor, seeder, plough, disk harrow and roller. No nitrogen fertilizers nor phytochemicals are used. A contractor is used for cutting and baling forage material. It is assumed that 1 ha of single vetch is replaced by 1 ha of vetch – oat intercrop (using 60 kg oat and 150 kg vetch seed/ ha). Costs are calculated for a reference surface of 1 ha. Percentages are referred to the cost for the 1 ha substituted with vetch-oat.

Cost-benefit analysis

● **Additional Costs[3] (in green, items related to environmental evaluation too)**				
	Increase	Decrease	Percentage	Euro
– Fuel		☐		
– Labour (man-hours)		☐		
– Equipment/materials (e.g. weigh scales, formalin etc.)	☐	☐		
– Feeding: concentrates	☐	☐		
– Feeding : forages	☐	☐		
– Electricity	☐	☐		
– Water (water, troughs, piping etc.)	☐	☐		
– Seed	☒	☐	25%[4]	30€
– Fertilizer	☐	☐		
– Sprays (herbicides, pesticides etc.)	☐	☐		

[3] Costs are equal except for the seeds and baling.
Fuel for cultivation (land preparation and sowing): 60 L*1.90€
Contractor charges for harvesting: 130€/ha
Labour: 40 hours/ha

[4] Add 60kg of oat seed by ha (0.5€/kg), for 150kg of vetch by ha (1.0€/kg) No extra fuel and labour required when using a twin-box seeder

– Contractor charges (ploughing, spraying, harvesting etc.)	☒	☐	50%[5]	375€
– Medicine (antibiotics, anthelmintics, vaccinations)	☐	☐		
– Technical advise	☐	☐		
– Vet services	☐	☐		
– Lab services	☐	☐		
– Other external services	☐	☐		
- Others (specify): ……..	☐	☐		
Total	☒	☐		405 €
● **Additional Incomes**				
	Increase	Decrease	Percentage	Euro
– Output (extra production)	☒	☐	50%	[6] 900€
– Quality bonus (avoid contact of forage with soil and spoiling)	☒	☐	10%[7]	180€
– Farm schemes and direct payments	☐	☐		
Others (specify): if plot surface is uneven, forage can be even more difficult to cut when laying down on the soil (case of single vetch crop)	☐	☐		
TOTAL	☒	☐		**1080€**
Average increase in earning (per ewe, ha, etc.)			(€/ha)	**675€**

Cost benefit analysis conclusion

Adding a small percentage of cereals at seeding of legume forage crop (case of vetch-oat) increases seeding costs (due to the addition of cereal seeds) and contractor charges (more bales produced). However, this extra-cost is largely covered by the outputs generated by the extra production of forage and the higher forage quality (decrease of losses by spoiling). The average increase in earning is 675€/ha when compared to single vetch cropping.

[5] Contractor charge for baling: 25€/silage bale of 600kg. With vetch-oat, production is 45 bales/ha whereas for single vetch, production is 30 bales/ha (case of high productive lowlands soils of central Greece). Contractor charges/ha are then higher.

[6] Silage bales selling price: 0.10€/kg of silage*600kg*45 bales = 2700€/ha for oat/vetch and 0.10€*600*30 = 1800€/ha for single vetch

[7] It is assumed that at least 10% of the forage production can be spoiled when in contact with soil. In case of severe precipitations, damage of vetch crop can be 100% whereas it is drastically reduced with the combination vetch-oat. Also, fermentation in silage bales evolves faster for vetch - oat forage material compared to single vetch, therefore producing better quality silage.

Sustainability analysis

Environmental indicators	Increase	Decrease	Not applicable
Feed efficiency	☐	☐	☐
Grazing efficiency	☐	☐	☐
Feed self-sufficiency	☒	☐	☐
Manure/slurry "production"	☐	☐	☐
Effluents "production" (water for washing milking machine or with chemical treatment for footbath)	☐	☐	☐
Waste (plastics, etc.)	☐	☐	☐

Global Environmental assessment	Positive	Negative	No change
Atmosphere (Emissions and air quality)	☐	☐	☐
Water (Use and quality)	☐	☐	☐
Land (Soil quality and degradation)	☐	☐	☐
Materials and energy (Use, waste reduction and disposal)[8]	☒	☐	☐
Biodiversity	☐	☐	☐

Other benefits	
• More leisure/family time	☐
• Improved animal welfare	☐
• Improved farm/farmer "image" (social acceptance)	☐
• Better work environment	☐
• Improve health and safety for farmers	☐
• Less physical labour	☐
• Improve environment/landscape	☐
• Improve biodiversity	☐
• Other (specify) ……..	☐

Sustainability analysis conclusion

With the vetch-oat combination, the farmer increases its forage production thus its feed self-efficiency. On-farm extra production decreases the purchase of forage and then environmental impacts of transport.

With the vetch-oat combination, there is no additional consumption of fuel at seeding by hectare, but an extra forage production. The fuel consumption/ton of forage is then reduced

[8] The mixed forage crop results in decreased fuel consumption/Tons of forage produced

for the farmer. This has to be nuanced by extra fuel consumption for harvesting (see contractor charges).

No aspects of social sustainability have been identified.

Solutions from Hungary

Replacement nutrition for first lactation

Need/issue: Replacement nutrition for first lactation

Topic: Nutrition

Country: Hungary

Dairy or/and meat sheep: meat sheep
Category of Animal (ewe, replacement, lamb): replacement

Short description of the "benchmark" farm for which the analysis is performed:
Meat sheep farm. Flock size 300 sheep, white dorper, tsigai.
Workers (in full time): 4

Cost benefit analysis

• **Additional Costs**				
	Increase	Decrease	Percentage	Euro
– Fuel	☒	☐	5 %	0,5€/sheep
– Labour (man-hours)	☒	☐	10 %	0,5€/sheep
– Equipment/materials (e.g. weigh scales, formalin etc.)[1]	☒	☐	40 %	2000 €
– Feeding : concentrates	☒	☐	35 %	10 €/lactation /sheep €
– Feeding : forages	☐	☐	… %	… €
– Electricity	☐	☐	… %	… €
– Water (water, troughs, piping etc.)	☐	☐	… %	… €
– Seed	☐	☐	… %	… €
– Fertilizer	☐	☐	… %	… €
– Sprays (herbicides, pesticides etc.)	☐	☐	… %	… €
– Contractor charges (ploughing, spraying, harvesting etc.)	☐	☐	… %	… €
– Medicine (antibiotics, anthelmintics, vaccinations)	☐	☐	… %	… €
– Technical advise	☐	☐	… %	… €
– Vet services	☐	☐	… %	… €
– Lab services	☐	☐	… %	… €
– Other external services	☐	☐	… %	… €
- Others (specify): minerals	☒	☐	… %	… €
Total	☐	☐		

• **Additional Incomes**				
	Increase	Decrease	Percentage	Euro
– Output (e.g. meat, milk, wool)	☒	☐	10 %	12 €/sheep
– Quality bonus (carcass confirmation, fat and protein composition etc.)	☒	☐	30 %	0,8€/kg
– Farm schemes and direct payments	☒	☐	30 %	… €
Others (specify): ……	☐	☐	… %	… €
Total	☐	☐		
Average increase in earning (per ewe, ha, etc.)			(€/…)	**…** €

Notes:

[1] For the precision mixing of feed a digital scale is necessary

Cost benefit analysis conclusion

If the forage is not optimal for first lactation ewes, the condition will worsen after lambing, and for this reason proper nutrition is very important. When the condition of early breed sheep lambs is poor, it takes a lot of time and extra forage to achieve optimal mating conditions. And that's an additional cost. When the time period between the first and second births lengthens, the expense is huge. If we cannot feed the sheep with replacement nutrition, the carcass weight will be 10-12 kg less than the optimal one. The perfect replacement diet is also a question of quality and quantity. It needs a few extra hours of work, due to the extra feeding time.

Sustainability analysis

Additional indicators

Environmental indicators	Increase	Decrease	Not applicable
Feed efficiency	☒	☐	☐
Grazing efficiency	☐	☐	☒
Feed self-sufficiency	☒	☐	☐
Manure/slurry “production”	☐	☐	☒
Effluents “production” (water for washing milking machine or with chemical treatment for footbath)	☐	☐	☒
Waste (plastics, etc.)	☐	☐	☒

Global Environmental assessment	Positive	Negative	No change
Atmosphere (Emissions and air quality)	☒	☐	☐
Water (Use and quality)	☐	☐	☒

Land (Soil quality and degradation)	☐	☐	☒
Materials and energy (Use, waste reduction and disposal)	☐	☐	☒

Other benefits	
• More leisure/family time	☐
• Improved animal welfare	☒
• Improved farm/farmer "image" (social acceptance)	☒
• Better work environment	☐
• Improve health and safety for farmers	☐
• Less physical labour	☐
• Improve environment/landscape	☐
• Improve biodiversity	☐
• Other (specify) ……..	☐

Sustainability analysis conclusion

This solution does not have any impact on fuel, electricity or water consumption, but allows for a better feeding management. But better feeding increases the emissions.

These solution does not have a high impact on the global environment, but if there is more meat production the weight of the animal is higher. The bigger animals causes a bit more emission. So the more production means more emissions (greenhouse gases, etc.) And bigger animals needs more water intake too.

Respiratory problems in the shed

Need/issue: Respiratory problems in the shed

Topic: Health

Country: Hungary

Dairy or/and meat sheep: meat sheep
Category of Animal (ewe, replacement, lamb): all

Short description of the "benchmark" farm for which the analysis is performed:
Meat sheep farm. Flock size 300 sheep, white dorper, tsigai.
Workers (in full time): 4

Cost benefit analysis

• **Additional Costs**				
	Increase	Decrease	Percentage	Euro
– Fuel	☐	☐	… %	… €
– Labour (man-hours)	☒	☐	5 %	0,5 €/ewe/year €
– Equipment/materials (e.g. weigh scales, formalin etc.)	☐	☐	… %	… €
– Feeding : concentrates	☐	☐	… %	… €
– Feeding : forages	☐	☐	… %	… €
– Electricity	☐	☐	… %	… €
– Water (water, troughs, piping etc.)	☐	☐	… %	… €
– Seed	☐	☐	… %	… €
– Fertilizer	☐	☐	… %	… €
– Sprays (herbicides, pesticides etc.)	☐	☐	… %	… €
– Contractor charges (ploughing, spraying, harvesting etc.)	☒	☐	5%	1 €/ewe/year
– Medicine (antibiotics, anthelmintics, vaccinations)	☒	☐	15%	3 €/ewe/year
– Technical advise	☐	☐	… %	… €
– Vet services	☒	☐	30%	3 €/ewe/year
– Lab services[2]	☒	☐	50%	15 €/ewe/year
– Other external services	☐	☐	10%	… €
- Others (specify):	☐	☐	… %	…. €
Total	☒	☐		22,5€/ewe/year

• **Additional Incomes**				
	Increase	Decrease	Percentage	Euro
– Output (e.g. meat, milk, wool)	☒	☐	20%	12 €/ewe/year
– Quality bonus (carcass confirmation, fat and protein composition etc.)[1]	☒	☐	20%	12 €/ewe/year
– Farm schemes and direct payments	☐	☐	… %	… €
Others (specify): ……	☐	☐	… %	… €
Total	☐	☐		**24** €/ewe/year
Average increase in earning (per ewe, ha, etc.)			(€/…)	**12** €

Notes:

[1] If the ewe will be select because of respiratory problems the carcass weight is 20% lower and the EUROP quality is worse with 2 class. → extra loss of income
[2] If we scan with molecular genetics methods the cost will be higher

Cost benefit analysis conclusion

The additional costs increase due to the increased vet visits and the cost of the vaccination. If we reduce respiratory problems, the flock will be healthier and improve animal welfare. This causes more carcass weight and thus more income. There is no extra work for the farmer and the healthier flock needs fewer hours of work. In the healthier flock, fewer sheep culled for respiratory problems will lead to fewer replacement sheep and thus fewer costs.

Sustainability analysis

Additional indicators

Environmental indicators	Increase	Decrease	Not applicable
Feed efficiency	☒	☐	☐
Grazing efficiency	☒	☐	☐
Feed self-sufficiency	☒	☐	☐
Manure/slurry "production"	☐	☐	☒
Effluents "production" (water for washing milking machine or with chemical treatment for footbath)	☐	☐	☒
Waste (plastics, etc.)	☒	☐	☐

Global Environmental assessment	Positive	Negative	No change
Atmosphere (Emissions and air quality)	☒	☐	☐

Water (Use and quality)	☐	☐	☒
Land (Soil quality and degradation)	☐	☐	☒
Materials and energy (Use, waste reduction and disposal)	☐	☐	☒

Other benefits	
• More leisure/family time	☐
• Improved animal welfare	☒
• Improved farm/farmer "image" (social acceptance)	☒
• Better work environment	☒
• Improve health and safety for farmers	☒
• Less physical labour	☒
• Improve environment/landscape	☐
• Improve biodiversity	☐
• Other (specify) ……..	☐

Sustainability analysis conclusion

This solution does not have any impact on fuel, electricity or water consumption, but the vaccination approves more biohazardous waste. These solution does not have a high impact on the global environment. The more production means more emissions (greenhouse gases, etc.), so the environment is a bit bigger impact. If our animal is larger their intake (feed, water etc.) will be slightly expanded.

Solutions from Ireland

Identifying and controlling Lameness

Need/issue: Lameness

Topic: Health

Country: Ireland

Dairy or/and meat sheep: Dairy and Meat

Category of Animal (ewe, replacement, lamb): All

Short description of the "benchmark" farm for which analysis is performed:

Benchmark is a meat sheep farm with 100 ewes plus their lambs (1.6 lambs reared/ewe joined/year) and 25 replacements. Rams are purchased each year. Stocking rate is equivalent to 10 ewes/ha and aims to finish lambs from grass prior to the end of the grazing season.

Farm has a footbath and handling facilities available. Water source is available, cost of formulin is €2.20/litre and zinc sulphate is €2/kg.

Cost-benefit analysis

• **Additional Costs**				
	Increase	Decrease	Percentage	Euro
– Fuel	☐	☐	… %	… €
– Labour (man-hours)	☐	☐	… %	… €
– Equipment/materials (e.g. weigh scales, formalin etc.) [1]	☒	☐	1%	… €
– Feeding : concentrates	☐	☐	… %	… €
– Feeding : forages			… %	… €
– Electricity	☐	☐	… %	… €
– Water (water, troughs, piping etc.)	☐	☐	… %	… €
– Seed	☐	☐	… %	… €
– Fertilizer	☐	☐	… %	… €
– Sprays (herbicides, pesticides etc.)	☐	☐	… %	… €
– Contractor charges (ploughing, spraying, harvesting etc.)	☐	☐	… %	… €
– Medicine (antibiotics, anthelmintics, vaccinations)[2]	☐	☒	5%	… €
– Technical advise	☐	☐	… %	… €
– Vet services	☐	☐	… %	… €
– Lab services	☐	☐	… %	… €
– Other external services	☐	☐	… %	… €

- Others (specify): ……..	☐	☐	… %	… €
Total	☐	☐	**…%**	
• **Additional Incomes**				
	Increase	Decrease	Percentage	Euro
– Output (e.g. meat, milk, wool)[3]	☒	☐	2-5 %	… €
– Quality bonus (carcass confirmation, fat and protein composition etc.)	☒	☐	… %	… €
– Farm schemes and direct payments	☐	☐	… %	… €
Others (specify):	☐	☐	… %	… €
Total	☒	☐		
Average increase in earning (per ewe, ha, etc.)			(€/…)	**…** €

Notes:

[1]Walk through 100 litre footbath using formalin at 5% (footbath cost €11/use), alternatively 500 litre batch footbath using zinc sulphate at 10% (footbath cost €100 but can be reused). Animals are footbathed when in handling unit for routine procedures e.g. vaccinating, dosing, weighing etc. Average labour is 8 hours/ewe/year (Connolly, 2000).

[2]Reduced treatments for lameness

[3]Increased growth rate thus reduced age at slaughter for lambs, improved milk yield. The increase in output will depend on flock lameness severity and output depends on product type i.e. meat or milk

References

Connolly, L. (2000). Labour on Sheep Farms. Irish Grassland and Animal Production Association Journal. Volume 34, 112 - 117.

Cost benefit analysis conclusion

An increase in footbathing reduces lameness and antibiotic use in the flock and thus improves animal welfare and performance.

Sustainability analysis

Environmental indicators	Increase	Decrease	Not applicable
Feed efficiency	X	☐	☐
Grazing efficiency	X	☐	☐
Feed self-sufficiency	☐	☐	X
Manure/slurry “production”	☐	☐	X
Effluents “production” (water for washing milking machine or with chemical treatment for footbath)	X	☐	☐
Waste (plastics, etc.)	☐	☐	X

Global Environmental assessment	Positive	Negative	No change

Atmosphere (Emissions and air quality)	X	☐	☐
Water (Use and quality)	☐	X	☐
Land (Soil quality and degradation)	☐	☐	X
Materials and energy (Use, waste reduction and disposal)	☐	☐	X
Biodiversity	☐	☐	X

Other benefits	
• More leisure/family time	X
• Improved animal welfare	X
• Improved farm/farmer "image" (social acceptance)	X
• Better work environment	X
• Improve health and safety for farmers	X
• Less physical labour	X
• Improve environment/landscape	☐
• Improve biodiversity	☐
• Other (specify) Reduced labour for treating lameness	x

Sustainability analysis conclusion

Reducing lameness improves feed and grazing efficiency as the animals have an improved growth rate and are slaughtered earlier. Greenhouse gas emissions per kg of carcass is reduced due to improved animal performance. Slight increase in effluents production and water use due to disposal of footbath solution.

A reduction in flock lameness improves animal welfare, creates a better work environment and reduces physical labour, all of which has a positive effect on farmer image.

Clostridial and Pasteurella vaccination

Need/issue: Clostridial disease - e.g. pulpy kidney, braxy, blackleg

Topic: Health

Country: Ireland

Dairy or/and meat sheep: Dairy and meat

Category of Animal (ewe, replacement, lamb): All

Short description of the "benchmark" farm for which analysis is performed:

Benchmark is a meat sheep farm with 100 ewes plus their lambs (1.6 lambs reared/ewe joined/year) and 25 replacements. Rams are purchased each year. Stocking rate is equivalent to 10 ewes/ha and aims to finish lambs from grass prior to the end of the grazing season.

Lambs receive 2 clostridial vaccines in their first year and subsequently 1 booster vaccine annually if kept as replacements. Ewes and rams receive a booster shot annually prior to lambing. Heptavac plus costs €80 for 50 doses and Covexin 10 costs €70 for 100 doses. The lambs are vaccinated whilst in the sheep handling facilities for routine procedures.

Cost-benefit analysis

• **Additional Costs**				
	Increase	Decrease	Percentage	Euro
– Fuel	☐	☐	… %	… €
– Labour (man-hours)[1]	☒	☐	<1 %	… €
– Equipment/materials (e.g. weigh scales, formalin etc.)[2]	☒	☐	<1%	… €
– Feeding : concentrates	☐	☐	… %	… €
– Feeding : forages			… %	… €
– Electricity	☐	☐	… %	… €
– Water (water, troughs, piping etc.)	☐	☐	… %	… €
– Seed	☐	☐	… %	… €
– Fertilizer	☐	☐	… %	… €
– Sprays (herbicides, pesticides etc.)	☐	☐	… %	… €
– Contractor charges (ploughing, spraying, harvesting etc.)	☐	☐	… %	… €
– Medicine (antibiotics, anthelmintics, vaccinations)[3]	☒	☐	22%	… €
– Technical advise	☐	☐	… %	… €
– Vet services	☐	☐	… %	… €
– Lab services	☐	☐	… %	… €
– Other external services	☐	☐	… %	… €
- Others (specify): ……..	☐	☐	… %	… €

Total	☐	☐		
• **Additional Incomes**				
	Increase	Decrease	Percentage	Euro
– Output (e.g. meat, milk, wool)[4]	☒	☐	5 %	… €
– Quality bonus (carcass confirmation, fat and protein composition etc.)	☐	☐	… %	… €
– Farm schemes and direct payments	☐	☐	… %	… €
Others (specify): ……	☐	☐	… %	… €
Total	☐	☐		
Average increase in earning (per ewe, ha, etc.)			(€/…)	**…** €

Notes:

[1]Slight labour increase for vaccinating lambs and replacements when in the yard
[2]Adjustable vaccinating gun €40
[3]Covexin 10 is €0.70 per dose, 100 ewes (annual booster), plus 160 lambs (2 doses) and 25 replacements (annual booster). 22% is based on total flock health costs including anthelmintics, flukicides, vaccines and flystrike prevention
[4] Associated with lower mortality rate

Cost benefit analysis conclusion

The use of Clostridial and Pasteurella vaccinations will increase medicine costs but this is offset by the decrease in lamb and ewe mortality, which increases animal output and flock profitability.

Sustainability analysis

Environmental indicators	Increase	Decrease	Not applicable
Feed efficiency	x	☐	☐
Grazing efficiency	☐	☐	☐
Feed self-sufficiency	☐	☐	☐
Manure/slurry “production”	☐	☐	☐
Effluents “production” (water for washing milking machine or with chemical treatment for footbath)	☐	☐	☐
Waste (plastics, etc.)	☐	☐	☐

Global Environmental assessment	Positive	Negative	No change
Atmosphere (Emissions and air quality)	x	☐	☐
Water (Use and quality)	☐	☐	☐
Land (Soil quality and degradation)	☐	☐	☐
Materials and energy (Use, waste reduction and disposal)	☐	☐	☐

Biodiversity	☐	☐	☐

Other benefits	
• More leisure/family time	☐
• Improved animal welfare	X
• Improved farm/farmer "image" (social acceptance)	X
• Better work environment	X
• Improve health and safety for farmers	☐
• Less physical labour	☐
• Improve environment/landscape	☐
• Improve biodiversity	☐
• Other (specify)	☐

Sustainability analysis conclusion

Reducing Clostridial and Pasteurella diseases reduces lamb and ewe mortality, thus increasing the number of animals drafted for slaughter and ewe productivity i.e. lambs reared per ewe joined.

A reduction in Clostridial and Pasteurella diseases improves animal welfare and creates a better work environment, all of which has a positive effect on farmer image.

Controlling external parasites

Need/issue: External parasitism

Topic: Health

Country: Ireland

Dairy or/and meat sheep: Dairy and Meat

Category of Animal (ewe, replacement, lamb): All

Short description of the "benchmark" farm for which analysis is performed:

Benchmark is a meat sheep farm with 100 ewes plus their lambs (1.6 lambs reared/ewe joined/year) and 25 replacements. Rams are purchased each year. Stocking rate is equivalent to 10 ewes/ha and aims to finish lambs from grass prior to the end of the grazing season.

Ewes, replacements and rams are sheared annually in May/June. All sheep are treated with a pour-on to prevent flystrike in early summer and ewe, rams and replacements are winter dipped for lice, ticks and scab prevention.

Cost-benefit analysis

• **Additional Costs**				
	Increase	Decrease	Percentage	Euro
– Fuel	☐	☐	… %	… €
– Labour (man-hours)	☒	☐	<1%	… €
– Equipment/materials (e.g. weigh scales, formalin etc.)	☐	☐	… %	… €
– Feeding : concentrates	☐	☐	… %	… €
– Feeding : forages			… %	… €
– Electricity	☐	☐	… %	… €
– Water (water, troughs, piping etc.)	☐	☐	… %	… €
– Seed	☐	☐	… %	… €
– Fertilizer	☐	☐	… %	… €
– Sprays (herbicides, pesticides etc.)	☐	☐	… %	… €
– Contractor charges (ploughing, spraying, harvesting etc.)	☐	☐	…%	… €
– Medicine (antibiotics, anthelmintics, vaccinations)[1]	☒	☐	40%	… €
– Technical advise	☐	☐	… %	… €
– Vet services	☐	☐	… %	… €
– Lab services	☐	☐	… %	… €
– Other external services	☐	☐	… %	… €
- Others (specify): ……..	☐	☐	… %	… €
Total	☐	☐		

• **Additional Incomes**				
	Increase	Decrease	Percentage	Euro
– Output (e.g. meat, milk, wool)[3]	☒	☐	1 %	… €
– Quality bonus (carcass confirmation, fat and protein composition etc.)	☐	☐	… %	… €
– Farm schemes and direct payments	☐	☐	… %	… €
Others (specify): ……	☐	☐	… %	… €
Total	☐	☐		
Average increase in earning (per ewe, ha, etc.)			(€/…)	**…** €

Notes:

[1] Costs of fly-strike prevention (€670) on ewes, replacements and lambs and winter dipping (€200; contractor and product) for ewes, replacements and rams.

[3] Income from reduced age at slaughter (no external parasite health issues) and lower mortality rate

Cost benefit analysis conclusion

The control of external parasites reduces labour and veterinary/antibiotic costs from parasite damage, and improves animal welfare, performance and possibly lowers mortality rate.

Sustainability analysis

Environmental indicators	Increase	Decrease	Not applicable
Feed efficiency	X	☐	☐
Grazing efficiency	☐	☐	☐
Feed self-sufficiency	☐	☐	☐
Manure/slurry "production"	☐	☐	☐
Effluents "production" (water for washing milking machine or with chemical treatment for footbath)	X	☐	☐
Waste (plastics, etc.)	☐	☐	☐

Global Environmental assessment	Positive	Negative	No change
Atmosphere (Emissions and air quality)	X	☐	☐
Water (Use and quality)	☐	☐	☐
Land (Soil quality and degradation)	☐	☐	☐
Materials and energy (Use, waste reduction and disposal)	☐	x	☐
Biodiversity	☐	☐	☐

Other benefits

• More leisure/family time	X
• Improved animal welfare	X
• Improved farm/farmer “image” (social acceptance)	X
• Better work environment	X
• Improve health and safety for farmers	☐
• Less physical labour	X
• Improve environment/landscape	☐
• Improve biodiversity	☐
• Other (specify)	☐

Sustainability analysis conclusion

Controlling external parasites improves feed efficiency as the animals have an improved growth rate and are slaughtered earlier. There is a slight increase in effluent production and water use due to disposal of the dipping solution.

A reduction in external parasites improves animal welfare, creates a better work environment and reduces physical labour, all of which have a positive effect on farmer image.

Effect of birth and rearing type on lamb performance

Need/issue: Lamb performance targets from birth to weaning

Topic: Nutrition

Country: Ireland

Dairy or/and meat sheep: Meat

Category of Animal (ewe, replacement, lamb): Ewes and lambs

Short description of the "benchmark" farm for which analysis is performed:

Benchmark is a meat sheep farm with 100 ewes plus their lambs (1.6 lambs reared/ewe joined/year) and 25 replacements. Rams are purchased each year. Stocking rate is equivalent to 10 ewes/ha and aims to finish lambs from grass prior to the end of the grazing season.

Cost-benefit analysis

• **Additional Costs**				
	Increase	Decrease	Percentage	Euro
– Fuel	☐	☐	… %	… €
– Labour (man-hours)	☐	☐	… %	… €
– Equipment/materials (e.g. weigh scales, formalin etc.)	☐	☐	… %	… €
– Feeding : concentrates	☐	☐	… %	… €
– Feeding : forages			… %	… €
– Electricity	☐	☐	… %	… €
– Water (water, troughs, piping etc.)	☐	☐	… %	… €
– Seed	☐	☐	… %	… €
– Fertilizer	☐	☐	… %	… €
– Sprays (herbicides, pesticides etc.)	☐	☐	… %	… €
– Contractor charges (ploughing, spraying, harvesting etc.)	☐	☐	… %	… €
– Medicine (antibiotics, anthelmintics, vaccinations)	☐	☐	… %	… €
– Technical advise	☐	☐	… %	… €
– Vet services	☐	☐	… %	… €
– Lab services	☐	☐	… %	… €
– Other external services	☐	☐	… %	… €
- Others (specify): ……	☐	☐	… %	… €
Total	☐	☐		
• **Additional Incomes**				
	Increase	Decrease	Percentage	Euro

– Output (e.g. meat, milk, wool)[1]	☒	☐	2%	… €
– Quality bonus (carcass confirmation, fat and protein composition etc.)	☐	☐	… %	… €
– Farm schemes and direct payments	☐	☐	… %	… €
Others (specify): ……	☐	☐	… %	… €
Total	☐	☐		
Average increase in earning (per ewe, ha, etc.)			(€/…)	**…** €

Notes:

[1]Increased performance when best management practices are followed

Cost benefit analysis conclusion

Nutritional management according to birth and rearing type improves feed efficiency and animal performance.

Sustainability analysis

Environmental indicators	Increase	Decrease	Not applicable
Feed efficiency	X	☐	☐
Grazing efficiency	X	☐	☐
Feed self-sufficiency	☐	☐	☐
Manure/slurry "production"	☐	☐	☐
Effluents "production" (water for washing milking machine or with chemical treatment for footbath)	☐	☐	☐
Waste (plastics, etc.)	☐	☐	☐

Global Environmental assessment	Positive	Negative	No change
Atmosphere (Emissions and air quality)	X	☐	☐
Water (Use and quality)	☐	☐	☐
Land (Soil quality and degradation)	☐	☐	☐
Materials and energy (Use, waste reduction and disposal)	☐	☐	☐
Biodiversity	☐	☐	☐

Other benefits	
• More leisure/family time	☐
• Improved animal welfare	X
• Improved farm/farmer "image" (social acceptance)	X
• Better work environment	X
• Improve health and safety for farmers	☐

• Less physical labour	☐
• Improve environment/landscape	☐
• Improve biodiversity	☐
• Other (specify)	☐

Sustainability analysis conclusion

Optimal nutritional management according to birth and rearing type improves feed and grazing efficiency as the animals have an improved growth rate and are slaughtered at a younger age. Greenhouse gas emissions per kg of carcass is reduced due to improved animal performance.

Management according to birth and rearing type improves animal welfare and creates a better work environment.

Flock Biosecurity

Need/issue: Flock health plan

Topic: Health

Country: Ireland

Dairy or/and meat sheep: Dairy and meat

Category of Animal (ewe, replacement, lamb): All

Short description of the "benchmark" farm for which analysis is performed:

Benchmark is a meat sheep farm with 100 ewes plus their lambs (1.6 lambs reared/ewe joined/year) and 25 replacements. Rams are purchased each year. Stocking rate is equivalent to 10 ewes/ha and aims to finish lambs from grass prior to the end of the grazing season.

Cost-benefit analysis

• **Additional Costs**				
	Increase	Decrease	Percentage	Euro
– Fuel	☐	☐	… %	… €
– Labour (man-hours)[1]	☐	☒	>5 %	… €
– Equipment/materials (e.g. weigh scales, formalin etc.)	☐	☐	… %	… €
– Feeding : concentrates	☐	☐	… %	… €
– Feeding : forages			… %	… €
– Electricity	☐	☐	… %	… €
– Water (water, troughs, piping etc.)	☐	☐	… %	… €
– Seed	☐	☐	… %	… €
– Fertilizer	☐	☐	… %	… €
– Sprays (herbicides, pesticides etc.)	☐	☐	… %	… €
– Contractor charges (ploughing, spraying, harvesting etc.)	☐	☐	… %	… €
– Medicine (antibiotics, anthelmintics, vaccinations)[2]	☐	☒	>5 %	… €
– Technical advise	☐	☐	… %	… €
– Vet services	☐	☐	… %	… €
– Lab services	☐	☐	… %	… €
– Other external services	☐	☐	… %	… €
- Others (specify): ……	☐	☐	… %	… €
Total	☐	☐		
• **Additional Incomes**				
	Increase	Decrease	Percentage	Euro

– Output (e.g. meat, milk, wool)[3]	☒	☐	10 %+	… €
– Quality bonus (carcass confirmation, fat and protein composition etc.)	☐	☐	… %	… €
– Farm schemes and direct payments	☐	☐	… %	… €
Others (specify): ……	☐	☐	… %	… €
Total	☐	☐		
Average increase in earning (per ewe, ha, etc.)			(€/…)	**…** €

Notes:

[1] Reduction in labour depends on potential disease/parasites that have not been introduced to the flock due to correct protocol procedures

[2] Reduction in medicine and and anthelmintic use depends on the potential disease/parasites that have not been introduced to the flock due to correct biosecurity protocol

[3] Benefits in output depend on the issues identifed when quarantining animals e.g. CODD, anthelmintic resistance, abortion agents etc.

Cost benefit analysis conclusion

Improving flock biosecurity reduces flock health issues and thus reduces medicine (antibiotic use), anthelminthic resistance and labour requirements. Improving flock biosecurity also increases animal performance and output, and thus profitability.

Sustainability analysis

Environmental indicators	Increase	Decrease	Not applicable
Feed efficiency	X	☐	☐
Grazing efficiency	☐	☐	☐
Feed self-sufficiency	☐	☐	☐
Manure/slurry “production”	☐	☐	☐
Effluents “production” (water for washing milking machine or with chemical treatment for footbath)	☐	☐	☐
Waste (plastics, etc.)	☐	☐	☐

Global Environmental assessment	Positive	Negative	No change
Atmosphere (Emissions and air quality)	X	☐	☐
Water (Use and quality)	☐	☐	☐
Land (Soil quality and degradation)	☐	☐	☐
Materials and energy (Use, waste reduction and disposal)	X	☐	☐
Biodiversity	☐	☐	☐

Other benefits	
• More leisure/family time	X

• Improved animal welfare	X
• Improved farm/farmer “image” (social acceptance)	X
• Better work environment	X
• Improve health and safety for farmers	X
• Less physical labour	X
• Improve environment/landscape	☐
• Improve biodiversity	☐
• Other (specify)	☐

Sustainability analysis conclusion

An effective flock biosecurity protocol improves feed efficiency as the animals have an improved growth rate and are slaughtered earlier. Greenhouse gas emissions per kg of carcass is reduced due to improved animal performance. A reduction in medicine and anthelmintic use depends on the potential disease/parasites that have been avoided in the flock due to correct biosecurity protocol.

An effective biosecurity protocol improves animal welfare by avoiding health and parasite issues, this reduces physical labour, improves farm image and potentially leaves additional leisure time.

Managing ewe lamb replacements to lamb as 1 year old

Need/issue: Knowledge of nutrition requirement and Growth targets for 1st lambing at 1 year of age

Topic: Nutrition

Country: Ireland

Dairy or/and meat sheep: Meat

Category of Animal (ewe, replacement, lamb): Replacement

Short description of the "benchmark" farm for which analysis is performed:

Benchmark is a meat sheep farm with 100 ewes plus their lambs (1.6 lambs reared/ewe joined/year) and 25 replacement ewe lambs joined to the ram to produce their first litter at 12/13months old. It is assumed that 80% of the ewe lambs (20 total) will rear 1.3 lambs per ewe lamb. Stocking rate is equivalent to 10 ewes/ha and aims to finish lambs from grass prior to the end of the grazing season.

Cost-benefit analysis

• **Additional Costs**				
	Increase	Decrease	Percentage	Euro
– Fuel	☐	☐	… %	… €
– Labour (man-hours)[1]	☒	☐	4%	… €
– Equipment/materials (e.g. weigh scales, formalin etc.)	☐	☐	… %	… €
– Feeding : concentrates[2]	☒	☐	20 %	… €
– Feeding : forages			… %	… €
– Electricity	☐	☐	… %	… €
– Water (water, troughs, piping etc.)	☐	☐	… %	… €
– Seed	☐	☐	… %	… €
– Fertilizer	☐	☐	… %	… €
– Sprays (herbicides, pesticides etc.)	☐	☐	… %	… €
– Contractor charges (ploughing, spraying, harvesting etc.)	☐	☐	… %	… €
– Medicine (antibiotics, anthelmintics, vaccinations)[3]	☒	☐	5%	… €
– Technical advise	☐	☐	… %	… €
– Vet services	☐	☐	… %	… €
– Lab services	☐	☐	… %	… €
– Other external services	☐	☐	… %	… €
- Others (specify): ……..	☐	☐	… %	… €
Total	☐	☐		

• **Additional Incomes**				
	Increase	Decrease	Percentage	Euro
– Output (e.g. meat, milk, wool)[4]	☒	☐	15 %	… €
– Quality bonus (carcass confirmation, fat and protein composition etc.)	☐	☐	… %	… €
– Farm schemes and direct payments	☐	☐	… %	… €
Others (specify): ……	☐	☐	… %	… €
Total	☐	☐		
Average increase in earning (per ewe, ha, etc.)			(€/…)	**…** €

Notes:

[1]Additional ewes to lamb. Average labour required is 8 hours/ewe/year (Connolly, 2000), of which 19% is at lambing time. Additional 1.5 hours/ewe lamb, equivalent to approximately 40 hours extra annually.

[2]40kg additional concentrate offered to ewe lambs and their lambs.

[3]Anthelmintics and vaccines for additional lambs born and reared. Assuming 1.3 lambs reared/ewe lambed = 26 lambs. These lambs require additional anthelmintics, vaccines and flystrike prevention treatments, totaling ~€80.

[4]Extra ~26 lambs reared

References

Connolly, L. (2000). Labour on Sheep Farms. Irish Grassland and Animal Production Association Journal. Volume 34, 112 - 117.

Cost benefit analysis conclusion

Lambing at one year of age requires additional inputs (feed, medicine and labour) to meet pregnancy and growth requirements of the replacements and their lambs. This results in an increase in ewe lifetime performance, while maintaining growth targets for joining to lamb at two years of age.

Sustainability analysis

Environmental indicators	Increase	Decrease	Not applicable
Feed efficiency	X	☐	☐
Grazing efficiency	X	☐	☐
Feed self-sufficiency	☐	☐	☐
Manure/slurry “production”	☐	☐	☐
Effluents “production” (water for washing milking machine or with chemical treatment for footbath)	☐	☐	☐
Waste (plastics, etc.)	☐	☐	☐

Global Environmental assessment	Positive	Negative	No change
Atmosphere (Emissions and air quality)	X	☐	☐
Water (Use and quality)	☐	☐	☐
Land (Soil quality and degradation)	☐	☐	☐
Materials and energy (Use, waste reduction and disposal)	☐	☐	☐
Biodiversity	☐	☐	☐

Other benefits	
• More leisure/family time	☐
• Improved animal welfare	☐
• Improved farm/farmer "image" (social acceptance)	X
• Better work environment	☐
• Improve health and safety for farmers	☐
• Less physical labour	☐
• Improve environment/landscape	☐
• Improve biodiversity	☐
• Other (specify) Increasing flock output at low cost	x

Sustainability analysis conclusion

Lambing ewes at one year of age improves feed and grazing efficiency as the ewes are rearing more lambs during their lifetime. Greenhouse gas emissions per kg of carcass is reduced due to improved animal performance/output.

Lambing at one year of age increases flock output at a low cost and improves farmer image.

Producing high feed value silage

Need/issue: Conserve forage production - hay, silage…

Topic: Nutrition

Country: Ireland

Dairy or/and meat sheep: Dairy and meat

Category of Animal (ewe, replacement, lamb): All

Short description of the "benchmark" farm for which analysis is performed:

Benchmark is a meat sheep farm with 100 ewes plus their lambs (1.6 lambs reared/ewe joined/year) and 25 replacements. Rams are purchased each year. Stocking rate is equivalent to 10 ewes/ha and aims to finish lambs from grass prior to the end of the grazing season.

Cost-benefit analysis

• **Additional Costs (in green, items related to environmental evaluation too)**				
	Increase	Decrease	Percentage	Euro
– Fuel	☐	☐	… %	… €
– Labour (man-hours)	☐	☐	… %	… €
– Equipment/materials (e.g. weigh scales, formalin etc.)	☐	☐	… %	… €
– Feeding : concentrates[1]	☐	☒	25 %	… €
– Feeding : forages	☐	☐	… %	… €
– Electricity	☐	☐	… %	… €
– Water (water, troughs, piping etc.)	☐	☐	… %	… €
– Seed	☐	☐	… %	… €
– Fertilizer	☐	☐	… %	… €
– Sprays (herbicides, pesticides etc.)	☐	☐	… %	… €
– Contractor charges (ploughing, spraying, harvesting etc.)	☐	☐	… %	… €
– Medicine (antibiotics, anthelmintics, vaccinations)	☐	☐	… %	… €
– Technical advise	☐	☐	… %	… €
– Vet services	☐	☐	… %	… €
– Lab services	☐	☐	… %	… €
– Other external services	☐	☐	… %	… €
- Others (specify): ……	☐	☐	… %	… €
Total	☐	☐		
• **Additional Incomes**				
	Increase	Decrease	Percentage	Euro

– Output (e.g. meat, milk, wool)[2]	☒	☐	5 %	… €
– Quality bonus (carcass conformation, fat and protein composition etc.)	☐	☐	… %	… €
– Farm schemes and direct payments	☐	☐	… %	… €
Others (specify): ……	☐	☐	… %	… €
Total	☐	☐		
Average increase in earning (per ewe, ha, etc.)			(€/…)	**…** €

Notes:

[1] Increasing silage feed value reduces the quantity of concentrate required

[2] Reduction in days to slaughter of approximately 10 days

Cost benefit analysis conclusion

An increase in silage feed value either increases animal performance at a constant concentrate input or maintain animal performance at a reduced concentrate requirement. Our objective is to increase dry matter digestibility (DMD) by 5%, equivalent to reducing the growth period by about 10 days. A 5 unit increase in DMD reduces concentrate requirement during late pregnancy while increasing lamb birth weight. The improvement in lamb birth weight and ewe body condition score at lambing reduces the age of slaughter of lambs in a grazing system, due to an increase in meat and ewe milk output.

Sustainability analysis

Additional indicators (to complete the green indicators in the cost benefit table)

Environmental indicators	Increase	Decrease	Not applicable
Feed efficiency	X	☐	☐
Grazing efficiency	☐	☐	X
Feed self-sufficiency	X	☐	☐
Manure/slurry “production”	☐	☐	X
Effluents “production” (water for washing milking machine or with chemical treatment for footbath)	☐	☐	X
Waste (plastics, etc.)	☐	☐	X

Global Environmental assessment	Positive	Negative	No change
Atmosphere (Emissions and air quality)	X	☐	☐
Water (Use and quality)	☐	☐	X
Land (Soil quality and degradation)	☐	☐	X
Materials and energy (Use, waste reduction and disposal)	☐	☐	X
Biodiversity	☐	☐	X

Other benefits	
• More leisure/family time	☐
• Improved animal welfare	☐
• Improved farm/farmer “image” (social acceptance)	X
• Better work environment	X
• Improve health and safety for farmers	☐
• Less physical labour	X
• Improve environment/landscape	☐
• Improve biodiversity	☐
• Other (specify)	☐

Sustainability analysis conclusion

Producing high feed value silage improves feed efficiency and feed self-sufficiency, as high feed value silage requires less concentrate to be fed. Greenhouse gas emissions per kg of high feed value silage is lower per kg concentrate so reducing your concentrate fed lowers emissions. Concentrate offered usually consists of imported feed, the reduction in these ingredients reduces associated greenhouse gas emissions, thus reducing energy requirements and improving air quality.

Improving the feed value of silage increases the performance from home produced feed and reduces reliance on imported feed. Also less labour associated with feeding concentrate.

Reducing anthelmintic resistance

Need/issue: Anthelmintic management

Topic: Health

Country: Ireland

Dairy or/and meat sheep: Dairy and meat

Category of Animal (ewe, replacement, lamb): All

Short description of the "benchmark" farm for which analysis is performed:

Benchmark is a meat sheep farm with 100 ewes plus their lambs (1.6 lambs reared/ewe joined/year) and 25 replacements. Rams are purchased each year. Stocking rate is equivalent to 10 ewes/ha and aims to finish lambs from grass prior to the end of the grazing season.

Cost-benefit analysis

• **Additional Costs**				
	Increase	Decrease	Percentage	Euro
– Fuel	☐	☐	… %	… €
– Labour (man-hours)	☐	☐	…%	… €
– Equipment/materials (e.g. weigh scales, formalin etc.)	☐	☐	… %	… €
– Feeding : concentrates	☐	☐	… %	… €
– Feeding : forages			… %	… €
– Electricity	☐	☐	… %	… €
– Water (water, troughs, piping etc.)	☐	☐	… %	… €
– Seed	☐	☐	… %	… €
– Fertilizer	☐	☐	… %	… €
– Sprays (herbicides, pesticides etc.)	☐	☐	… %	… €
– Contractor charges (ploughing, spraying, harvesting etc.)	☐	☐	… %	… €
– Medicine (antibiotics, anthelmintics, vaccinations)[1,2]	☐	☒	<2%	… €
– Technical advise	☐	☐	… %	… €
– Vet services	☐	☐	… %	… €
– Lab services[3]	☒	☐	100%	… €
– Other external services	☐	☐	… %	… €
- Others (specify): ……	☐	☐	… %	… €
Total	☐	☐		
• **Additional Incomes**				
	Increase	Decrease	Percentage	Euro

– Output (e.g. meat, milk, wool)[4]	☒	☐	5%+	… €
– Quality bonus (carcass conformation, fat and protein composition etc.)	☐	☐	… %	… €
– Farm schemes and direct payments	☐	☐	… %	… €
Others (specify): ……	☐	☐	… %	… €
Total	☐	☐		
Average increase in earning (per ewe, ha, etc.)			(€/…)	**… €**

Notes:

[1] Anthelmintic use is reduced due to FEC and dosing only as required

[2] If anthelmintic resistance develops, anthelmintic costs will substantially increase due to need for group 4 and 5 wormers

[3] Lab services increase to undertake FEC

[4] Increase in animal production due to lower worm burden and less chance of anthelmintic resistance developing

Cost benefit analysis conclusion

Reducing anthelmintic resistance on farm improves animal performance and reduces the amount and type of anthelmintics required. If anthelmintic resistance develops, anthelmintic costs will substantially increase due to need for group 4 and 5 wormers (orange/amino-acetonitrile derivatives and purple/spiroindoles).

Sustainability analysis

Environmental indicators	Increase	Decrease	Not applicable
Feed efficiency	X	☐	☐
Grazing efficiency	X	☐	☐
Feed self-sufficiency	☐	☐	☐
Manure/slurry “production”	☐	☐	☐
Effluents “production” (water for washing milking machine or with chemical treatment for footbath)	☐	☐	☐
Waste (plastics, etc.)	☐	☐	☐

Global Environmental assessment	Positive	Negative	No change
Atmosphere (Emissions and air quality)	X	☐	☐
Water (Use and quality)	☐	☐	☐
Land (Soil quality and degradation)	☐	☐	☐
Materials and energy (Use, waste reduction and disposal)	☐	☐	☐
Biodiversity	☐	☐	☐

Other benefits

• More leisure/family time	X
• Improved animal welfare	X
• Improved farm/farmer “image” (social acceptance)	X
• Better work environment	X
• Improve health and safety for farmers	☐
• Less physical labour	X
• Improve environment/landscape	☐
• Improve biodiversity	☐
• Other (specify)	☐

Sustainability analysis conclusion

Reducing anthelmintic resistance improves feed and grazing efficiency as the animals have an improved growth rate and are slaughtered at a younger age. Greenhouse gas emissions per kg of carcass is reduced due to improved animal performance.

A reduction in anthelmintic resistance improves animal welfare, creates a better work environment and reduces physical labour, all of which has a positive effect on farmer image.

Rotational grazing systems (Establishment and management)

Need/issue: Grassland and grazing management

Topic: Nutrition

Country: Ireland

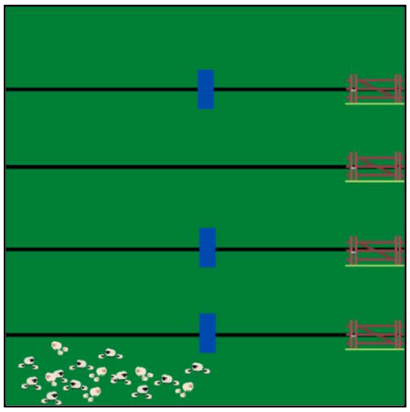
Dairy or/and meat sheep: Meat and dairy

Category of Animal (ewe, replacement, lamb): All

Short description of the "benchmark" farm for which analysis is performed:

Benchmark is a meat sheep farm grazing 100 ewes plus their lambs (1.6 lambs reared/ewe joined/year) and 25 replacements. Rams are purchased each year. Stocking rate is equivalent to 10 ewes/ha and aims to finish lambs from grass prior to the end of the grazing season.

Five 2 ha paddocks were established using permanent fencing which includes gates, water troughs and pipes.



4 x 316m fencing, 4 new gates and posts, and 3 water troughs

Cost-benefit analysis

• **Additional Costs (in green, items related to environmental evaluation too)**				
	Increase	Decrease	Percentage	Euro
– Fuel	☐	☐	… %	… €
– Labour (man-hours)	☐	☐	… %	… €
– Equipment/materials (e.g. weigh scales, formalin etc.)[1,2]	☒	☐	10-20 %	… €
– Feeding : concentrates	☐	☐	… %	… €
– Feeding : forages			… %	… €
– Electricity	☐	☐	… %	… €
– Water (water, troughs, piping etc.)[3]	☒	☐	50 %	… €
– Seed	☐	☐	… %	… €
– Fertilizer	☐	☐	… %	… €

– Sprays (herbicides, pesticides etc.)	☐	☐	… %	… €
– Contractor charges (ploughing, spraying, harvesting etc.)	☐	☐	… %	… €
– Medicine (antibiotics, anthelmintics, vaccinations)	☐	☐	… %	… €
– Technical advise	☐	☐	… %	… €
– Vet services	☐	☐	… %	… €
– Lab services	☐	☐	… %	… €
– Other external services	☐	☐	… %	… €
- Others (specify): ……..	☐	☐	… %	… €
Total	☐	☐		
• **Additional Incomes**				
	Increase	Decrease	Percentage	Euro
– Output (e.g. meat, milk, wool)[4]	☒	☐	5 %	… €
– Quality bonus (carcass confirmation, fat and protein composition etc.)	☐	☐	… %	… €
– Farm schemes and direct payments	☐	☐	… %	… €
Others (specify): ……	☐	☐	… %	… €
Total	☐	☐		
Average increase in earning (per ewe, ha, etc.)			(€/…)	**…** €

Notes:

[1]Fencing costs: material and cost to erect (wires, strainer, stakes etc.) is €8/metre x 1264 metres = €10,112 plus 4 gates and posts (€1,120) = €9,772 excluding VAT, depreciated over 12 years = €814 per annum. Grant aid of 40% is available in some countries therefore cost equivalent of €488 per year

[2]250m water pipes, 3 double sides water troughs and installation labour = €870 excluding VAT, depreciated over 12 years = €72 per annum

[3]Increased quantity and feed value of forage produced for grazing and silage production. Sharrow, S. H., & Krueger, W. C. (1979). Performance of sheep under rotational and continuous grazing on hill pastures. *Journal of animal science*, *49*(4), 893-899.

Cost benefit analysis conclusion

Despite the initial materials cost of establishing a paddock system, the benefits include improved herbage utilisation, management strategies and the opportunity to conserve high feed value forage for the winter period.

Sustainability analysis

Environmental indicators	Increase	Decrease	Not applicable

Feed efficiency	X	☐	☐
Grazing efficiency	X	☐	☐
Feed self-sufficiency	X	☐	☐
Manure/slurry "production"	☐	X	☐
Effluents "production" (water for washing milking machine or with chemical treatment for footbath)	☐	☐	X
Waste (plastics, etc.)	☐	☐	X

Global Environmental assessment	Positive	Negative	No change
Atmosphere (Emissions and air quality)	X	☐	☐
Water (Use and quality)	☐	☐	X
Land (Soil quality and degradation)	☐	☐	X
Materials and energy (Use, waste reduction and disposal)	☐	☐	X
Biodiversity	☐	☐	X

Other benefits	
• More leisure/family time	☐
• Improved animal welfare	☐
• Improved farm/farmer "image" (social acceptance)	X
• Better work environment	X
• Improve health and safety for farmers	☐
• Less physical labour	X
• Improve environment/landscape	☐
• Improve biodiversity	☐
• Other (specify)	☐

Sustainability analysis conclusion

Establishing a rotational grazing system improves feed and grazing efficiency (utilisation of herbage) and increases animal output. Feed self-sufficiency also increases due to improved opportunities for the production of winter forage. There is a positive impact on emissions as the grazing season length can be increased from a rotational grazing system, reducing housing time for animals over the winter period. There are greater emissions associated with manure excreted indoors. Higher growth rates from lambs will reduce days to slaughter, which ultimately reduces animal related emissions. There is a slight negative impact from materials used due to the initial investment in fencing.

Use of a rotational grazing system creates a better working environment for grazing management and a better farmer image.

Solutions from Italy

Inclusion and management of Sulla (Sulla coronaria (L.) medik.) in the forage systems

Need/issue: Forage crops (maize, sorgho, kale, rape, fodder beet, etc …)

Topic: Nutrition

Country: Italy

Dairy or/and meat sheep: dairy and meat
Category of Animal (ewe, replacement, lamb): all

Short description of the "benchmark" farm for which the analysis is performed: Dairy sheep farm, 75 ha, 500 ewes, good level of mechanization. The surface is used for the production of grass, hay and cereal grains. The cultivable area is 45 ha, 17 ha out of them for the production of hay obtained from pure or a mixture of grasses and legumes and 10 ha for the production of grains from barley. The remaining 18 ha are annually cultivated for grazing. It is assumed that 1 ha of grass (pure or mixture of grass and legumes) is replaced with 1 ha of perennial legume Sulla (S. coronaria).
Cultivation techniques:
Sulla- Fertilization: 2 q/ha triple superphosphate (92 kg/ha of P2O5), seeding rate: 30 kg/ha; weeding: Imazamox (Altorex, 1 l/ha in 400 l of H2O)
Italian ryegrass – Fertilization: at seeding 2 q/ha of 18:46 + 0,5 q/ha Urea (92 kg/ha di P2O5+59 kg/ha N); at the end of the winter: 1 q/ha ammonium nitrate (26 kg/ha N); seeding rate: 30 kg/ha; weeding: 2,4 D (0,5/1 l/ha)

Cost benefit analysis

• **Additional Costs**[1]				
	Increase	Decrease	Percentage	Euro
– Fuel	☐	☒	50%[2]	
– Labour (man-hours)	☐	☒	50%[2]	
– Equipment/materials (e.g. weigh scales, formalin etc.)	☒	☐	0.05%[3]	25 €/ha
– Feeding : concentrates	☐	☐		
– Feeding : forages	☐	☒	25%[4]	
– Electricity	☐	☐		
– Water (water, troughs, piping etc.)	☐	☐		
– Seed	☒	☐	66%	
– Fertilizer	☐	☒	69%	
– Sprays (herbicides, pesticides etc.)	☒	☐	50%	
– Contractor charges (ploughing, spraying, harvesting etc.)	☐	☐		

– Medicine (antibiotics, anthelmintics, vaccinations)	☐	☐		
– Technical advise	☐	☐		
– Vet services	☐	☐		
– Lab services	☐	☐		
– Other external services	☐	☐		
- Others (specify): ……..	☐	☐		
Total	☐	☐		
• **Additional Incomes[1]**				
	Increase	Decrease	Percentage	Euro
– Output (e.g. meat, milk, wool)	☒	☐	15%	
– Quality bonus (carcass confirmation, fat and protein composition etc.)	☒	☐		
– Farm schemes and direct payments	☐	☐		
Others (specify): ……	☐	☐		
Total	☐	☐		
Average increase in earning (per ewe, ha, etc.)			(€/…)	

Notes:

[1] All the percentages are referred only to the cost and outputs for 1 ha of raygrass replaced by Sulla

[2] Sulla is a biennial species that guarantees forage production for two consecutive years. Italian ryegrass is an annual species. Sulla cultivation costs are incurred every two years, while those of Italian ryegrass every year.

[3] The seed of Sulla is more expensive than Italian ryegrass. Before seeding it is necessary to inoculate seeds with specific rhizobium available in the market

[4] The inclusion of Sulla reduces forage costs because its growing season in the Mediterranean environment begins in early autumn allowing the grazing season to start earlier than annual grasses.

Cost benefit analysis conclusion

The inclusion of Sulla is expected to be profitable for most sheep farms since it reduces the costs of fuel and manpower with respect to annual grasses. Moreover, it strongly reduces the need for fertilizers. Generally, it increases also milk production due to its optimal nutritional values. Profitability in meat farms and/or climates different from the Mediterranean one should be verified.

Sustainability analysis

Environmental indicators	Increase	Decrease	Not applicable

Feed efficiency	☐	☐	☐
Grazing efficiency	☒	☐	☐
Feed self-sufficiency	☒	☐	☐
Manure/slurry "production"	☐	☐	☒
Effluents "production" (water for washing milking machine or with chemical treatment for footbath)	☐	☐	☒
Waste (plastics, etc.)	☐	☐	☒

Global Environmental assessment	Positive	Negative	No change
Atmosphere (Emissions and air quality)	☒	☐	☐
Water (Use and quality)	☐	☐	☒
Land (Soil quality and degradation)	☒	☐	☐
Materials and energy (Use, waste reduction and disposal)	☐	☐	☐

Other benefits	
• More leisure/family time	☐
• Improved animal welfare	☒
• Improved farm/farmer "image" (social acceptance)	☐
• Better work environment	☐
• Improve health and safety for farmers	☐
• Less physical labour	☐
• Improve environment/landscape	☒
• Improve biodiversity	☐
• Other (specify) ……..	☐

Sustainability analysis conclusion

The use of Sulla is expected to have a positive global environmental impact since the decrease in fuel combined with the increase in grazing, feeding self-sufficiency and the decrement in nitrogen returned to the environment from animals are expected to act on the GHG emissions. It has also to be noted the strong reduction in the use of fertilizers and long-term improvement of the soil quality.

The inclusion of Sulla, a tannin-rich plant, is also expected to improve animal welfare thanks to its anthelmintic effects in livestock.

Inclusion and management of Chicory (*Cichorium intybus* L.) in the forage systems

Need/issue: Forage crops (maize, sorgho, kale, rape, fodder beet, etc …)

Topic: Nutrition

Country: Italy

Dairy or/and meat sheep: dairy and meat
Category of Animal (ewe, replacement, lamb): all

Short description of the "benchmark" farm for which the analysis is performed: Dairy sheep farm, 75 ha, 500 ewes, good level of mechanization. The surface is used for the production of grass, hay and cereal grains. The cultivable area is 45 ha, 17 ha out of them for the production of hay obtained from pure or a mixture of grasses and legumes and 10 ha for the production of grains from barley. The remaining 18 ha are annually cultivated for grazing. It is assumed that 1 ha of grass (pure or mixture of grass and legumes) is replaced with 1 ha of perennial broad-leafed Chicory (*C. intybus* L.).
Cultivation techniques:
Chicory- Fertilization: at seeding 2 q/ha of 18:46 + 0,5 q/ha Urea (92 kg/ha di P2O5+59 kg/ha N); at the end of the winter: 1 q/ha ammonium nitrate (26 kg/ha N); seeding rate: 25 kg/ha; weeding: Propizamide (Kerb Flo, 0.70 – 1.5 l/ha in 600 l of H_2O)
Italian ryegrass – Fertilization: at seeding 2 q/ha of 18:46 + 0,5 q/ha Urea (92 kg/ha di P2O5+59 kg/ha N); at the end of the winter: 1 q/ha ammonium nitrate (26 kg/ha N); seeding rate: 30 kg/ha; weeding: 2,4 D (0,5-1 l/ha).

Cost benefit analysis

• **Additional Costs**[1]				
	Increase	Decrease	Percentage	Euro
– Fuel	☐	☒	50%[2]	
– Labour (man-hours)	☐	☒	50%[2]	
– Equipment/materials (e.g. weigh scales, formalin etc.)	☐	☐		
– Feeding : concentrates	☐	☐		
– Feeding : forages	☐	☒	25%[3]	
– Electricity	☐	☐		
– Water (water, troughs, piping etc.)	☐	☐		
– Seed	☒	☐	66%	
– Fertilizer	☐	☐		
– Sprays (herbicides, pesticides etc.)	☒	☐	50%	
– Contractor charges (ploughing, spraying, harvesting etc.)	☐	☐		

– Medicine (antibiotics, anthelmintics, vaccinations)	☐	☐		
– Technical advise	☐	☐		
– Vet services	☐	☐		
– Lab services	☐	☐		
– Other external services	☐	☐		
- Others (specify): ……..	☐	☐		
Total	☐	☐		
• **Additional Incomes[1]**				
	Increase	Decrease	Percentage	Euro
– Output (e.g. meat, milk, wool)	☒	☐	15%	
– Quality bonus (carcass confirmation, fat and protein composition etc.)	☒	☐		
– Farm schemes and direct payments	☐	☐		
Others (specify): ……	☐	☐		
Total	☐	☐		
Average increase in earning (per ewe, ha, etc.)			(€/…)	

Notes:

[1] All the percentages are referred only to costs and outputs of 1 ha of grass replaced by Chicory

[2] Chicory is a biennial species that guarantees forage production for two consecutive years. Italian ryegrass is a annual species. Chicory cultivation costs are incurred every two years, while those of Italian ryegrass every year.

[3] The inclusion of Chicory reduces forage costs because its growing season in the Mediterranean environment begins in early autumn allowing the grazing season to start earlier than annual grasses.

Cost benefit analysis conclusion

The inclusion of Chicory is expected to be profitable for most sheep farms since it allows a more homogenous distribution of forage availability across seasons and reduces costs with respect to annual grasses. Profitability in meat farms and/or climates different from the Mediterranean one should be verified.

Sustainability analysis

Environmental indicators	Increase	Decrease	Not applicable
Feed efficiency	☐	☐	☐
Grazing efficiency	☒	☐	☐

Feed self-sufficiency	☒	☐	☐
Manure/slurry "production"	☐	☐	☒
Effluents "production" (water for washing milking machine or with chemical treatment for footbath)	☐	☐	☒
Waste (plastics, etc.)	☐	☐	☒

Global Environmental assessment	Positive	Negative	No change
Atmosphere (Emissions and air quality)	☐	☐	☒
Water (Use and quality)	☐	☐	☒
Land (Soil quality and degradation)	☒	☐	☐
Materials and energy (Use, waste reduction and disposal)	☐	☐	☒

Other benefits	
• More leisure/family time	☐
• Improved animal welfare	☒
• Improved farm/farmer "image" (social acceptance)	☐
• Better work environment	☐
• Improve health and safety for farmers	☐
• Less physical labour	☒
• Improve environment/landscape	☐
• Improve biodiversity	☐
• Other (specify) ……..	☐

Sustainability analysis conclusion.

The use of chicory is expected to have a slightly positive global environmental impact since the positive effects on grazing efficiency and feed-self sufficiency offset the higher cost of the purchase of seed and herbicide. The inclusion of Chicory is expected to improve animal welfare thanks to its content of bioactive compounds that exert an anthelmintic effect in livestock.

Guidelines for the interpretation of milk urea concentration in sheep milk

Need/issue: Urea levels in milk (unbalanced energy/protein ratio in the diet)

Topic: Nutrition

Country: Italy

Dairy or/and meat sheep: Dairy

Category of Animal (ewe, replacement, lamb): ewe

Short description of the "benchmark" farm for which the analysis is performed:
Sarda breed sheep farm of 70 ha. Production: milk.

Scenario 1 (high concentration of milk urea - excess of crude protein (CP) in the diet (or excess of CP/Net Energy in the diet).
Heads: 350 ewes of which 300 lactating (average production 300 l/year) with a high-protein diet that causes a high level of the concentration of urea in milk (above 45 mg/l). This scenario may apply to early-lactation ewes grazing young pastures in winter (18-20% CP).
For decreasing the urea milk level to a recommended value without effect on production level (1.7 L/d) a more balanced feed plan replacing 400 gr/d ewe of a pelleted concentrate with 19% of crude protein with the same amount of a cereal (corn) with 8% of crude protein.

Cost benefit analysis

• **Additional Costs**				
	Increase	Decrease	Percentage	Euro
– Fuel	☐	☐		
– Labour (man-hours)	☐	☐		
– Equipment/materials (e.g. weigh scales, formalin etc.)	☐	☐		
– Feeding : concentrates	☐	☒	16%	2,160 € [1]
– Feeding : forages	☐	☐		
– Electricity	☐	☐		
– Water (water, troughs, piping etc.)	☐	☐		
– Seed	☐	☐		
– Fertilizer	☐	☐		
– Sprays (herbicides, pesticides etc.)	☐	☐		
– Contractor charges (ploughing, spraying, harvesting etc.)	☐	☐		
– Medicine (antibiotics, anthelmintics, vaccinations)	☐	☐		
– Technical advise	☐	☐		

– Vet services	☐	☐		
– Lab services	☐	☐		0 [2]
– Other external services	☐	☐		
- Others (specify): ……..	☐	☐		
Total	☐	☐		
• **Additional Incomes**				
	Increase	Decrease	Percentage	Euro
– Output (e.g. meat, milk, wool)	☐	☐		
– Quality bonus (carcass confirmation, fat and protein composition etc.)	☐	☐		
– Farm schemes and direct payments	☐	☐		
Others (specify): ……	☐	☐		
Total	☐	☐		
Average increase in earning per ewe			(€/ewe)	**7.2** €

Notes:

[1] replacing 0.4 kg/d of pelleted concentrate with a price of 35 cents/kg with same amount of corn with a price of 25 cents/kg for a period of 180 days. It is assumed a ratio between the price of cereal and pelleted concentrate of 0.75.

[2] It is assumed that the farm already pays for milk quality analyses that provide also urea concentration.

Cost benefit analysis conclusion.

In the case of a protein excess in the diet, the main advantage in the monitoring of urea in milk in order to correct the diet is the reduction in costs due to a more efficient use of concentrated feeds. The costs of the labs have to be evaluated in the specific situations

Sustainability analysis

Environmental indicators	Increase	Decrease	Not applicable
Feed efficiency	☒	☐	☐
Grazing efficiency	☐	☐	☐
Feed self-sufficiency	☐	☐	☐
Manure/slurry “production”	☐	☐	☐
Effluents “production” (water for washing milking machine or with chemical treatment for footbath)	☐	☐	☐
Waste (plastics, etc.)	☐	☐	☐

Global Environmental assessment	Positive	Negative	No change

Atmosphere (Emissions and air quality)	☒	☐	☐
Water (Use and quality)	☐	☐	☐
Land (Soil quality and degradation)	☐	☐	☐
Materials and energy (Use, waste reduction and disposal)	☐	☐	☐

Other benefits	
• More leisure/family time	☐
• Improved animal welfare	☒[3]
• Improved farm/farmer "image" (social acceptance)	☒[4]
• Better work environment	☐
• Improve health and safety for farmers	☐
• Less physical labour	☐
• Improve environment/landscape	☒[5]
• Improve biodiversity	☐
• Other (specify) ……..	☐

Sustainability analysis conclusion.

A better diet balance leads to fewer health problems and higher feed efficiency. In addition, a less nitrogen emission (NH3, and nitrous oxide) reduce the carbon footprint of sheep farming.

The reduction of an unbalanced diet improves animal welfare and the farmer's "image" due to the recognition of greater care in the management by dairies and food technicians and veterinarians.

Scenario 2 (low concentration of milk urea – deficit of crude protein (CP) in the diet (or deficit of CP/Net Energy in the diet).

Heads: 350 ewes of which 300 lactating (average production 240 l/year) with a low-protein diet that causes low level of milk urea (below 30 mg/l) and low milk production. This scenario may apply to mid-lactation ewes in good BCS, grazing heading-phase grass pastures in spring (12-14% CP).

For increasing urea milk level to a recommended value, aiming at a production level of 1.3 L/d a more balanced feed plan is applied, replacing 300 gr/d ewe of cereal (corn 8 % CP) with the same amount of a pelleted concentrate (19% CP).

Cost benefit analysis

• **Additional Costs**				
	Increase	Decrease	Percentage	Euro
– Fuel	☐	☐		

– Labour (man-hours)	☐	☐		
– Equipment/materials (e.g. weigh scales, formalin etc.)	☐	☐		
– Feeding : concentrates	☒	☐	4%	540 € [1]
– Feeding : forages	☐	☐		
– Electricity	☐	☐		
– Water (water, troughs, piping etc.)	☐	☐		
– Seed	☐	☒		
– Fertilizer	☐	☐		
– Sprays (herbicides, pesticides etc.)	☐	☐		
– Contractor charges (ploughing, spraying, harvesting etc.)	☐	☐		
– Medicine (antibiotics, anthelmintics, vaccinations)	☐	☐		
– Technical advise	☐	☐		
– Vet services	☐	☐		
– Lab services	☐	☐		0 €[2]
– Other external services	☐	☐		
- Others (specify): ……..	☐	☐		
Total	☐	☐		
• **Additional Incomes**				
	Increase	Decrease	Percentage	Euro
– Output (e.g. meat, milk, wool)	☒	☐		1,800 €[3]
– Quality bonus (carcass confirmation, fat and protein composition etc.)	☐	☐		
– Farm schemes and direct payments	☐	☐		
Others (specify): ……	☐	☐		
Total	☐	☐		
Average increase in earning per ewe			(€/ewe)	**3.6** €

[1] replacing 0.3 kg/d of cereal a price of 25 cents/kg with same amount of a pelleted concentrate with a price of 35 cents/kg for a period of 60 days. It is assumed a ratio between the price of cereal and pelleted concentrate of 0.75.

[2] It is assumed that the farm already pays for milk quality analyses that provide also urea concentration.

[3] increase of milk production by 0.1 L/d for 60 days.

Cost benefit analysis conclusion.

With a low concentration of milk urea due to a deficit of crude protein in the diet the profitability for the farm is assured by the increase in incomes that largely counterbalances the higher costs for concentrates.

Sustainability analysis

Environmental indicators	Increase	Decrease	Not applicable
Feed efficiency	☒	☐	☐
Grazing efficiency	☐	☐	☐
Feed self-sufficiency	☐	☐	☐
Manure/slurry "production"	☐	☐	☐
Effluents "production" (water for washing milking machine or with chemical treatment for footbath)	☐	☐	☐
Waste (plastics, etc.)	☐	☐	☐

Global Environmental assessment	Positive	Negative	No change
Atmosphere (Emissions and air quality)	☒	☐	☐
Water (Use and quality)	☐	☐	☐
Land (Soil quality and degradation)	☐	☐	☐
Materials and energy (Use, waste reduction and disposal)	☐	☐	☐

Other benefits	
• More leisure/family time	☐
• Improved animal welfare	☒[4]
• Improved farm/farmer "image" (social acceptance)	☒[5]
• Better work environment	☐
• Improve health and safety for farmers	☐
• Less physical labour	☐
• Improve environment/landscape	☒[6]
• Improve biodiversity	☐
• Other (specify) ……..	☐

Sustainability analysis conclusion.

A better diet balance leads to fewer health problems and higher feed efficiency. In addition, a less nitrogen emission (NH3, and nitrous oxide) reduce the carbon footprint of sheep farming.

The reduction of an unbalanced diet improves animal welfare and the farmer's "image" due to the recognition of greater care in the management by dairies and food technicians and veterinarians.

Appraisal of udder morphology to prevent high somatic cell count and mastitis

Need/issue: Clinical mastitis (abnormal milk, swelling or redness of the udder) or subclinical mastitis (high somatic cell count -SCC- in milk)

Topic: Health

Country: Italy
Dairy or/and meat sheep: Dairy
Category of Animal (ewe, replacement, lamb): Ewe

Short description of the "benchmark" farm for which the analysis is performed:
Dairy sheep farm, 300 milked ewes 70 out of them primiparous, milking machine, average milk production of 200 liters/ year*ewe, 5% incidence of clinical mastitis, average somatic cell count higher than 1 million, milk price of 1 euro per liter, premium of 0.02€/L with an average SCC lower than 1 million.

Cost benefit analysis

• **Additional Costs**				
	Increase	Decrease	Percentage	Euro
– Fuel	☐	☐		
– Labour (man-hours)	☒	☐	1 % [1]	
– Equipment/materials (e.g. weigh scales, formalin etc.)	☐	☐		
– Feeding : concentrates	☐	☐		
– Feeding : forages				
– Electricity	☐	☐		
– Water (water, troughs, piping etc.)	☐	☐		
– Seed	☐	☐		
– Fertilizer	☐	☐		
– Sprays (herbicides, pesticides etc.)	☐	☐		
– Contractor charges (ploughing, spraying, harvesting etc.)	☐	☐		
– Medicine (antibiotics, anthelmintics, vaccinations)	☐	☒	20% [2]	
– Technical advise	☒	☐	0.5% [3]	
– Vet services	☐	☒	10% [2]	
– Lab services	☐	☒	10% [2]	
– Other external services	☐	☐		
- Others (specify):	☐	☐		
Total	☐	☐		

• **Additional Incomes**				
	Increase	Decrease	Percentage	Euro
– Output (e.g. meat, milk, wool)	☒	☐	6% [4]	3600 €
– Quality bonus (carcass confirmation, fat and protein composition etc.)	☒	☐	2% [5]	1200 €
– Farm schemes and direct payments	☐	☐		
Others (specify): ……	☐	☐		
Total	☐	☐		
Average increase in earning per ewe			(€/ewe)	**16 €**

Notes:

[1] two days per year to perform udder scoring

[2] percentage referred only to the cost for clinical mastitis

[3] one day per year of training

[4] on the hypothesis based on a reduction of 20% of the incidence of the clinical mastitis (+1% of milk production of the whole flock) and a decrease of the average SCC to 700.000 which should increase the milk production of 5%.

[5] variability of increase depending on the milk payment system related to the hygienic quality.

Cost benefit analysis conclusion.

High relative profitability is expected from the application of this solution. The costs are relatively small mainly if the farmer realizes the udder appraisal by himself. On the other hand, large savings in the use of antibiotics and higher incomes may be realized.

Sustainability analysis

Environmental indicators	Increase	Decrease	Not applicable
Feed efficiency	☒	☐	☐
Grazing efficiency	☐	☐	☐
Feed self-sufficiency	☐	☐	☐
Manure/slurry “production”	☐	☐	☐
Effluents “production” (water for washing milking machine or with chemical treatment for footbath)	☐	☒	☐
Waste (plastics, etc.)	☐	☒	☐

Global Environmental assessment	Positive	Negative	No change
Atmosphere (Emissions and air quality)	☒	☐	☐
Water (Use and quality)	☐	☐	☐
Land (Soil quality and degradation)	☐	☐	☐
Materials and energy (Use, waste reduction and disposal)	☒	☐	☐

Other benefits	
• More leisure/family time	☐
• Improved animal welfare	☒
• Improved farm/farmer “image” (social acceptance)	☒
• Better work environment	☐
• Improve health and safety for farmers	☐
• Less physical labour	☐
• Improve environment/landscape	☐
• Improve biodiversity	☐
• Other (specify) ……..	☐

Sustainability analysis conclusion.

The most important effects on the sustainability is the reduction in the use of antibiotics and the increase in feed efficiency with positive effects on emissions and air quality and the use of materials and energy.

Improved animal welfare and farmer “image” are other important expected benefits.

Good machine-milking practices for prevention of mastitis

Need/issue: Clinical mastitis (e.g. lesion in the udder, and altered milk condition) or subclinical mastitis (e.g. high somatic cell count).

Milking machine management

Topic: Health and Management

Country: Italy

Dairy or/and meat sheep: Dairy
Category of Animal (ewe, replacement, lamb): Ewe

Short description of the "benchmark" farm for which the analysis is performed:
Dairy sheep farm with 400 milking ewes. Average milk production of 190 liters/ year/ewe, 1% incidence of clinical mastitis, average somatic cell counts higher than 1 million, milk price of 1 euro per liter, premium of 0.02€/L with an average SCC lower than 1 million. Two workers involved in milking.

Cost benefit analysis

• **Additional Costs**				
	Increase	Decrease	Percentage	Euro
– Fuel	☒	☐	#	#
– Labour (man-hours)	☒	☐	10%	1,500 €[1]
– Equipment/materials (e.g. weigh scales, formalin etc.)	☒	☐	n.a. %	500 €[2]
– Feeding : concentrates	☐	☐	#	#
– Feeding : forages			#	#
– Electricity	☐	☐	#	#
– Water (water, troughs, piping etc.)	☒	☐	n.a. %	100 € [3]
– Seed	☐	☐	#	#
– Fertilizer	☐	☐	#	#
– Sprays (herbicides, pesticides etc.)	☐	☐	#	#
– Contractor charges (ploughing, spraying, harvesting etc.)	☐	☐	#	#
– Medicine (antibiotics, anthelmintics, vaccinations)	☐	☒	n.a.%	100 €
– Technical advise	☐	☒	n.a. %	100 €
– Vet services	☐	☒	n.a. %	100 €
– Lab services	☐	☒	n.a. %	100 €
– Other external services	☐	☐	#	#
- Others (specify): minerals	☐	☐	#	#
Total	☐	☐		

• **Additional Incomes**				
	Increase	Decrease	Percentage	Euro
– Output (e.g. meat, milk, wool)	☒	☐		4,000 €[4]
– Quality bonus (carcass confirmation, fat and protein composition etc.)	☒	☐	0.02 %	1,842 €
– Farm schemes and direct payments	☐	☐	#	#
Others (specify): ……	☐	☐	#	#
Total	☐	☐		
Average increase in earning per ewe			(€/ewe)	10.35

Notes:
n.a. not applicable
[1] costs have been calculated considering 2 milkings/day for 7 months and 2 workers. The cost for 1 worker/hour is 10 €.
[2] we have considered the cost of the disinfectant used for the post-dipping
[3] we have considered major cost for water purification.
[4] we have considered less involuntary culling which results in more meat production (lamb); 3% of lambs (around n. 12) can be destined for meat and not for the replacement (800 €). We also estimated an increasing milk production. No clinical mastitis (which were supposed to be around 1%) means to save 400 liters of milk (400€) and 4 ewes (400€). In addition, subclinical mastitis causes milk production decreasing, which has been estimated around 3% so that means to save (2,400 €)

Cost benefit analysis conclusion.

The profitability of the application of these good practices is assured by the strong reduction of clinical and sub-clinical mastitis that largely counterbalances the increase of manpower and equipment. Larger incomes may be expected also from the increase in milk quality when a quality-based payment system exists.

Sustainability analysis

Additional indicators

Environmental indicators	Increase	Decrease	Not applicable
Feed efficiency	☒	☐	☐
Grazing efficiency	☐	☐	☐
Feed self-sufficiency	☐	☐	☐
Manure/slurry “production”	☐	☐	☐
Effluents “production” (water for washing milking machine or with chemical treatment for footbath)	☒	☐	☐
Waste (plastics, etc.)	☒	☐	☐

Global Environmental assessment	Positive	Negative	No change
Atmosphere (Emissions and air quality)	☐	☐	☐
Water (Use and quality)	☐	☒	☐
Land (Soil quality and degradation)	☐	☐	☐
Materials and energy (Use, waste reduction and disposal)	☐	☒	☐

Other benefits	
• More leisure/family time	☒
• Improved animal welfare	☒
• Improved farm/farmer “image” (social acceptance)	☒
• Better work environment	☐
• Improve health and safety for farmers	☐
• Less physical labour	☐
• Improve environment/landscape	☐
• Improve biodiversity	☐
• Other (specify) ……..	☐

Sustainability analysis conclusion

Negative impacts on the environment due to the large use of water and disinfectants may be mitigated by reducing waste. The main positive impact is expected by the reduction of the use of antibiotics.

Important positive impacts are expected on more leisure for the farmer, the animal welfare, and on the farmer's “image”.

Nutrition plan of ewe-lambs from weaning to mating

Need/issue: Knowledge of nutrition requirements in different stages of development

Topic: Nutrition

Country: Italy

Dairy or/and meat sheep: Dairy
Category of Animal (ewe, replacement, lamb): replacement ewe-lambs

Short description of the "benchmark" farm for which the analysis is performed:
Sarda breed sheep farm. Production: milk.
Heads: 350 ewes of which 300 lactating (average production 250 l/year), 70 replacement lambs of which 50 in production the following year.
It is assumed that with the feed plan the fertility of the ewe-lambs increases from 70 to 85% with 10 more primiparous lambed, lambings are concentrated and anticipated by one month in 75% of the ewe-lambs, with a production greater than about 30 L per head lambed and a 30% higher selling price of lamb meat (from 2.5 to 3.5 €/kg) for a better lambing period just before the Easter.

Cost benefit analysis

• **Additional Costs**				
	Increase	Decrease	Percentage	Euro
– Fuel	☐	☐		
– Labour (man-hours)	☒	☐	2%	140
– Equipment/materials (e.g. weigh , formalin etc.)	☒	☐		200 [1]
– Feeding : concentrates	☐	☐		0 [2]
– Feeding : forages	☐	☐		
– Electricity	☐	☐		
– Water (water, troughs, piping etc.)	☐	☐		
– Seed	☐	☐		
– Fertilizer	☐	☐		
– Sprays (herbicides, pesticides etc.)	☐	☐		
– Contractor charges (ploughing, spraying, harvesting etc.)	☐	☐		
– Medicine (antibiotics, anthelmintics, vaccinations)	☐	☐		
– Technical advise	☐	☐		
– Vet services	☐	☐		
– Lab services	☐	☐		
– Other external services	☐	☐		
- Others (specify):	☐	☐		

Total	☐	☐		
• **Additional Incomes**				
	Increase	Decrease	Percentage	Euro
– Output (e.g. meat, milk, wool)	☒	☐	5%	3,800 €[3]
– Quality bonus (carcass confirmation, fat and protein composition etc.)	☐	☐		
– Farm schemes and direct payments	☐	☐		
Others (specify): ……	☐	☐		
Total	☐	☐		
Average increase in earning per ewe			(€/ewe)	**10** €

Notes:

[1] Annual depreciation of a scale with RFID reader
[2] No additional costs are considered because we assumed a less waste of concentrates
[3] Estimate based on the following components:

- Milk production of 10 ewe-lambs of 200 L/ewe at 1 €/l;
- Production of 10 lambs with a price 1 €/kg of live weight higher in 75% of the ewe-lambs lambed (60);
- Milk production increased by 30 L in 75% of the ewe-lambs lambed.

Cost benefit analysis conclusion

Adopting a nutrition plan for lambs from weaning to mating according to the needs reported in the solution involves an increase in labor and equipment and materials costs. On the other hand, it allows for an increase in income due to an increase in milk production and the sale of more lambs.

Sustainability analysis

Environmental indicators	Increase	Decrease	Not applicable
Feed efficiency	☒	☐	☐
Grazing efficiency	☐	☐	☐
Feed self-sufficiency	☐	☐	☐
Manure/slurry “production”	☐	☐	☐
Effluents “production” (water for washing milking machine or with chemical treatment for footbath)	☐	☐	☐
Waste (plastics, etc.)	☐	☐	☐

Global Environmental assessment	Positive	Negative	No change
Atmosphere (Emissions and air quality)	☒	☐	☐
Water (Use and quality)	☐	☐	☐
Land (Soil quality and degradation)	☐	☐	☐

Materials and energy (Use, waste reduction and disposal)	☐	☐	☐

Other benefits	
• More leisure/family time	☐
• Improved animal welfare	☒
• Improved farm/farmer "image" (social acceptance)	☐
• Better work environment	☐
• Improve health and safety for farmers	☐
• Less physical labour	☐
• Improve environment/landscape	☒
• Improve biodiversity	☐
• Other (specify) ……..	☐

Sustainability analysis conclusion

A positive impact on the environment is expected from the increase in the fertility and productivity of the flock. Better animal conditions due to greater homogeneity in groups are also expected to decrease inter-individual competition for feeding improving animal welfare.

How to produce high-quality grass-silage

Need/issue: Conserved forage production (hay, silage…)

Topic: Nutrition

Country: Italy

Dairy or/and meat sheep: Dairy

Category of Animal (ewe, replacement, lamb): All

Short description of the "benchmark" farm for which the analysis is performed:
Dairy sheep farm, 800 milked ewes, 300 replacement. Surface: 450 hectares all ploughable. High level of mechanisation

Cost benefit analysis

• **Additional Costs**				
	Increase	Decrease	Percentage	Euro
– Fuel	☒	☐	30%	1,200 [1]
– Labour (man-hours)	☐	☐		
– Equipment/materials (e.g. weigh scales, formalin etc.)	☒	☐	80%	8,800 [2]
– Feeding : concentrates	☐	☒	22%	24,000 [3]
– Feeding : forages	☐	☐		
– Electricity	☐	☐		
– Water (water, troughs, piping etc.)	☐	☐		
– Seed	☐	☐		
– Fertilizer	☐	☐		
– Sprays (herbicides, pesticides etc.)	☐	☐		
– Contractor charges (ploughing, spraying, harvesting etc.)	☐	☐		
– Medicine (antibiotics, anthelmintics, vaccinations)	☐	☐		
– Technical advise	☐	☐		
– Vet services	☐	☐		
– Lab services	☐	☐		
– Other external services	☐	☐		
- Others (specify): …….	☐	☐		
Total	☐	☐		
• **Additional Incomes**				
	Increase	Decrease	Percentage	Euro
– Output (e.g. meat, milk, wool)	☒[4]	☐	12%	40,000 €

– Quality bonus (carcass confirmation, fat and protein composition etc.)	☐	☐		
– Farm schemes and direct payments	☐	☐		
Others (specify): ……	☐	☐		
Total	☐	☐		
Average increase in earning per ewe			(€/ewe)	**65 €**

Notes:

[1] Related to the hay shredding for 1,000 bales

[2] 5300 € for film cost; 2200 € for cost of ferments; 1300 € for net for bales wrapping - 1,000 bales

[3] 200 g/ewe less of daily concentrates

[4] increase of daily milk production of 200 g (50 liters on a lactation basis). Milk price 1.3 €/liter

Cost benefit analysis conclusion.

The production of high-quality grass silage is expected to increase the profitability of dairy farms due mainly to the increase of incomes and the reduction of costs related to the supply of concentrates that largely compensate the increases of man-power and equipment.

Sustainability analysis

Environmental indicators	Increase	Decrease	Not applicable
Feed efficiency	☒	☐	☐
Grazing efficiency	☐	☐	☐
Feed self-sufficiency	☒	☐	☐
Manure/slurry "production"	☐	☐	☐
Effluents "production" (water for washing milking machine or with chemical treatment for footbath)	☐	☐	☐
Waste (plastics, etc.)	☐	☐	☐

Global Environmental assessment	Positive	Negative	No change
Atmosphere (Emissions and air quality)	☒	☐	☐
Water (Use and quality)	☐	☐	☐
Land (Soil quality and degradation)	☐	☐	☐
Materials and energy (Use, waste reduction and disposal)	☐	☐	☐

Other benefits	
• More leisure/family time	☐
• Improved animal welfare	☒
• Improved farm/farmer "image" (social acceptance)	☒
• Better work environment	☒

• Improve health and safety for farmers	☐
• Less physical labour	☒
• Improve environment/landscape	☐
• Improve biodiversity	☐
• Other (specify) ……..	☐

Sustainability analysis conclusion:

The improvement of the feed-efficiency and the feed-self sufficiency is expected to have a positive impact on the emissions.

Other positive impacts are expected on the animal welfare, farmer “image”, work environment and physical labour.

Solutions from Spain

Bedding management and relative humidity references (Feedlots)

Need/issue: Lameness

Topic: Health

Country: Spain

Dairy or/and meat sheep: dairy and meat
Category of Animal (ewe, replacement, lamb): all categories

Short description of the "benchmark" farm for which the analysis is performed:
The economic and environmental analysis was carried out on a typical lamb feedlot with a capacity of 4,000 animals.

Cost benefit analysis

• **Additional Costs**				
	Increase	Decrease	Percentage	Euro
– Fuel	☐	☐	… %	… €
– Labour (man-hours)	☒	☐	… %	0.39 €
– Equipment/materials (e.g. weigh scales, formalin etc.)	☐	☐	… %	… €
– Feeding : concentrates	☐	☐	… %	… €
– Feeding : forages	☒	☐	… %	0.19 €
– Electricity	☐	☐	… %	… €
– Water (water, troughs, piping etc.)	☐	☐	… %	… €
– Seed	☐	☐	… %	… €
– Fertilizer	☐	☐	… %	… €
– Sprays (herbicides, pesticides etc.)	☐	☐	… %	… €
– Contractor charges (ploughing, spraying, harvesting etc.)	☐	☐	… %	… €
– Medicine (antibiotics, anthelmintics, vaccinations)	☐	☐	… %	… €
– Technical advise	☒	☐	… %	0.15 €
– Vet services	☐	☐	… %	… €
– Lab services	☐	☐	… %	… €
– Other external services	☐	☐	… %	… €
- Others (specify): measurement devices……..	☒	☐	… %	0.03 €
Total	☐	☐		0.75 €

• **Additional Incomes**				
	Increase	Decrease	Percentage	Euro
– Output (e.g. meat, milk, wool)	☒	☐	… %	1.05 €
– Quality bonus (carcass confirmation, fat and protein composition etc.)	☐	☐	… %	… €
– Farm schemes and direct payments	☐	☐	… %	… €
Others (specify): less mortality and morbidity	☐	☒	… %	0.21 €
Total	☐	☐		**1.26**
Average increase in earning per lamb			(€/…)	**0.5** €

Cost benefit analysis conclusion

This solution needs several additional labour and measurements devices to be implemented. Some technical advice is needed as well. It improves animal welfare and productivity, therefore, it leads to a better health status and zootechnical indexes.

ADDITIONAL COSTS	EXPLANATION	EUROS/LAMB			
Additional Labour	2 times more per week. 1h/4000 lambs each time. 104 hours/year. 15 Euros/hour	0.39 €			
Technical Advice	1 hour/month. 12 hours/year. 50 Euros/hour. 4000 lambs/feedlot	0.15 €			
Aditional straw	60gr/lamb-week. 60 E/Tm. 4000 lamb/feedlot	0.19 €			
Measurement Devices	200 Euros/device. 2 years of life. 4000 lambs feedlot	0.03 €	0.75 €		
ADDITIONAL INCOMES	**EXPLANATION**	**EUROS/FEMALE**		**0.51 €**	**0.63%**
Best technical indexes.	Improvement of 0.25 FC. 15Kg of BW gained	1.05 €			
Less mortality and morbidity	Improvement of 0.35% mortality.	0.21 €	1.26 €		

Cost straw.- 60 €/Tm
Cost feed.-280 €/Tm
Cost lamb.- 60 €

Sustainability analysis

Environmental indicators	Increase	Decrease	Not applicable
Feed efficiency (1)	☒	☐	☐
Grazing efficiency	☐	☐	☒
Feed self-sufficiency	☐	☐	☒
Manure/slurry "production" (2)	☒	☐	☐
Effluents "production" (water for washing milking machine or with chemical treatment for footbath)	☐	☐	☒
Waste (plastics, etc.)	☐	☐	☒

(1) Better management of bedding leads to a better animal welfare and, therefore, higher efficiency

(2) If we manage the bedding better the quality of manure could be more suitable for environment practices

Global Environmental assessment	Positive	Negative	No change
Atmosphere (Emissions and air quality) (1)	☒	☐	☐
Water (Use and quality)	☐	☐	☒
Land (Soil quality and degradation) (2)	☒	☐	☐
Materials and energy (Use, waste reduction and disposal) (3)	☒	☐	☐
Biodiversity	☐	☐	☒

(1) Good bedding management leads to a lower ammonia concentration
(2) If we manage the bedding better the quality of manure could be more suitable for environment practices
(3) Less ammonia concentration could save energy from mechanical ventilation devices

Other benefits	
• More leisure/family time	☐
• Improved animal welfare	☒
• Improved farm/farmer "image" (social acceptance)	☒
• Better work environment (appeals to new entrants)	☒
• Less physical labour (suitable for females and aging farmers)	☐
• Improve environment/landscape	☐
• Improve biodiversity	☐
• Other (specify) ……..	☐

Sustainability analysis conclusion

The implementation of this solution leads to a better environmental condition due to a reduction in the ammonia load. Consequently, animals will have a better health status and a better feed efficiency as well. On the other hand, the good bedding management will produce a better manure quality more suitable for environmental practices. In addition, the more environmental conditions, the less ventilation power costs, therefore, this solution can save energy in buildings with mechanical ventilation devices.

As we have mentioned previously, the animal welfare goes up due to the better environmental conditions. It improves the labour in the farm and the image of the company, reducing bad smell and improving the landscape attraction.

Manual of good practices for the management of lambs on artificial rearing

Need/issue: Artificial Rearing

Topic: Health & Nutrition & Management

Country: Spain

Dairy or/and meat sheep: Dairy and Meat
Category of Animal (ewe, replacement, lamb): Lamb

Short description of the "benchmark" farm for which the analysis is performed:
The cost-benefit analysis of this solution was carried out on a farm of 420 ewes with a lambing rate of 1.3 lambings per ewe per year, with an average prolificacy of 1.6 and a lamb mortality rate of 10%, generating a production of 780 lambs per year. The lambs produced are managed on artificial rearing.

Cost benefit analysis

• **Additional Costs**				
	Increase	Decrease	Percentage	Euro
– Fuel	☐	☐	… %	… €
– Labour (man-hours)	☒	☐	… %	1.75 €
– Equipment/materials (e.g. weigh scales, formalin etc.)	☒	☐	… %	0.64 €
– Feeding : concentrates	☐	☐	… %	… €
– Feeding : forages	☐	☐	… %	… €
– Electricity	☐	☐	… %	… €
– Water (water, troughs, piping etc.)	☐	☐	… %	… €
– Seed	☐	☐	… %	… €
– Fertilizer	☐	☐	… %	… €
– Sprays (herbicides, pesticides etc.)	☐	☐	… %	… €
– Contractor charges (ploughing, spraying, harvesting etc.)	☐	☐	… %	… €
– Medicine (antibiotics, anthelmintics, vaccinations)	☐	☒	… %	-0.15 €
– Technical advise	☐	☐	… %	… €
– Vet services	☐	☐	… %	… €
– Lab services	☐	☐	… %	… €
– Other external services	☒	☐	… %	0.77 €
- Others (specify):	☐	☐	… %	… €
Total	☐	☐		3.01
• **Additional Incomes**				

	Increase	Decrease	Percentage	Euro
– Output (e.g. meat, milk, wool)	☒	☐	… %	1.13 €
– Quality bonus (carcass confirmation, fat and protein composition etc.)	☐	☐	… %	… €
– Farm schemes and direct payments	☐	☐	… %	… €
Others (specify) : less mortality and pathologies	☐	☒	… %	6.08 €
Total	☐	☐		**7.21**
Average increase in earning (per ewe, ha, etc.)			(€/…)	**4.19** €

Cost benefit analysis conclusion

To implement this solution, some additional labour and more equipment is needed, besides some technical training and advice. The better health status leads to a reduction in the antibiotic use and less mortality and morbidity ratios and, consequently, to some better technical results.

ADDITIONAL COSTS	EXPLANATION	EUROS/LAMB			
Additional Labour	Changing machine fornitures. 15 min daily. 15 Euros/hour. 91 hours. 400 females. 780 animals reared	1.75 €			
Equipement and Materials	Gooms, teats, desinfection material, hot water. About 500 Euros/year. 780 animals reared	0.64 €			
Reduction antibiotics	10% less treatments in the flock. 1.5 Euros/animal	-0.15 €			
Artificial Reared Machine Maintenance	About 50 Euros/month. 780 animals reared	0.77 €	3.01 €		
ADDITIONAL INCOMES	**EXPLANATION**	**EUROS/LAMB**		**4.19 €**	**16.76%**
More meat and efficiency	Overgrowing of 0.25 Kg BW gained per animal. 4.5 Euros/Kg BW	1.13 €			
Less mortality and morbidity. Improvement of health	Improvement of 15% less mortality. 4.5 Euros/Kg BW. 9 Kg BW/animal. 780 lambs reared.	6.08 €	7.20 €		

Threshold cost: 25 Euros/animal

Sustainability analysis

Environmental indicators	Increase	Decrease	Not applicable
Feed efficiency (1)	☒	☐	☐
Grazing efficiency	☐	☐	☒
Feed self-sufficiency	☐	☐	☒
Manure/slurry "production"	☐	☐	☒
Effluents "production" (water for washing milking machine or with chemical treatment for footbath)	☒	☐	☐
Waste (plastics, etc.)	☐	☐	☒

(1) The more animal welfare and health status, the better feed efficiency

Global Environmental assessment	Positive	Negative	No change
Atmosphere (Emissions and air quality) (1)	☒	☐	☐
Water (Use and quality) (2)	☐	☐	☒
Land (Soil quality and degradation)	☐	☐	☒
Materials and energy (Use, waste reduction and disposal) (3)	☒	☐	☐
Biodiversity	☐	☐	☒

(1) A better management of the machine and equipment leads to an improvement in the environmental conditions

(2) and (3) The more machine maintenance and cleaning, more use of water for cleaning and the more efficient use of water and energy; but on the other hand a better conversion index is expected for the lambs.

Other benefits	
• More leisure/family time	☐
• Improved animal welfare	☒
• Improved farm/farmer "image" (social acceptance)	☒
• Better work environment (appeals to new entrants)	☒
• Less physical labour (suitable for females and aging farmers)	☒
• Improve environment/landscape	☐
• Improve biodiversity	☐
• Other (specify) ……..	☐

Sustainability analysis conclusion

A good management of the milking machine and equipment leads to an increase of the feeding efficiency and to a better animal welfare condition. Therefore, the implementation of this

solution can improve the efficiency of the use of water and energy and the improvement of the environmental conditions.

In addition, the image of the farm is better and the work conditions are more suitable for the social sustainability.

Replacement management tool

Need/issue: Grazing management

Topic: Nutrition & Management

Country: Spain

Dairy or/and meat sheep: Dairy
Category of Animal (ewe, replacement, lamb): Replacement

Short description of the "benchmark" farm for which the analysis is performed:
The analysis of the use of this solution is based on create ewe lambs that can be put into in the first year of life (feeding and management) were made on a flock of 400 ewes with 4 lambing periods per year, with a replacement rate of 120 ewes lambs per year.

Cost benefit analysis

• **Additional Costs**				
	Increase	Decrease	Percentage	Euro
– Fuel	☐	☐	… %	… €
– Labour (man-hours)	☒	☐	… %	1.15 €
– Equipment/materials (e.g. weigh scales, formalin etc.)	☐	☐	… %	… €
– Feeding : concentrates	☐	☐	… %	… €
– Feeding : forages	☐	☐	… %	… €
– Electricity	☐	☐	… %	… €
– Water (water, troughs, piping etc.)	☐	☐	… %	… €
– Seed	☐	☐	… %	… €
– Fertilizer	☐	☐	… %	… €
– Sprays (herbicides, pesticides etc.)	☐	☐	… %	… €
– Contractor charges (ploughing, spraying, harvesting etc.)	☐	☐	… %	… €
– Medicine (antibiotics, anthelmintics, vaccinations)	☐	☐	… %	… €
– Technical advise	☒	☐	… %	5 €
– Vet services	☐	☐	… %	… €
– Lab services	☐	☐	… %	… €
– Other external services	☐	☐	… %	… €
- Others (specify):	☒	☐	… %	… €
Total	☐	☐		6.5
• **Additional Incomes**				
	Increase	Decrease	Percentage	Euro
– Output (e.g. meat, milk, wool)	☒	☐	… %	4.5 €

– Quality bonus (carcass confirmation, fat and protein composition etc.)	☐	☐	… %	… €
– Farm schemes and direct payments	☐	☐	… %	… €
Others (specify): shorter replacement period and earlier age at mating	☒	☐	… %	9 €
Total	☐	☐		**13.5**
Average increase in earning (lamb-ewe)			(€/…)	**7** €

Cost benefit analysis conclusion

A good planification of the rearing and replacement period implies some additional labour and technical advice to implement the solution. The additional incomes would be less time for the rearing period and a more suitable growth leading to an increase of milk production.

ADDITIONAL COSTS	EXPLANATION	EUROS/EWELAMB			
Additional Labour	Planification of 4 lambing periods/year (using tool). 3 hours/time. 15 Euros/hour. 120 ewe-lambs reared	1.50 €			
Technical Advice	3 hour/time. 12 hours/year. 50 Euros/hour. 120 animals reared	5.00 €	6.50 €		
ADDITIONAL INCOMES	**EXPLANATION**	**EUROS/EWELAMB**		**7.00 €**	**5.60%**
More milk yield and milk quality	More time in production. 30 days producing more milk. 6 years of life production. 5 liters more per year. 0.9 Euros/liter	4.50 €			
Less time in rearing period	Saving 30 days. 0.3Euros per day	9.00 €	13.50 €		

We consider 30% of replacement rate (120 animals from 400 females)

Threshold cost: 125 Euros/animal

Sustainability analysis

Environmental indicators	Increase	Decrease	Not applicable
Feed efficiency (1)	☒	☐	☐
Grazing efficiency (2)	☒	☐	☐

Feed self-sufficiency (3)	☒	☐	☐
Manure/slurry "production"	☐	☒	☐
Effluents "production" (water for washing milking machine or with chemical treatment for footbath)	☐	☐	☒
Waste (plastics, etc.)	☐	☐	☒

(1) The farmer can reduce the replacement period; therefore, the feed and grazing efficiency is better.
(2) Same remark than before
(3) The better feeding planification leads to a better feed self-sufficiency as well

Global Environmental assessment	Positive	Negative	No change
Atmosphere (Emissions and air quality) (1)	☒	☐	☐
Water (Use and quality)	☐	☐	☒
Land (Soil quality and degradation)	☐	☐	☒
Materials and energy (Use, waste reduction and disposal)	☐	☐	☒
Biodiversity	☐	☐	☒

(1) The more feeding efficiency, the less emissions, and the better air quality

Other benefits	
• More leisure/family time	☒
• Improved animal welfare	☒
• Improved farm/farmer "image" (social acceptance)	☒
• Better work environment (appeals to new entrants)	☒
• Less physical labour (suitable for females and aging farmers)	☒
• Improve environment/landscape	☐
• Improve biodiversity	☐
• Other (specify) ……..	☐

Sustainability analysis conclusion

The implementation of this solution leads to a better replacement planification with a reduction of the replacement period and a more accurate feeding schedule. Consequently, it means an increment of the feeding, grazing and feed-self efficiency.

Besides, the feeding plan set up the feeding schedule and the group of animals, therefore, the animal welfare is better. The planification allows the family to organise better the labour improving the social sustainability and the image of the company.

Design and strategy of the hoof bath

Need/issue: Lameness

Topic: Health

Country: Spain

Dairy or/and meat sheep: both
Category of Animal (ewe, replacement, lamb): ewe and replacement

Short description of the "benchmark" farm for which the analysis is performed:
Whenever flocks have a high incidence or lameness or may have a higher risk (because they are place in very humid climatic areas), it is recommended to make the sheep walk through a foot bath during the humid seasons (spring and autumn) every 15 days, which means 12 treatments per year.

For this purpose, a footbath has to be built. The estimated costs correspond to:

- the construction of a footbath.
- The use of disinfectant, zinc or copper sulphate, at 10%,
- and the passage of the animals through the footbath 12 times a year.

The estimated benefits are an **increase in fertility of 7%,** which would mean an increase of 10.5 lambs per 100 ewes, and an increase in milk production estimated at 1400 litters of milk per 100 ewes, and an additional **5% of milk production when the incidence of lameness occurs in lactation,** assessed in 1000 l of milk/100 ewes. Also, it was considered higher growth rates of the lambs in meat flocks, and therefore shorter timer to achieve the slaughter weight (-15 days), which involves +2.63€ /lamb benefit from feed consumption.

The economic balance was calculated per ewe in a flock of 300 ewes.

Cost benefit analysis

• **Additional Costs (in green, items related to environmental evaluation too)**				
	Increase	Decrease	Percentage	Euro
– Fuel	☐	☐	… %	… €
– Labour (man-hours)	☒	☐	… %	2.041[1] €
– Equipment/materials (e.g. weigh scales, formalin etc.)	☒	☐	… %	0.267-0.367[2] €
– Feeding: concentrates	☐	☐	… %	… €
– Feeding : forages	☐	☐	… %	… €
– Electricity	☐	☐	… %	… €
– Water (water, troughs, piping etc.)	☒	☐	… %	0.008[3] €
– Seed	☐	☐	… %	… €
– Fertilizer	☐	☐	… %	… €
– Sprays (herbicides, pesticides etc.)	☐	☐	… %	… €

– Contractor charges (ploughing, spraying, harvesting etc.)	☐	☐	… %	… €
– Medicine (antibiotics, anthelmintics, vaccinations)	☐	☒	… %	0.15… €
– Technical advise	☐	☐	… %	… €
– Vet services	☐	☐	… %	… €
– Lab services	☐	☐	… %	… €
– Other external services	☐	☐	… %	… €
- Others (specify):	☐	☐	… %	… €
Total	☐	☐		2.16-2.26€
• **Additional Incomes**				
	Increase	Decrease	Percentage	Euro
– Output per ewe (e.g. meat, milk, wool)	☒	☐	7 % lambing 5% milk	11.55€ meat 29.52€ milk[4] €
– Quality bonus (carcass conformation, fat and protein composition etc.)	☒	☐	… %	… €
– Farm schemes and direct payments	☐	☐	… %	… €
Others (specify): ……	☐	☐	… %	… €
Total	☐	☐		**11.55€ 29.52€**
Average increase in earning (per ewe, ha, etc**.)**			(€/…)	**9.39€ meat- 27.36€ milk[5]** €

Notes:

1 The construction of the hoofbath (5 hours) and the dedication to make the sheep walk through the footbath each time (2 hr), amount to a total of 29 hours (the time it takes per animal is negligible). Total 29 hr. Cost/hr: 21.11€

2 The cost of materials for construction (brickets, concrete), as well as the disinfectant; the price difference is due to the cost of the disinfectant.

3 The cost of water (≈1200 l/ each time)

4 The expected benefits have been calculated in terms of +7% of fertility, which would mean an increase of 10.5 lambs per 100 ewes, and an increase in milk production estimated at 1400 litters of milk per 100 ewes, and 5% of milk production when the incidence of lameness occurs in lactation.

suckling lamb: 70-75 €
fat lamb: 80-85€
1 l of milk:1.20 €/l
concentrate: 0.50€/kg

5 .- There are probably more benefits attributable to this solution, such as reduction of veterinary and pharmaceutical costs, reduction in the culling of sick and chronically injured animals and therefore less

need for replacement animals, in addition to less labour needs (monitor and treat the lamb sheep), and higher personal satisfaction for the farmer.

Cost benefit analysis conclusion

A footrot control plan using hoof baths generates costs of around €2 per ewe, corresponding to labour (for construction just on the first year), water and disinfectant costs, but the benefits in a flock of 300 ewes can be assessed around 2800 € if it is for meat production (due to an increase of the number of lambs sold, which may also be achieved in a shorter period of time) and in 8200€, if it is a dairy flock (due to the profit corresponding to the increase of lambs sold, and litters of milk produced).

Sustainability analysis

Environmental indicators	Increase	Decrease	Not applicable
Feed efficiency	☒	☐	☐
Grazing efficiency	☒	☐	☐
Feed self-sufficiency	☒	☐	☐
Manure/slurry "production"	☐	☐	☒
Effluents "production" (water for washing milking machine or with chemical treatment for footbath)	☒	☐	☐
Waste (plastics, etc.)	☒	☐	☐

Global Environmental assessment	Positive	Negative	No change
Atmosphere (Emissions and air quality)	☐	☐	☒
Water (Use and quality)	☐	☒	☐
Land (Soil quality and degradation)	☐	☐	☒
Materials and energy (Use, waste reduction and disposal)	☐	☒	☐
Biodiversity	☐	☐	☒

Other benefits	
• More leisure/family time	☒
• Improved animal welfare	☒
• Improved farm/farmer "image" (social acceptance)	☒
• Better work environment	☒
• Improve health and safety for farmers	☒
• Less physical labour	☒
• Improve environment/landscape	☐
• Improve biodiversity	☐
• Other (specify) Improves fertility & lambing concentration, facilitates flock management and reduces labor requirements, veterinary and pharmaceutical cost	☒

Sustainability analysis conclusion

This solution generates a positive impact in terms of higher intake and efficiency in feed consumption and better grazing management, due to the reduction of lameness. However, it requires the use of more water and disinfectants, which implies the generation of waste from disinfectant containers. In terms of biodiversity, we consider that there may be an improvement due to the reduction of the presence of pathogens.

The lower incidence of footrot and lameness on the farm involves lower labour needs, and greater peace of mind for the farmer. In addition to the improvement of the image of the sector, and the overall benefit of reducing the use of antibiotics and analgesics, perfectly aligned with the "One Health" strategy.

Deworming program for sheep

Need/issue: Poor Body Condition

Topic: Health

Country: Spain

Dairy or/and meat sheep: dairy and meat
Category of Animal (ewe, replacement, lamb): ewe, replacement and lambs

Short description of the "benchmark" farm for which the analysis is performed:
Flock type, a 300 dairy sheep flock, with one lambing season per year, and that attends communal pastures. Treatment against internal parasites (deworming) is recommended at least once a year, but always after coprological analysis for the main groups of animals (replacement, young sheep 1-2 years old, and adult sheep).

Costs and benefits have been assessed on a per animal basis.

Cost benefit analysis

• **Additional Costs**				
	Increase	Decrease	Percentage	Euro
– Fuel	☐	☐	… %	… €
– Labour (man-hours)	☐	☒	… %	0[1] €
– Equipment/materials (e.g. weigh scales, formalin etc.)	☐	☐	… %	… €
– Feeding : concentrates	☐	☐	… %	… €
– Feeding : forages	☐	☐	… %	… €
– Electricity	☐	☐	… %	… €
– Water (water, troughs, piping etc.)	☐	☐	… %	… €
– Seed	☐	☐	… %	… €
– Fertilizer	☐	☐	… %	… €
– Sprays (herbicides, pesticides etc.)	☐	☐	… %	… €
– Contractor charges (ploughing, spraying, harvesting etc.)	☐	☐	… %	… €
– Medicine (antibiotics, anthelmintics, vaccinations)	☐	☒	50 %	0.13-0.48[2]
– Technical advise	☐	☐	… %	… €
– Vet services	☐	☐	… %	… €
– Lab services	☒	☐	100 %	0.2 €
– Other external services	☐	☐	… %	… €
- Others (specify):	☐	☐	… %	
Total	☐	☐		**(-0.28)-0.07€**

• **Additional Incomes**				
	Increase	Decrease	Percentage	Euro
– Output (e.g. meat, milk, wool)	☒	☐	… %	6.48 meat 9.7 milk [3]€
– Quality bonus (carcass confirmation, fat and protein composition etc.)	☐	☐	… %	… €
– Farm schemes and direct payments	☐	☐	… %	… €
Others (specify): ……	☐	☐	… %	… €
Total	☐	☐		**16.15**
Average increase in earning (per ewe, ha, etc.)			(€/…)	**16.08-16.15[4]€**

Notes:

1 The collection of faecal samples could take 2 hours per year, (work that is not normally done), analyses show that one treatment can normally be saved (2 hours per application).
2 The cost of the treatment depending on the type of parasites present may vary between the prices described per animal
3 The expected benefits have been calculated by a 0.2 increase in prolificacy, and a 5% increase in milk produced.
4 There are probably more benefits attributable to this solution, such as reduced lamb mortality, better feed utilization,... difficult to assign.

Cost benefit analysis conclusion

Coprological analysis allows a more rational (less product and fewer treatments) and effective use of anthelmintics against internal parasites present in the flock. It also reduces the risk of resistance and improves flock productivity. For a 300 heads dairy sheep flock, the gross benefit achieved by the implementation of this practice can be assessed around 4800 €.

Sustainability analysis

Environmental indicators	Increase	Decrease	Not applicable
Feed efficiency	☒	☐	☐
Grazing efficiency	☒	☐	☐
Feed self-sufficiency	☐	☐	☒
Manure/slurry “production”	☐	☐	☒
Effluents “production” (water for washing milking machine or with chemical treatment for footbath)	☐	☐	☒
Waste (plastics, etc.)	☐	☒	☐

Global Environmental assessment	Positive	Negative	No change
Atmosphere (Emissions and air quality)	☒	☐	☐
Water (Use and quality)	☐	☐	☒

Land (Soil quality and degradation)	☒	☐	☐
Materials and energy (Use, waste reduction and disposal)	☒	☐	☐
Biodiversity	☒	☐	☐

Other benefits	
• More leisure/family time	☐
• Improved animal welfare	☒
• Improved farm/farmer "image" (social acceptance)	☒
• Better work environment (appeals to new entrants)	☒
• Less physical labour (suitable for females and aging farmers)	☒
• Improve environment/landscape	☒
• Improve biodiversity	☒
• Other (specify) ……..	☐

Sustainability analysis conclusion

A good deworming programme and the use of specific anthelmintic products improve feed conversion efficiency, decreases the parasite load of grasslands and reduce the number of plastic packages used. As a result of healthier sheep, the methane enteric emission is expected to decrease. Also, since the antiparasitic treatments are only applied when required (after coprological analysis and only to infested group of sheep), the amount of residues generated is lower, and so the incidence on the soil microfauna.

Fewer but more effective anthelmintic treatments allow the farmer to have more leisure time, improve animal health and welfare, and reduce side effects on soil organisms caused by degradation products, improving biodiversity and functionality of pastures.

Control plan of external parasites

Need/issue: External parasitism

Topic: Health

Country: Spain

Dairy or/and meat sheep: dairy and meat
Category of Animal (ewe, replacement, lamb): ewe, replacement and lambs

Short description of the "benchmark" farm for which the analysis is performed:
Flock type, a 300 dairy sheep flock, with one lambing season per year, and that attends communal pastures. It is considered a high risk of scabies and/or ticks in May-June and another high incidence of ticks in September. Therefore, a preventive treatment against external parasites is recommended after shearing (around May), before attending communal pastures.

Costs and benefits have been assessed on a per animal basis.

Cost benefit analysis

• **Additional Costs**				
	Increase	Decrease	Percentage	Euro
– Fuel	☐	☐	… %	… €
– Labour (man-hours)	☒	☐	100 %	0.14[1] €
– Equipment/materials (e.g. weigh scales, formalin etc.)	☐	☐	… %	… €
– Feeding : concentrates	☐	☐	… %	… €
– Feeding : forages	☐	☐	… %	… €
– Electricity	☐	☐	… %	… €
– Water (water, troughs, piping etc.)	☐	☐	… %	… €
– Seed	☐	☐	… %	… €
– Fertilizer	☐	☐	… %	… €
– Sprays (herbicides, pesticides etc.)	☐	☐	… %	… €
– Contractor charges (ploughing, spraying, harvesting etc.)	☐	☐	… %	… €
– Medicine (antibiotics, anthelmintics, vaccinations)	☒	☐	100 %	0.55[2] €
– Technical advise	☐	☐	… %	… €
– Vet services	☐	☐	… %	… €
– Lab services	☒	☐	100 %	0.1 €
– Other external services	☐	☐	… %	… €
- Others (specify):	☐	☐	… %	
Total	☐	☐		0.79€

• **Additional Incomes**				
	Increase	Decrease	Percentage	Euro
– Output (e.g. meat, milk, wool)	☒	☐	12% lambs, 8% milk	3.888 € 15.52€ [3]€
– Quality bonus (carcass confirmation, fat and protein composition etc.)	☐	☐	… %	… €
– Farm schemes and direct payments	☐	☐	… %	… €
Others (specify): ……	☐	☐	… %	… €
Total	☐	☐		**19.408€**
Average increase in earning (per ewe, ha, etc.)			(€/…)	**18.618[4]€**

Notes:

1: 2 hours of work in a flock of 300 ewes. Cost/hour 21.11€
2: Increased production, because of a decrease in the incidence of abortion and the increase in the percentage of ewes lambed, approximately 8%. Therefore, the number of lambs sold increases, and the number of litters milked increases. 12% more lambs and 8% more milk. We estimate lambs sold with an average weight of 10.125 kg and the payment of 3.20€/kg, and an average production of 200 l of milk milked, paid at 0.97 €/l.
3: Estimation of direct benefits, because we consider that there are some indirect benefits that are difficult to value as a consequence of a concentration of lambing period, and therefore better feeding management and cost reduction, longer lactation period for many ewes, and therefore more litters of milk produced.
4.- There are probably more benefits attributable to this solution, such as reduced lamb mortality, better feed utilization,... difficult to assign.

Cost benefit analysis conclusion

The best way to avoid ectoparasite infestations in flocks is to apply preventive measures. In the case of the presence of ectoparasites, correct identification will allow more appropriate treatment, improving animal health and welfare and productivity. The application of treatments against external parasites, may provide a gross benefit over 5500 € for an average flock of 300 dairy sheep (mainly through higher fertility rates, and the associated outcomes – lambs and milk).

Sustainability analysis

Environmental indicators	Increase	Decrease	Not applicable
Feed efficiency	☒	☐	☐
Grazing efficiency[1]	☒	☐	☐
Feed self-sufficiency	☒	☐	☐
Manure/slurry "production" [1]	☐	☒	☐
Effluents "production" (water for washing milking machine or with chemical treatment for footbath)	☐	☐	☒

Waste (plastics, etc.)	☐	☐	☒

[1]The treatment against ectoparasites allows taking the flocks to infested communal pastures, instead of being kept indoors. It also decreases the amount of manure production within the barn.

Global Environmental assessment	Positive	Negative	No change
Atmosphere (Emissions and air quality)	☒	☐	☐
Water (Use and quality)	☐	☐	☒
Land (Soil quality and degradation)	☒	☐	☐
Materials and energy (Use, waste reduction and disposal)	☐	☐	☒
Biodiversity	☐	☐	☒

Other benefits	
• More leisure/family time	☒
• Improved animal welfare	☒
• Improved farm/farmer "image" (social acceptance)	☒
• Better work environment	☒
• Less physical labour	☐
• Improve environment/landscape	☒
• Improve biodiversity	☐
• Other (specify) ……..	☐

Sustainability analysis conclusion

Improving animal health and welfare will improve feed conversion, body condition, ewe prolificity and milk production, and will be able to use pastures longer in the season. Healthier animals and more productive flocks, also allow decreasing the enteric methane emissions and the carbon footprint of the activity.

Preventive measures reduce the use of pest control products, allowing the farmer more free time, improving animal health and welfare and reducing side effects on soil organisms caused by degradation products, which decreases biodiversity and pasture functionality.

Flock Health Plan

Need/issue: Sheep shed management

Topic: Health

Country: Spain

Dairy or/and meat sheep: Dairy and meat
Category of Animal (ewe, replacement, lamb): ewe, replacement and lambs

Short description of the "benchmark" farm for which the analysis is performed:
It is generally recommended to remove the litter from the sheep barn at least twice a year (both before and after lambing), whereas it is usually removed just once (so in general we may consider adding 1 more litter removal).

The assessment (when calculating labour needs and DDD expenditure) has been done considering facilities for a flock of 300 ewes.

The sanitary treatments considered are external deworming after shearing, internal deworming 1 or 2 a year, according to coprological analyses, and vaccination against clostridia and pasteurella.

It would be advisable to vaccinate against *Chlamydia abortus*, Toxoplasmosis abortion and *Coxiella burnetti*, and optional depending on the health status of the flock vaccination against Johne's disease and Contagious Agalactia.

The first recommendation is to avoid introducing animals from other flocks; therefore, the expenses derived from this practice have not been included, knowing that they are significant if the conditions of quarantine and veterinary analyses are fulfilled to prevent the introduction of any of the possible existing diseases in the area.

Costs have been assessed per animal.

Cost benefit analysis

• **Additional Costs (in green, items related to environmental evaluation too)**				
	Increase	Decrease	Percentage	Euro
– Fuel	☐	☐	%	€
– Labour (man-hours)	☒	☐	1 %	1.14[1] €
– Equipment/materials (e.g. weigh scales, formalin etc.)	☐	☐	… %	… €
– Feeding : concentrates	☐	☐	… %	… €
– Feeding : forages	☐	☐	… %	… €
– Electricity	☐	☐	… %	… €
– Water (water, troughs, piping etc.)	☒	☐	33 %	0.01[2] €

– Seed	☐	☐	… %	… €
– Fertilizer	☐	☐	… %	… €
– Sprays (herbicides, pesticides etc.)	☐	☐	… %	… €
– Contractor charges (ploughing, spraying, harvesting etc.)	☒	☐	33 %	1.17[3] €
– Medicine (antibiotics, anthelmintics, vaccinations)	☒	☐	30 %	2.20-3.26[4] €
– Technical advise	☐	☐	… %	… €
– Vet services	☒	☐	30 %	1.0[5] €
– Lab services	☒	☐	100 %	0.2[6] €
– Other external services	☐	☐	… %	… €
- Others (specify):	☐	☐	… %	… €
Total	☐	☐		5.71-6.78€
• **Additional Incomes**				
	Increase	Decrease	Percentage	Euro
– Output per ewe (e.g. meat, milk, wool)	☒	☐	8 % lambing +5% production	10.20+2.63 € meat 27.2+9.0€ milk[6]
– Quality bonus (carcass confirmation, fat and protein composition etc.)	☐	☒	… %	… €
– Farm schemes and direct payments	☐	☐	… %	… €
Others (specify): ……	☐	☐	… %	… €
Total	☐	☐		**12.83€ meat 36.2€ milk**
Average increase in earning (per ewe, ha, etc.)			(€/…)	**7.12€ meat 30.49€ milk[7]**

Notes:

1: +17 hours of farmer labour have been considered for litter removal, DDD, external deworming, and collection of faecal samples and internal deworming, as well as vaccination against clostridiosis and pasteurellosis . Cost/hour 21.11€.
2: consideration of 1 €/m3 and 3 m3.
3: The fuel cost has included the use of a tractor and tractor driver for 5 hours. Cost hour: 70€
4: We would apply external deworming after shearing. Internal deworming 1 or 2 times a year according to the results of coprological analysis.
5: Veterinary services contracted for the vaccination plan against abortions: €1 per ewe per year.
6: 2 veterinary analyses (egg count in faeces)
6: Increased production, as a result of an increase in the percentage of ewes lambed, approximately 8%. Therefore, the number of lambs sold and milk yield increases: 12% more lambs and 8% more milk. In addition, there would be an 5% increase in milk production. We estimate suckling lambs sold with an

average weight of 10.125 kg and the payment of 70-75€/lamb, and an average production of 200 l of milk milked, paid at 1.20 €/l. Fattened lambs for sale at the feedlot, 21 kg, are priced at 80-85 € and the average stay of the lambs in the flock can be reduced by 15 days, resulting in a saving in concentrate consumption of 2.63€/lamb

7: Estimation of direct benefits, because we consider that there are some indirect benefits that are difficult to value, such as better feed utilization, more rational use of labour, ... difficult to be assessed.

Cost benefit analysis conclusion

The establishment of a sanitary plan in a flock generates an estimated cost of between 6 and 7 euros per ewe derived from the use of disinfectants, antiparasitic, and vaccines, mainly with the corresponding work of the veterinary services. Their use is estimated to generate a profit of between €13 and €36 per ewe, depending on whether the flock is for meat or milk, respectively. Benefits are directly related to higher production efficiency and reduced costs of lamb production because of increased feed efficiency and therefore improved feed conversion rates. These benefits in a flock of 300 ewes may be assessed in around 3849€ in meat flocks and 10860€ in dairy flocks.

Sustainability analysis

Environmental indicators	Increase	Decrease	Not applicable
Feed efficiency	☒	☐	☐
Grazing efficiency	☐	☐	☒
Feed self-sufficiency	☐	☐	☒
Manure/slurry “production”	☐	☐	☒
Effluents “production” (water for washing milking machine or with chemical treatment for footbath)	☒	☐	☐
Waste (plastics, etc.)	☒	☐	☐

Global Environmental assessment	Positive	Negative	No change
Atmosphere (Emissions and air quality)	☐	☐	☒
Water (Use and quality)	☐	☒	☐
Land (Soil quality and degradation)	☐	☐	☒
Materials and energy (Use, waste reduction and disposal)	☐	☒	☐
Biodiversity	☒	☐	☐

Other benefits	
• More leisure/family time	☒
• Improved animal welfare	☒
• Improved farm/farmer “image” (social acceptance)	☒

• Better work environment	☒
• Improve health and safety for farmers	☒
• Less physical labour	☐
• Improve environment/landscape	☒
• Improve biodiversity	☒
• Other (specify) Improves fertility & lambing concentration, facilitates flock management and reduces man-power requirements ……..	☒

Sustainability analysis conclusion

The implementation of this solution means higher use of medicines and vaccines, and therefore generates a significant environmental impact due to the production of waste, dirty water and plastic debris. However, its impact in terms of biodiversity and generation of high quality compost is very positive, as a consequence of the reduction in the use of medicines (antibiotics, anti-inflammatory treatments, etc.) that is expected with its application.

The prevention of the appearance of diseases in a flock is probably the factor that has the greatest economic and social impact both internally in the flock itself and in society in general, due to the impact it has on the image of the sector, as well as the implications on the health of the population in general. Any solution that prevents the use of drugs will be aligned with the "One health" strategy.

Good milking practices

Need/issue: Milking machine management

Topic: Health and management

Country: Spain

Dairy or/and meat sheep: Dairy
Category of Animal (ewe, replacement, lamb): ewe

Short description of the "benchmark" farm for which the analysis is performed:
The economic balance was calculated per ewe in a dairy sheep flock of 300 ewes with an average production of 200 litres / head.

The implementation of good milking practices allows a general improvement of the sanitary status of the udder of the sheep, and therefore a decrease in the needs of veterinary treatments, laboratory analysis and technical assistance, which may be assessed in up to 6%. In addition, a slight increase in the cost of additional materials for the milking parlour can be expected (around 1,5%).

Regarding the benefits, it means **higher milk yield** (+3-5%) and better bulk tank milk quality and the consequent **higher price perceived** (+2-4%) by the farmer.

Cost benefit analysis

• **Additional Costs (in green, items related to environmental evaluation too)**				
	Increase	Decrease	Percentage	Euro
– Fuel	☐	☐	… %	… €
– Labour (man-hours)	☐	☐	0[3] %	… €
– Equipment/materials (e.g. weigh scales, formalin etc.)	☒	☐	1[4] %	… €
– Feeding : concentrates	☐	☐	… %	… €
– Feeding : forages	☐	☐	… %	… €
– Electricity	☒	☐	%	… €
– Water (water, troughs, piping etc.)	☒	☐	0.5[2] %	… €
– Seed	☐	☐	… %	… €
– Fertilizer	☐	☐	… %	… €
– Sprays (herbicides, pesticides etc.)	☐	☐	… %	… €
– Contractor charges (ploughing, spraying, harvesting etc.)	☐	☐	… %	… €
– Medicine (antibiotics, anthelmintics, vaccinations)	☐	☒	2[1] %	… €
– Technical advise	☐	☐	… %	… €
– Vet services	☐	☒	2[1] %	… €
– Lab services	☐	☒	2[1] %	… €

– Other external services	☐	☐	… %	… €
- Others (specify):	☐	☐	… %	… €
Total	☐	☒	**4,5%**	
• **Additional Incomes**				
	Increase	Decrease	Percentage	Euro
– Output per ewe (e.g. meat, milk, wool)	☒	☐	3 %	… €
– Quality bonus (carcass confirmation, fat and protein composition etc.)	☒	☐	2 %	… €
– Farm schemes and direct payments	☐	☐	… %	… €
Others (specify): ……	☐	☐	… %	… €
Total	☒	☐	**5%**	
Average increase in earning (per ewe, ha, etc**.)**			(€/…)	**5-15** €

Notes:

1 Veterinary, medication and analytical costs are reduced as the risk of mastitis is reduced and therefore less disease is expected on the farm.

2 There may be a slight increase in water and energy costs depending on what they were doing before as the washings have to be done correctly with the water at the right temperature.

3 As for labor, it can be maintained, increased or reduced. On the one hand, the increase is due to the extra time in the milking routine, that is, the time dedicated to check the milking vacuum, monitor regularly the udder, apply product after milking, etc. But on the other hand, time is reduced by avoiding over-milking and doing the putting on and taking off of milking units correctly and this would reduce milking time and therefore labor. As a result, no additional time devoted to milking has been considered.

4 Depending also on the type of maintenance that is done it may increase slightly. However, this will mean that there will not be any over jumping and probably there will be fewer emergencies with a higher cost, so we can also say that there is no over cost, since one compensates the other. In the case of having to invest in meters or automatic removals (milking equipment) there would be an extra investment.

Cost benefit analysis conclusion

The estimated benefits from the implementation of appropriate milking practices are several. First, a general improvement of the sanitary status of the udder of the sheep, which is reflected in a decrease in the somatic cell count and in the incidence of mastitis. Therefore, is has implication in terms of animal welfare and less veterinary costs. In addition, it means **higher milk yield** (+3-5%) and better bulk tank milk quality and the consequent **higher price perceived** (+2-4%) by the farmer. For an average dairy sheep flock of 300 ewes and 200 l/ewe, the economic added income may range from 1500 to 4500 €.

Sustainability analysis

Environmental indicators	Increase	Decrease	Not applicable
Feed efficiency	☐	☐	☒
Grazing efficiency	☐	☐	☒
Feed self-sufficiency	☐	☐	☒
Manure/slurry "production"	☐	☐	☒
Effluents "production" (water for washing milking machine or with chemical treatment for footbath)	☒	☐	☐
Waste (plastics, etc.)	☐	☐	☐

Global Environmental assessment	Positive	Negative	No change
Atmosphere (Emissions and air quality)	☐	☐	☒
Water (Use and quality)	☐	☒	☐
Land (Soil quality and degradation)	☐	☐	☒
Materials and energy (Use, waste reduction and disposal)	☐	☒	☐
Biodiversity	☐	☐	☒

Other benefits	
• More leisure/family time	☐
• Improved animal welfare	☒
• Improved farm/farmer "image" (social acceptance)	☒
• Better work environment	☒
• Improve health and safety for farmers	☐
• Less physical labour	☒
• Improve environment/landscape	☐
• Improve biodiversity	☐
• Other (specify) ……Less use of antibiotics for sanitary treatments…….	☒

Sustainability analysis conclusion

The implementation of cleaner milking routines means the utilisation of more hot water and disinfectant products both for the udder of the sheep and for the milking equipment (machine and deposits). In addition to higher water and energy consumption, more effluents (dirty water) are generated.

The implementation of preventive measurements around milking and the achievement of better sanitary status of the sheep, involves less incidence of mastitis and as a result less application of antibiotics and veterinary treatments. Therefore, this solution is aligned with the objectives of the "One Health" strategy. The incidences of hazards around milking should be

less frequent, milking routines may become more regular and easier to be implemented, and as a result, more satisfaction for the farmer.

Use of portable NIR'S to assess forage feed value

Need/issue: Forage feed value

Topic: Nutrition

Country: Spain

Dairy or/and meat sheep: Dairy and meat
Category of Animal (ewe, replacement, lamb): ewe, replacement, and lambs

Short description of the "benchmark" farm for which the analysis is performed:
This solution is considered valid for a group of farmers, cooperative or association.

It has been assessed its implementation for a group of 40 farmers, with an average flock size of 300 animals.

A minimum of 4 visits to the farms has been considered to evaluate the fodder produced and/or the silos produced.

The laboratory analysis of forages has been considered as an incremental expense, since they are not usually evaluated.

This solution, together with technical advice on livestock feeding planning, would allow a better valorisation of the forages produced and a better adjustment of concentrate requirements. Generally, a reduction of the purchase of feedstuff in quantity and/or quality, protein needs, etc. may be expected.

The costs and benefits have been assessed on a per animal basis.

Cost benefit analysis

• **Additional Costs (in green, items related to environmental evaluation too)**				
	Increase	Decrease	Percentage	Euro
– Fuel	☒	☐	100 %	0.307[1]€
– Labour (man-hours)	☐	☐	… %	€
– Equipment/materials (e.g. weigh scales, formalin etc.)	☒	☐	100 %	0.183[2] €
– Feeding : concentrates	☐	☒	3-8 %	2.57-4.00[3]€
– Feeding : forages	☐	☐	… %	… €
– Electricity	☐	☐	… %	… €
– Water (water, troughs, piping etc.)	☐	☐	… %	… €
– Seed	☐	☐	… %	… €
– Fertilizer	☐	☐	… %	… €
– Sprays (herbicides, pesticides etc.)	☐	☐	… %	… €
– Contractor charges (ploughing, spraying, harvesting etc.)	☐	☐	… %	… €

– Medicine (antibiotics, anthelmintics, vaccinations)	☐	☐	… %	€
– Technical advise	☒	☐	… %	2[4] €
– Vet services	☐	☐	… %	… €
– Lab services	☐	☐	… %	€
– Other external services	☐	☐	… %	… €
- Others (specify):	☐	☐	… %	… €
Total	☐	☐		**-1.51-0.08€**
• **Additional Incomes**				
	Increase	Decrease	Percentage	Euro
– Output per ewe (e.g. meat, milk, wool)	☒	☐	5% meat lamb, and 5% milk	2.43€ meat lamb 9.7€ [5]milk
– Quality bonus (carcass confirmation, fat and protein composition etc.)	☐	☐	… %	… €
– Farm schemes and direct payments	☐	☐	… %	… €
Others (specify): ……	☐	☐	… %	… €
Total	☐	☐		**12.13€**
Average increase in earning (per ewe, ha, etc**.)**			(€/…)	**12.05-13.64[6] €**

Notes:

1: Travel of a technician to the flock. Average distance of 100 km, 4 visits, and cost 23 €/trip.
2: Cost of NIR, divided into 10 years of amortization and distributed among all flocks and attributed to ewe.
3: We have considered a reduction in concentrate consumption of between 3 and 8%, with the benefit varying according to the % reduction in consumption and the cost of concentrate (0.35-0.45 €/kg).
4: Considered as the cost of technical service, sample collection and analysis.
5: Increased production as a result of improved feeding management, valued at 5% more lambs produced, and milk production. We estimate suckling lambs sold with an average weight of 10.125 kg and the payment of 3.20€/kg, and an average production of 200 l of milk milked, paid at 0.97 €/l.
6: Estimation of direct benefits, because we consider that there are some indirect benefits that are difficult to value as a consequence of a concentration of lambing period, and therefore better feeding management and cost reduction, longer lactation period for many ewes, and therefore more litters of milk produced. We also estimate that the production of better quality fodder is continuous.

Cost benefit analysis conclusion

The implementation of this solution aims to achieve better quality forages, and so higher lower feeding costs, higher feed self-sufficiency, and so, a higher margin upon feeding costs. For a average flock, it may means and additional gross benefit of 3600 €.

Sustainability analysis

Environmental indicators	Increase	Decrease	Not applicable
Feed efficiency	☒	☐	☐
Grazing efficiency	☐	☐	☐
Feed self-sufficiency	☒	☐	☐
Manure/slurry "production"	☐	☐	☒
Effluents "production" (water for washing milking machine or with chemical treatment for footbath)	☐	☐	☒
Waste (plastics, etc.)	☒	☐	☐

Global Environmental assessment	Positive	Negative	No change
Atmosphere (Emissions and air quality)	☒	☐	☐
Water (Use and quality)	☐	☐	☒
Land (Soil quality and degradation)	☐	☐	☒
Materials and energy (Use, waste reduction and disposal)	☐	☒	☐
Biodiversity	☐	☒	☐

Other benefits	
• More leisure/family time	☐
• Improved animal welfare	☒
• Improved farm/farmer "image" (social acceptance)	☒
• Better work environment	☒
• Improve health and safety for farmers	☐
• Less physical labour	☒
• Improve environment/landscape	☐
• Improve biodiversity	☐
• Other (specify): Improves lambing concentration, facilitates flock management and reduces labor requirements	☒

Sustainability analysis conclusion

The implementation of this solution aims to improve the quality of home-produced forages, and therefore should lead to a lower dependence from concentrates and feeding inputs from abroad, and so to decrease the associated negative impacts (deforestation, transport, etc.). Also, the utilisation of higher quality forages is related to an improvement in the digestibility and lower methane emissions from ruminant fermentation. Since less poor-quality forages are made, in the case of plastic bales, less waste is generated.

The implementation of this solution aims to achieve better quality forages, and so higher lower feeding costs, and therefore higher feed self-sufficiency. In the case of PDO or PGI food

products, self-sufficiency is aligned with the fulfilment of the Commission Delegated Regulation (EU) No 664/2014 of 18 December 2013. The production of higher quality forages helps to improve the animal welfare and health of ruminants. Also, since less poor-quality forages are used, the labour it requires to be removed, is avoided.

Solutions from Turkey

BCS as a tool for nutrition requirement of ewes

Need/issue: Knowledge of nutrition requirement

Topic: Nutrition

Country: Turkey

Dairy or/and meat sheep:
Category of Animal (ewe, replacement, lamb): Ewe,lamb,replacement

Short description of the "benchmark" farm for which the analysis is performed:
It is about the body reserve prediction. In the experiment farm where 184 adult ewe were breed, the total gain were by the increase of each score of body weight :

- the increase of lamb per sheep 0,15%

- weaned lamb/reared ewe increased 0.10%

-increase of total productivity by 0,25%

Cost benefit analysis

• **Additional Costs**				
	Increase	Decrease	Percentage	Euro
– Fuel	☐	☐	… %	… €
– Labour (man-hours)	☒	☐	5 %	… €
– Equipment/materials (e.g. weigh scales, formalin etc.)	☐	☐	… %	… €
– Feeding : concentrates	☐	☐	… %	… €
– Feeding : forages			… %	… €
– Electricity	☐	☐	… %	… €
– Water (water, troughs, piping etc.)	☐	☐	… %	… €
– Seed	☐	☐	… %	… €
– Fertilizer	☐	☐	… %	… €
– Sprays (herbicides, pesticides etc.)	☐	☐	… %	… €
– Contractor charges (ploughing, spraying, harvesting etc.)	☐	☐	… %	… €
– Medicine (antibiotics, anthelmintics, vaccinations)	☐	☐	… %	… €
– Technical advise	☐	☒	15 %	… €
– Vet services	☐	☒	10 %	… €
– Lab services	☐	☐	… %	… €
– Other external services	☐	☐	… %	… €

- Others (specify): ……..	☐	☐	… %	… €
Total	☐	☐		
• **Additional Incomes**				
	Increase	Decrease	Percentage	Euro
– Output (e.g. meat, milk, wool)	☒	☐	25 %	… €
– Quality bonus (carcass confirmation, fat and protein composition etc.)	☐	☐	… %	… €
– Farm schemes and direct payments	☐	☐	… %	… €
Others (specify): ……	☐	☐	… %	… €
Total	☐	☐		
Average increase in earning (per ewe, ha, etc.)			(€/…)	**25** €/ewe

Cost benefit analysis conclusion

BCS tool allows farmer to classify animals according to their conditions which will improve the productivity. BSC application may increase the labour essential amount however its benefits are far beyond this labour cost. Because animals will be under better health and bosy conditions the vet servise cost will decrease.

Sustainability analysis

Environmental indicators	Increase	Decrease	Not applicable
Feed efficiency	☒	☐	☐
Grazing efficiency	☒	☐	☐
Feed self-sufficiency	☐	☐	☐
Manure/slurry “production”	☐	☐	☒
Effluents “production” (water for washing milking machine or with chemical treatment for footbath)	☐	☐	☒
Waste (plastics, etc.)	☐	☐	☒

Global Environmental assessment	Positive	Negative	No change
Atmosphere (Emissions and air quality)	☐	☐	☒
Water (Use and quality)	☐	☐	☒
Land (Soil quality and degradation)	☐	☐	☒
Materials and energy (Use, waste reduction and disposal)	☐	☐	☒

Other benefits

• More leisure/family time	☐
• Improved animal welfare	☒
• Improved farm/farmer "image" (social acceptance)	☒
• Better work environment	☐
• Improve health and safety for farmers	☐
• Less physical labour	☐
• Improve environment/landscape	☐
• Improve biodiversity	☐
• Other (specify) ……..	☐

Sustainability analysis conclusion

BCS tool will help to increase feed and grazing efficiency with better classification of animals according to their physical stages. Better animals will improve farmers social acceptance and animals welfare.

Cross comparison of feed catalogue value with animals' blood test

Need/issue: Vitamin and mineral supplementation

Topic: Nutrition

Country: Turkey

Dairy or/and meat sheep:
Category of Animal (ewe, replacement, lamb): Ewe, replacement

Short description of the "benchmark" farm for which the analysis is performed:
Six to twelve ewes can be selected from the 100 heads flock. The animals need to be healthy and without disease. Blood samples can be collected either from the live animals or in case they went for slaughter.
Blood test can be made in government labs of private lab facilities. The blood results can be compared with the feed catalogue. If the animals blood test provide sufficient vit and mineral combination-that matches to the catalogue value. It can be an alternative cross comparison with the feed providers value.

Cost benefit analysis

• **Additional Costs**				
	Increase	Decrease	Percentage	Euro
– Fuel	☐	☐	… %	… €
– Labour (man-hours)	☐	☐	%	… €
– Equipment/materials (e.g. weigh scales, formalin etc.)	☐	☐	… %	… €
– Feeding : concentrates	☐	☐	… %	… €
– Feeding : forages			… %	… €
– Electricity	☐	☐	… %	… €
– Water (water, troughs, piping etc.)	☐	☐	… %	… €
– Seed	☐	☐	… %	… €
– Fertilizer	☐	☐	… %	… €
– Sprays (herbicides, pesticides etc.)	☐	☐	… %	… €
– Contractor charges (ploughing, spraying, harvesting etc.)	☐	☐	… %	… €
– Medicine (antibiotics, anthelmintics, vaccinations)	☐	☐	… %	… €
– Technical advise	☒	☐	5 %	… €
– Vet services	☐	☐	… %	… €
– Lab services	☒	☐	5 %	… €
– Other external services	☐	☐	… %	… €
- Others (specify): ……	☐	☐	… %	… €
Total	☐	☐	**10**	

• **Additional Incomes**				
	Increase	Decrease	Percentage	Euro
– Output (e.g. meat, milk, wool)	☒	☐	10 %	… €
– Quality bonus (carcass confirmation, fat and protein composition etc.)	☐	☐	… %	… €
– Farm schemes and direct payments	☐	☐	… %	… €
Others (specify): ……	☐	☐	… %	… €
Total	☐	☐		
Average increase in earning (per ewe, ha, etc.)			(€/…)	**10**€/per ewe

Cost benefit analysis conclusion

By making routine blood test on the animal's health state, it will improve overall performance and productivity in the farm and decrease the inefficient feed and supplement cost. It might cost a lot if you test all the animals but no need for this. The farmer can take sample animals blood which will decrease the lab cost.

Sustainability analysis

Environmental indicators	Increase	Decrease	Not applicable
Feed efficiency	☒	☐	☐
Grazing efficiency	☐	☐	☒
Feed self-sufficiency	☒	☐	☐
Manure/slurry "production"	☐	☐	☒
Effluents "production" (water for washing milking machine or with chemical treatment for footbath)	☐	☐	☒
Waste (plastics, etc.)	☐	☐	☒

Global Environmental assessment	Positive	Negative	No change
Atmosphere (Emissions and air quality)	☒	☐	☐
Water (Use and quality)	☐	☐	☒
Land (Soil quality and degradation)	☐	☐	☒
Materials and energy (Use, waste reduction and disposal)	☐	☐	☒

Other benefits

• More leisure/family time	☐
• Improved animal welfare	☒
• Improved farm/farmer "image" (social acceptance)	☐
• Better work environment	☐
• Improve health and safety for farmers	☐
• Less physical labour	☐
• Improve environment/landscape	☐
• Improve biodiversity	☐
• Other (specify) ……..	☐

Sustainability analysis conclusion

Mineral and vitamin supplementation is essential for animal production. If we know exactly which minerals or Vitamins are deficient in animals we can provide the supplementation properly in an efficient way. This will increase the efficiency in the whole production chain and improve the sustainability aspects in the environment.

Gradual weaning protocol for lambs

Need/issue: Weaning transition management
Topic: Nutrition
Country: Turkey

Dairy or/and meat sheep: Dairy, meat
Category of Animal (ewe, replacement, lamb): Lamb
Short description of the "benchmark" farm for which the analysis is performed:
The protocol used in the experimental farm is below:
-after the first week of suckling free hay and concentrate pellet is available for lambs
-after 3rd week of suckling: restricted suckling is performed to encourage hay and pellet consumption
-after 4th week creep feeders are provided: min 250gr pellet per lamb(can be gradually increased) and good hay/roughage availability+restricted suckling (morning and night after grazing of ewes)
-lambs can be weaned after they reach 3-4 times of their birth weights. The success of early weaning depends partly on the rumen development of lambs.

Cost benefit analysis

• **Additional Costs**				
	Increase	Decrease	Percentage	Euro
– Fuel	☐	☐	… %	… €
– Labour (man-hours)	☒	☐	5 %	… €
– Equipment/materials (e.g. weigh scales, formalin etc.)	☐	☐	%	… €
– Feeding : concentrates	☒	☐	2 %	… €
– Feeding : forages			… %	… €
– Electricity	☐	☐	… %	… €
– Water (water, troughs, piping etc.)	☐	☐	… %	… €
– Seed	☐	☐	… %	… €
– Fertilizer	☐	☐	… %	… €
– Sprays (herbicides, pesticides etc.)	☐	☐	… %	… €
– Contractor charges (ploughing, spraying, harvesting etc.)	☐	☐	… %	… €
– Medicine (antibiotics, anthelmintics, vaccinations)	☐	☐	… %	… €
– Technical advise	☐	☐	… %	… €
– Vet services	☒	☐	10 %	… €
– Lab services	☐	☐	… %	… €
– Other external services	☐	☐	… %	… €
- Others (specify): ……	☐	☐	… %	… €

Total	☐	☐	**17**	
• **Additional Incomes**				
	Increase	Decrease	Percentage	Euro
– Output (e.g. meat, milk, wool)	☒	☐	10 %	… €
– Quality bonus (carcass confirmation, fat and protein composition etc.)	☐	☐	… %	… €
– Farm schemes and direct payments	☐	☐	… %	… €
Others (specify): ……	☐	☐	… %	… €
Total	☐	☐	**10**	
Average increase in earning (per ewe, ha, etc.)			€/…)	**25€**

Cost benefit analysis conclusion

Weaning transition management is one of the most important management elements in a farm. There might be a lot of lamb loses during this period which can affect the farm income up to 60%. Thus having a strategy for wen the lambs and manage this period with less stress can improve the feed efficiency-thus cost efficient production.

Sustainability analysis

Environmental indicators	Increase	Decrease	Not applicable
Feed efficiency	☒	☐	☐
Grazing efficiency	☐	☐	☒
Feed self-sufficiency	☐	☐	☒
Manure/slurry “production”	☐	☐	☒
Effluents “production” (water for washing milking machine or with chemical treatment for footbath)	☐	☐	☒
Waste (plastics, etc.)	☐	☐	☒

Global Environmental assessment	Positive	Negative	No change
Atmosphere (Emissions and air quality)	☐	☐	☒
Water (Use and quality)	☐	☐	☒
Land (Soil quality and degradation)	☐	☐	☒
Materials and energy (Use, waste reduction and disposal)	☐	☐	☒

Other benefits	
• More leisure/family time	☐

• Improved animal welfare	☒
• Improved farm/farmer “image” (social acceptance)	☒
• Better work environment	☐
• Improve health and safety for farmers	☐
• Less physical labour	☐
• Improve environment/landscape	☐
• Improve biodiversity	☐
• Other (specify) ……..	☐

Sustainability analysis conclusion

Less stress in the animals will improve the feed efficiency and overall welfare. This will also impact the farmers social acceptance and image.

Lamb growth protocol for performance target

Need/issue: Lamb performance targets from birth to weaning

Topic: Nutrition

Country: Turkey

Dairy or/and meat sheep:
Category of Animal (ewe, replacement, lamb): Lamb

Short description of the "benchmark" farm for which the analysis is performed:
The experiment intensive dairy farm applied lamb performance targets from birth to weaning. They used creep feeders for early weaning at 4-5 weeks when lambs were able to consume <250g concentrate/day. Their average birth weight in the flock is 4.1kg and average weaning weight was 17.6 kg.

They provided concentrates containing 18-20% protein and mineral blocks. They saved a lot of milk to be used in cheese production. The target growth rates for lambs up to 8 weeks were greater than 250g/day.

Cost benefit analysis

• **Additional Costs**				
	Increase	Decrease	Percentage	Euro
– Fuel	☐	☐	… %	… €
– Labour (man-hours)	☒	☐	5 %	… €
– Equipment/materials (e.g. weigh scales, formalin etc.)	☐	☐	… %	… €
– Feeding : concentrates	☒	☐	7 %	… €
– Feeding : forages	X		5 %	… €
– Electricity	☐	☐	… %	… €
– Water (water, troughs, piping etc.)	☐	☐	… %	… €
– Seed	☐	☐	… %	… €
– Fertilizer	☐	☐	… %	… €
– Sprays (herbicides, pesticides etc.)	☐	☐	… %	… €
– Contractor charges (ploughing, spraying, harvesting etc.)	☐	☐	… %	… €
– Medicine (antibiotics, anthelmintics, vaccinations)	☐	☐	5 %	… €
– Technical advise	☐	☐	… %	… €
– Vet services	☐	☐	5 %	… €
– Lab services	☐	☐	… %	… €
– Other external services	☐	☐	… %	… €
- Others (specify): ……..	☐	☐	… %	… €

Total	☐	☐	**27**	25€/lamb
• **Additional Incomes**				
	Increase	Decrease	Percentage	Euro
– Output (e.g. meat, milk, wool)	☒	☐	25%	… €
– Quality bonus (carcass confirmation, fat and protein composition etc.)	☐	☐	… %	… €
– Farm schemes and direct payments	☐	☐	… %	… €
Others (specify): ……	☐	☐	… %	… €
Total	☐	☐		
Average increase in earning (per ewe, ha, etc.)			(€/…)	**45** €

Cost benefit analysis conclusion

By using creep feeders farmer can stimulate the rumen development, thus increase feed efficiency and wean the lambs earlier to benefit more from the milk sales in the farm.

Sustainability analysis

Environmental indicators	Increase	Decrease	Not applicable
Feed efficiency	☒	☐	☐
Grazing efficiency	☐	☐	☒
Feed self-sufficiency	☐	☐	☒
Manure/slurry “production”	☐	☐	☒
Effluents “production” (water for washing milking machine or with chemical treatment for footbath)	☐	☐	☒
Waste (plastics, etc.)	☐	☐	☒

Global Environmental assessment	Positive	Negative	No change
Atmosphere (Emissions and air quality)	☐	☐	☒
Water (Use and quality)	☐	☐	☒
Land (Soil quality and degradation)	☐	☐	☒
Materials and energy (Use, waste reduction and disposal)	☐	☐	☒

Other benefits	
• More leisure/family time	☐
• Improved animal welfare	☒
• Improved farm/farmer “image” (social acceptance)	☐

• Better work environment	☐
• Improve health and safety for farmers	☐
• Less physical labour	☐
• Improve environment/landscape	☐
• Improve biodiversity	☐
• Other (specify) ……..	☐

Sustainability analysis conclusion

Weaning the lamb at early times allows to to profit from the more milk. This fact will increase the overall sustainability of the farm and improve animal welfare.

Targeted drainage system in the grassland

Need/issue: Lameness/foot disease

Topic: Nutrition

Country: Turkey

Dairy or/and meat sheep:
Category of Animal (ewe, replacement, lamb): Ewe, replacement

Short description of the "benchmark" farm for which the analysis is performed:
Artificial sets/resting moulds are builded by farmer in his private grassland. He used gravel with drainage ability.

The sets size is depend on the flock size and pasture land availability.

Ideally 2 m^2 per ewe can be considered.

The farmer experience less microbial activity in the wet season which improved animal welfare and drug use.

Cost benefit analysis

• **Additional Costs**				
	Increase	Decrease	Percentage	Euro
– Fuel	☐	☐	… %	… €
– Labour (man-hours)	☒	☐	15 %	… €
– Equipment/materials (e.g. weigh scales, formalin etc.)	☒	☐	10%	… €
– Feeding : concentrates	☐	☐	… %	… €
– Feeding : forages			… %	… €
– Electricity	☐	☐	… %	… €
– Water (water, troughs, piping etc.)	☐	☐	… %	… €
– Seed	☐	☐	… %	… €
– Fertilizer	☐	☐	… %	… €
– Sprays (herbicides, pesticides etc.)	☐	☐	… %	… €
– Contractor charges (ploughing, spraying, harvesting etc.)	☐	☐	… %	… €
– Medicine (antibiotics, anthelmintics, vaccinations)	☐	☒	35 %	… €
– Technical advise	☐	☐	… %	… €
– Vet services	☐	☒	10 %	… €
– Lab services	☐	☒	5 %	… €
– Other external services	☐	☐	… %	… €
- Others (specify): ……	☐	☐	… %	… €
Total	☐	☐		

• **Additional Incomes**				
	Increase	Decrease	Percentage	Euro
– Output (e.g. meat, milk, wool)	☒	☐	15 %	… €
– Quality bonus (carcass confirmation, fat and protein composition etc.)	☐	☐	15 %	… €
– Farm schemes and direct payments	☐	☐	…%	… €
Others (specify): ……	☐	☐	… %	… €
Total	☐	☐		
Average increase in earning (per ewe, ha, etc.)			(€/…)	**25** €/ewe

Cost benefit analysis conclusion

By building artificial set on the grassland will improve animal foot health and overall wellbeing. Animals will have less lameness and foot problems which will decrease medicine use, Vet service cost and lab cost.

Sustainability analysis

Environmental indicators	Increase	Decrease	Not applicable
Feed efficiency	☒	☐	☐
Grazing efficiency	☒	☐	☐
Feed self-sufficiency	☐	☐	☒
Manure/slurry “production”	☐	☐	☒
Effluents “production” (water for washing milking machine or with chemical treatment for footbath)	☐	☐	☒
Waste (plastics, etc.)	☐	☐	☒

Global Environmental assessment	Positive	Negative	No change
Atmosphere (Emissions and air quality)	☐	☐	☒
Water (Use and quality)	☐	☐	☒
Land (Soil quality and degradation)	☐	☐	☒
Materials and energy (Use, waste reduction and disposal)	☐	☐	☒

Other benefits	
• More leisure/family time	☐
• Improved animal welfare	☒
• Improved farm/farmer “image” (social acceptance)	☒

• Better work environment	☒
• Improve health and safety for farmers	☐
• Less physical labour	☐
• Improve environment/landscape	☐
• Improve biodiversity	☐
• Other (specify) ……..	☐

Sustainability analysis conclusion

By using artificial sets on the grassland will help to reduce foot problems and this will provide more healthier animals. This will improve the farmers' image and animal welfare.

"Wikiloc"- a free tool to record grazing activities

Need/issue: Grassland and grazing management

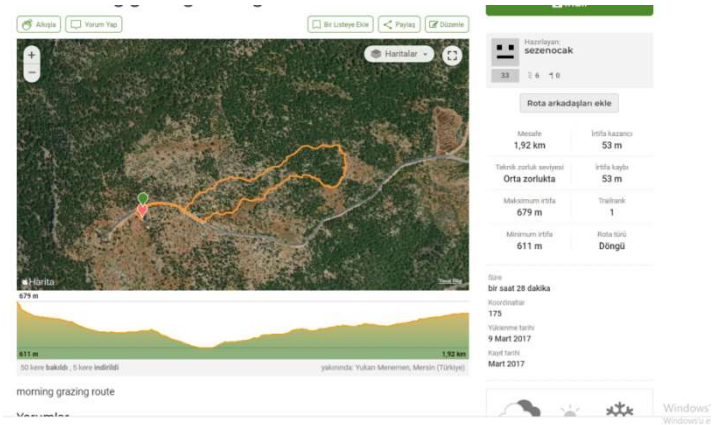
Topic: Nutrition

Country: Turkey

Dairy or/and meat sheep:
Category of Animal (ewe, replacement, lamb): Ewe,lamb,replacement

Short description of the "benchmark" farm for which the analysis is performed:

The farmer used the tool in the Mediterranean highlands during the grazing period. He was able to record his grazing route, with better management of grazing, less environmental degradation by sharing his location with the other rangers.



Cost benefit analysis

• **Additional Costs**				
	Increase	Decrease	Percentage	Euro
– Fuel	☐	☐	… %	… €
– Labour (man-hours)	☐	☐	%	… €
– Equipment/materials (e.g. weigh scales, formalin etc.)	☒	☐	0,003 %	… €
– Feeding : concentrates	☐	☒	40 %	… €
– Feeding : forages		X	50 %	… €
– Electricity	☐	☐	… %	… €
– Water (water, troughs, piping etc.)	☐	☐	… %	… €
– Seed	☐	☐	… %	… €
– Fertilizer	☐	☒	… %	… €
– Sprays (herbicides, pesticides etc.)	☐	☐	… %	… €

– Contractor charges (ploughing, spraying, harvesting etc.)	☐	☐	… %	… €
– Medicine (antibiotics, anthelmintics, vaccinations)	☐	☐	… %	… €
– Technical advise	☐	☐	… %	… €
– Vet services	☐	☐	… %	… €
– Lab services	☐	☐	… %	… €
– Other external services	☐	☐	… %	… €
- Others (specify): ……..	☐	☐	… %	… €
Total	☐	☐		30€/ewe
• **Additional Incomes**				
	Increase	Decrease	Percentage	Euro
– Output (e.g. meat, milk, wool)	☐	☐	20 %	… €
– Quality bonus (carcass confirmation, fat and protein composition etc.)	☐	☐	… %	… €
– Farm schemes and direct payments	☐	☐	… %	… €
Others (specify): ……	☐	☐	… %	… €
Total	☐	☐		
Average increase in earning (per ewe, ha, etc.)			(€/…)	**20** €/ewe

Cost benefit analysis conclusion

Using wikiloc while grazing will help to benefit more from grassland because they will be able to communicate from the application. The only extra cost involving the purchase of a smartphone is very small, indeed most of the farmers have it nowadays. Because the animals graze all the day they will need less concentrate and forage.

Sustainability analysis

Environmental indicators	Increase	Decrease	Not applicable
Feed efficiency	☐	☐	☒
Grazing efficiency	☒	☐	☐
Feed self-sufficiency	☐	☐	☒
Manure/slurry “production”	☐	☐	☒
Effluents “production” (water for washing milking machine or with chemical treatment for footbath)	☐	☐	☒
Waste (plastics, etc.)	☐	☒	☐

Global Environmental assessment	Positive	Negative	No change

Atmosphere (Emissions and air quality)	☐	☐	☒
Water (Use and quality)	☐	☐	☒
Land (Soil quality and degradation)	☒	☐	☐
Materials and energy (Use, waste reduction and disposal)	☒	☐	☐

Other benefits	
• More leisure/family time	☐
• Improved animal welfare	☒
• Improved farm/farmer "image" (social acceptance)	☒
• Better work environment	☐
• Improve health and safety for farmers	☐
• Less physical labour	☐
• Improve environment/landscape	☒
• Improve biodiversity	☐
• Other (specify) ……..	☐

Sustainability analysis conclusion

Wikiloc application is a free tool which does not need any extra cost. This application has no negative impacts to the environment. It has a positive impact on grazing efficiency and land.

Solutions from UK

Scottish Animal Health Planning System

Need/issue: Flock health planning

Topic: Health

Country: UK

Dairy or/and meat sheep: Both
Category of Animal (ewe, replacement, lamb): All

Short description of the "benchmark" farm for which the analysis is performed: This solution is difficult to assess for a cost/benefit analysis as the solution is an 'app'. The following information is based on general aspects of any farm having a health plan.

Cost benefit analysis

• **Additional Costs**				
	Increase	Decrease	Percentage	Euro
– Fuel	☐	☐	… %	… €
– Labour (man-hours)	☐	☐	… %	… €
– Equipment/materials (e.g. weigh scales, formalin etc.)	☐	☐	… %	… €
– Feeding : concentrates	☐	☐	… %	… €
– Feeding : forages			… %	… €
– Electricity	☐	☐	… %	… €
– Water (water, troughs, piping etc.)	☐	☐	… %	… €
– Seed	☐	☐	… %	… €
– Fertilizer	☐	☐	… %	… €
– Sprays (herbicides, pesticides etc.)	☐	☐	… %	… €
– Contractor charges (ploughing, spraying, harvesting etc.)	☐	☐	… %	… €
– Medicine (antibiotics, anthelmintics, vaccinations)	☐	☐	… %	… €
– Technical advice[9]	☒	☐	… %	… €
– Vet services[10]	☐	☒	… %	… €
– Lab services[11]	☒	☐	… %	… €
– Other external services	☐	☐	… %	… €

[9] By having a health plan on your farm, you may increase the technical advice needed
[10] The veterinary services may decrease if you have a proper health plan (less reactive, more proactive)
[11] Laboratory services may increase as the health plan may entail more analysis (e.g. forage analysis, blood analysis)

- Others (specify): ……..	☐	☐	… %	… €
Total	☐	☐		
• **Additional Incomes**				
	Increase	Decrease	Percentage	Euro
– Output (e.g. meat, milk, wool)[12]	☒	☐	… %	… €
– Quality bonus (carcass confirmation, fat and protein composition etc.)	☐	☐	… %	… €
– Farm schemes and direct payments	☐	☐	… %	… €
Others (specify): ……	☐	☐	… %	… €
Total	☐	☐	**0**	
Average increase in earning (per ewe, ha, etc.)			(€/0)	**… €**
Other benefits				
• More leisure/family time				☐
• Improved animal welfare				☒
• Improved farm/farmer "image" (social acceptance)				☒
• Better work environment (appeals to new entrants)[13]				☒
• Less physical labour (suitable for females and aging farmers)				☐
• Improve environment/landscape				☐
• Other (specify) ……..				☐

Cost benefit analysis conclusion

Scottish Animal Health Planning System (SAHPS) is a another tool in toolbox for the sheep farmer. Whilst it is difficult to quantify the financial benefits of the tool, the pros of using this are largely around greater control of animal health and welfare. The functionality of the application extends to supporting a free comprehensive health plan with benchmarking capability to other businesses such as comparing disease or production data. The tool is online but also on an app format making it easy to use for young farmers. The app data can be viewed by vets, consultant and famers making it easier to optimise health management and agree interventions. The tool can theoretically financially benefit the farmer with less reactive vet costs as the business minimises the number of sick animals and focuses on a more proactive health management approach. With livestock there will always be deadstock, but the health planning system is one way to mitigate loss of animals and drive improvement.

[12] Having a health plan may help you increase your output, by having less sick or unwell animals
[13] Using an online tool for your health plan may appeal more to the younger generation of farmers.

Sustainability analysis

Environmental indicators	Increase	Decrease	Not applicable
Feed efficiency	☐	☐	☒
Grazing efficiency	☐	☐	☒
Feed self-sufficiency	☐	☐	☒
Manure/slurry "production"	☐	☐	☒
Effluents "production" (water for washing milking machine or with chemical treatment for footbath)	☐	☐	☒
Waste (plastics, etc.)	☐	☐	☒

Global Environmental assessment	Positive	Negative	No change
Atmosphere (Emissions and air quality)	☐	☐	☒
Water (Use and quality)	☐	☐	☒
Land (Soil quality and degradation)	☐	☐	☒
Materials and energy (Use, waste reduction and disposal)	☐	☐	☒
Biodiversity	☐	☐	☒

Sustainability analysis conclusion

Having a health plan, using an app to create it, can be beneficial to animal welfare, improve farmers' image and encourage new entrants. It is also beneficial for the animals, and for the farmers, enabling them to plan ahead by being less reactive, and more proactive. Definite numbers are difficult to estimate as feedback from farmers using the app is not available at this stage.

Guidelines on milk/grass transition

Need/issue: Post weaning management: adaptation to new feeding regime (lamb)

Topic: Nutrition

Country: Scotland
Dairy or/and meat sheep: Meat Sheep
Category of Animal (ewe, replacement, lamb): Lamb
Short description of the "benchmark" farm for which the analysis is performed:
250-hectare Central Scotland farm up to 290 meters above sea-level. Approximately 50% of the farm is rough, uncultivatable hill grazing. 600 cross ewes (Texel, Cheviot and Aberfield genetics) and 100 Saler cross cows. Average ewe flock scan is 185% and 160% lambs are reared per ewes put to the tup. The flock lamb outdoors from April 20th. It is a grass-based system; the farmer spends £3 per ewe in feed and £2.80 per ewe in forage.

This analysis is based on how the lambs would perform on an example hill farm under good weaning management (optimal timing, minimal stress and good grazing management) compared with poor weaning management. The assumption is that lambs will not experience a growth rate check post-weaning if weaning is managed well. These lambs will then be ready for sale sooner which will reduce pressure on the farm grazing to enable the farmer to increase ewe condition resulting in a 2% greater rearing percentage (equating to 19 lambs priced at £90/lamb) in the subsequent year.

Cost benefit analysis

• **Additional Costs (in green, items related to environmental evaluation too)**				
	Increase	Decrease	Percentage	Euro
– Fuel	☐	☐	… %	… €
– Labour (man-hours)	☒	☐	100 %	72 €[1]
– Equipment/materials (e.g. weigh scales, formalin etc.)	☐	☐	… %	… €
– Feeding : concentrates	☐	☐	… %	… €
– Feeding : forages	☐	☐	… %	… €
– Electricity	☐	☐	… %	… €
– Water (water, troughs, piping etc.)	☐	☐	… %	… €
– Seed	☐	☐	… %	… €
– Fertilizer	☐	☐	… %	… €
– Sprays (herbicides, pesticides etc.)	☐	☐	… %	… €
– Contractor charges (ploughing, spraying, harvesting etc.)	☐	☐	… %	… €
– Medicine (antibiotics, anthelmintics, vaccinations)	☐	☐	… %	… €
– Technical advise	☐	☐	… %	… €
– Vet services	☐	☐	… %	… €

– Lab services	☐	☐	… %	… €
– Other external services	☐	☐	… %	… €
- Others (specify):	☐	☐	… %	… €
Total	☒	☐		72 €
• **Additional Incomes**				
	Increase	Decrease	Percentage	Euro
– Output per ewe (e.g. meat, milk, wool)	☒	☐	2 %	1700 €
– Quality bonus (carcass confirmation, fat and protein composition etc.)	☐	☐	… %	… €
– Farm schemes and direct payments	☐	☐	… %	… €
Others (specify): ……	☐	☐	… %	… €
Total	☐	☐		**1710 €**
Average increase in earning (per ewe, ha, etc.)			(€/…)	**17.1**€/ewe 82 £/ha[2]

Notes:

[1] An additional day of labour to reduce the need to complete other management tasks on day of weaning

[2] Based on 4.8 ewes/ha

Cost benefit analysis conclusion

For Scottish grass-based farms the benefit of good weaning management is that lambs are sold sooner, and this means there is more grass available for the breeding ewe flock in the lead up to mating. This can be capitalised on with greater ewe condition, greater stocking capacity on the farm or less feeding required in the Autumn and Winter. This analysis worked on the assumption that the greater ewe condition will result in a 2% greater rearing percentage worth £1,710 for the benchmark farm.

Sustainability analysis

Environmental indicators	Increase	Decrease	Not applicable
Feed efficiency	☒	☐	☐
Grazing efficiency	☒	☐	☐
Feed self-sufficiency	☒	☐	☐
Manure/slurry “production”	☐	☐	☒
Effluents “production” (water for washing milking machine or with chemical treatment for footbath)	☐	☐	☒
Waste (plastics, etc.)	☐	☐	☒

Global Environmental assessment	Positive	Negative	No change

Atmosphere (Emissions and air quality)	☒	☐	☐
Water (Use and quality)	☐	☐	☒
Land (Soil quality and degradation)	☐	☐	☒
Materials and energy (Use, waste reduction and disposal)	☐	☐	☒
Biodiversity	☐	☐	☒

Other benefits	
• More leisure/family time	☐
• Improved animal welfare	☒
• Improved farm/farmer "image" (social acceptance)	☐
• Better work environment	☐
• Improve health and safety for farmers	☐
• Less physical labour	☐
• Improve environment/landscape	☐
• Improve biodiversity	☐
• Other (specify) ……..	☐

Sustainability analysis conclusion

By reducing stress and managing weaning well, the farmer is maximising the feed efficiency of the lambs at grass which reduces the need to potentially feed them later in life when their feed efficiency is poorer. In addition, by increasing the output per ewe, the greenhouse gas emissions per kilogram of lamb are reduced because the ewe's methane emissions are divided by more kilograms of lamb output.

Reducing stress at weaning benefits the welfare of the lambs.

Use of Targeted Selected Treatment (TST) for ewe lambs

Need/issue: Internal parasitism (ewe & replacements)

Topic: *Health*

Country: *UK*

Dairy or/and meat sheep: *meat sheep*
Category of Animal (ewe, replacement, lamb): *replacement, lamb*

Short description of the "benchmark" farm for which the analysis is performed:
The TST has been tested at SRUC research farm in Scotland. The farm is 2200 ha, with 1300 ewes and 28 cows, with an altitude ranging from 300 – 1000m. Most of the vegetation on the farm is mountain pasture of poor quality, with some lowland fields that are partially fertilised (~50 ha). No silage or hay is being made for the sheep. The annual rainfall is >3000 mm. The TST has been tested annually on 900 lambs, over a 4-year period.

Cost benefit analysis

• **Additional Costs (in green, items related to environmental evaluation too)**				
	Increase	Decrease	Percentage	Euro
– Fuel	☐	☐	0 %	0 €
– Labour (man-hours)	☐	☒	21 %	-0.08 €
– Equipment/materials (e.g. weigh scales, formalin etc.)	☒	☐	100 % (if you need to buy an EID crate)	5000 €
– Feeding : concentrates	☐	☐	0 %	0 €
– Feeding : forages	☐	☐	0 %	0 €
– Electricity	☒	☐	1-2 %	10-20 €
– Water (water, troughs, piping etc.)	☐	☐	0 %	0 €
– Seed	☐	☐	0 %	0 €
– Fertilizer	☐	☐	0 %	0 €
– Sprays (herbicides, pesticides etc.)	☐	☐	0 %	0€
– Contractor charges (ploughing, spraying, harvesting etc.)	☐	☐	0 %	0 €
– Medicine (antibiotics, anthelmintics, vaccinations)	☐	☒	56 %	-1.80 €
– Technical advice	☐	☐	0 %	0 €
– Vet services	☐	☐	0 %	0 €
– Lab services	☐	☐	0 %	0 €
– Other external services	☐	☐	0 %	0 €
- Others (specify):	☐	☐	0 %	0 €
Total	☐	☒	**38%**	

• **Additional Incomes**				
	Increase	Decrease	Percentage	Euro
– Output per ewe (e.g. meat, milk, wool)	☐	☐	0 %	0 €
– Quality bonus (carcass confirmation, fat and protein composition etc.)	☐	☐	0 %	0 €
– Farm schemes and direct payments	☐	☐	0 %	0 €
Others (specify): ……	☐	☐	0 %	0 €
Total	☐	☐		
Average increase in earning (per ewe, ha, etc.)			(+1.88 €/lamb)	**~1700** € for 900 lambs (return on EID crate investment = ~3 years)

Notes:

[1] You need to have an EID weigh crate to weigh your ewe lambs. A bottom of the range crate costs ~5000 euros. The weigh crate will use a bit of electricity to run.

Cost benefit analysis conclusion

This solution reduces the use (and therefore costs) of anthelmintics treatments of lambs and young replacement, without compromising on their growth. It also drastically reduces on-farm labour. It requires a weigh crate with an EID panel reader and farm management software.

Sustainability analysis

Environmental indicators	Increase	Decrease	Not applicable
Feed efficiency	☐	☐	☒
Grazing efficiency	☒	☐	☐
Feed self-sufficiency	☐	☐	☒
Manure/slurry "production"	☐	☐	☒
Effluents "production" (water for washing milking machine or with chemical treatment for footbath)	☐	☒	☐
Waste (plastics, etc.)	☐	☒	☐

Global Environmental assessment	Positive	Negative	No change
Atmosphere (Emissions and air quality)	☐	☐	☒
Water (Use and quality)	☐	☐	☒
Land (Soil quality and degradation)	☒	☐	☐

Materials and energy (Use, waste reduction and disposal)	☒	☐	☐
Biodiversity	☒	☐	☐

Other benefits	
• More leisure/family time	☒
• Improved animal welfare	☒
• Improved farm/farmer "image" (social acceptance)	☒
• Better work environment	☒
• Improve health and safety for farmers	☐
• Less physical labour	☒
• Improve environment/landscape	☒
• Improve biodiversity	☒
• Other (specify) …reduce resistance to anthelmintics……..	☒

Sustainability analysis conclusion

This solution decreases the use of anthelmintic treatment and products, and only target the animals that do not cope with worm infection. It reduces the dejection of resistant worms on pastures, the leaching of anthelmintic treatments in the soil. Less product is used, so fewer plastic bottles to dispose of. It increases grazing efficiency as the approach requires the farmer to measure grass production regularly, thus informing on grass availability. It does not compromise lamb growth.

The solution reduces resistance to anthelmintic products, reduces farm labour, as there are less animals to treat, it improves animal welfare by only targeting animal that needs treatment, it improves farmer's image by reducing potential leaching of medicine in the environment, and improve the environment (better for the microbiofauna).

"Feeding the ewe" - feed planning

Need/issue: Knowledge of nutrition requirement (ewe)

Topic: Identify nutritional requirements of the ewe throughout her production cycle
Country: UK

Dairy or/and meat sheep: both
Category of Animal (ewe, replacement, lamb): ewe

Short description of the "benchmark" farm for which the analysis is performed:
Lowland indoor lambing sheep farm, 100 ewes, targeted feeding and body condition scoring. Investment in handling facilities and weigh scales. Ewes are body condition scored so they can be managed to remain in the target range for each stage of the production cycle. Ensuring ewes have target muscle mass and fat cover for the system and the time of year leads to improved fertility, increased lamb performance and reduced incidence of metabolic diseases.

At scanning ewe's are grouped by condition score and litter size and fed to requirements. Silage/hay is analysed to ensure the forage is being utilised to full potential, targeting silage of high quality (<11 ME) to reduce reliance on concentrates.

Cost benefit analysis

• **Additional Costs**				
	Increase	Decrease	Percentage	Euro
– Fuel	☐	☐	… %	… €
– Labour (man-hours)	☒	☐	… %	… €
– Equipment/materials (e.g. weigh scales, formalin etc.)	☐	☐	… %	€350 -1200
– Feeding : concentrates	☐	☒	17%	… €
– Feeding : forages	☒		20 %	… €
– Electricity	☐	☐	… %	… €
– Water (water, troughs, piping etc.)	☐	☐	… %	… €
– Seed	☐	☐	… %	… €
– Fertilizer	☐	☐	… %	… €
– Sprays (herbicides, pesticides etc.)	☐	☐	… %	… €
– Contractor charges (ploughing, spraying, harvesting etc.)	☐	☐	… %	… €
– Medicine (antibiotics, anthelmintics, vaccinations)	☐	☐	… %	… €
– Technical advise	☐	☐	… %	… €
– Vet services	☒	☐	… %	… €
– Lab services	☒	☐	… %	€20-25
– Other external services	☐	☐	… %	… €

- Others (specify): ……..	☐	☐	… %	… €
Total	☐	☐		
• **Additional Incomes**				
	Increase	Decrease	Percentage	Euro
– Output (e.g. meat, milk, wool)	☒	☐	10 %	… €
– Quality bonus (carcass confirmation, fat and protein composition etc.)	☐	☐	… %	… €
– Farm schemes and direct payments	☐	☐	… %	… €
Others (specify): ……	☐	☐	… %	… €
Total	☐	☐		
Average increase in earning (per ewe, ha, etc.)			(€/…)	**… €**
Other benefits				
• More leisure/family time				☐
• Improved animal welfare				☒
• Improved farm/farmer "image" (social acceptance)				☒
• Better work environment (appeals to new entrants)				☐
• Less physical labour (suitable for females and aging farmers)				☐
• Improve environment/landscape				☐
• Other (specify) ……..				☐

Notes:

[1] Output figure based on increased 8 week weight of lambs

[2] Concentrate decrease based on 70kg ewe carrying twins in the last 7 weeks pre-lambing, based on increasing silage from 9.5 ME to 11.5 ME

Cost benefit analysis conclusion

This solution allows for a better use of feeds and efficiency, and better outcome from the animal, by helping the farmer feeding their animals based on their requirements. No waste and better outcome for the animals.

Sustainability analysis

Environmental indicators	Increase	Decrease	Not applicable
Feed efficiency	☒	☐	☐
Grazing efficiency	☒	☐	☐
Feed self-sufficiency	☒	☐	☐
Manure/slurry "production"	☐	☐	☒

Effluents “production” (water for washing milking machine or with chemical treatment for footbath)	☐	☐	☒
Waste (plastics, etc.)	☐	☒	☒

Global Environmental assessment	Positive	Negative	No change
Atmosphere (Emissions and air quality)	☐	☐	☒
Water (Use and quality)	☐	☐	☒
Land (Soil quality and degradation)	☐	☐	☒
Materials and energy (Use, waste reduction and disposal)	☐	☒	☐
Biodiversity	☐	☐	☒

Sustainability analysis conclusion

This solution does not have any impact on fuel, electricity or water consumption, but allows for a better grazing management and feeding of the animals, with a lower reliance on bought-in concentrates. In turn, the output from the animal is potentially increasing by 10%, due to a better feed management.

The solution does not have a major impact on the global environment, apart for perhaps a reduction in disposal of plastic, as less plastic bags of concentrates are needed, since the guidelines focus on using silage and grazing instead of concentrates.

Booklet on how to recognise and treat lameness

Need/issue: Lameness (ewe & replacement)

Topic: Health

Country: United Kingdom

Dairy or/and meat sheep: Both
Category of Animal (ewe, replacement, lamb): All

Short description of the "benchmark" farm for which the analysis is performed:
Extensively managed hill sheep farm, 1200 ewes producing lamb for breeding and slaughter. Approximately 4% of ewes and lambs are affected by lameness throughout the year. Slaughter lambs are sold in the Autumn direct to abattoir

Cost benefit analysis

• **Additional Costs (in green, items related to environmental evaluation too)**				
	Increase	Decrease	Percentage	Euro
– Fuel	☐	☐	… %	… €
– Labour (man-hours)	☐	☐	… %	… €
– Equipment/materials (e.g. weigh scales, formalin etc.)	☒	☐	%[1]	… €
– Feeding : concentrates	☐	☐	… %	… €
– Feeding : forages	☐	☐	… %	… €
– Electricity	☐	☐	… %	… €
– Water (water, troughs, piping etc.)	☐	☐	… %	… €
– Seed	☐	☐	… %	… €
– Fertilizer	☐	☐	… %	… €
– Sprays (herbicides, pesticides etc.)	☐	☐	… %	… €
– Contractor charges (ploughing, spraying, harvesting etc.)	☐	☐	… %	… €
– Medicine (antibiotics, anthelmintics, vaccinations)	☐	☒	%[2]	… €
– Technical advice	☐	☒	%[3]	… €
– Vet services	☐	☒	%[3]	… €
– Lab services	☐	☐	… %	… €
– Other external services	☐	☐	… %	… €
- Others (specify):	☐	☐	… %	… €
Total	☐	☐		
• **Additional Incomes**				
	Increase	Decrease	Percentage	Euro

– Output per ewe (e.g. meat, milk, wool)	☒	☐	%[4]	… €
– Quality bonus (carcass confirmation, fat and protein composition etc.)	☒	☐	%[5]	… €
– Farm schemes and direct payments	☒	☐	%[6]	… €
Others (specify): ……	☐	☐	… %	… €
Total	☐	☐		
Average increase in earning (per ewe, ha, etc.)			(€/…)	**… €**

Notes:

[1] Some investment in equipment may be required – eg foot baths
[2] Medicine and antibiotic use should be reduced due to treatments being targeted to the specific cause of lameness.
[3] There will be a reduction in the need for technical and veterinary advice as the information is already provided in the booklet in terms of identification and appropriate treatment methods.
[5] Animals who are not lame will have improved growth rates and rearing performance. By reducing the incidence of lameness it will reduce the number of ewes culled prematurely from the flock.
[6] Reducing lameness will result in improved carcass quality.
[7] Reducing the incidence of lameness, by treating each cause appropriately, will be beneficial to farm welfare schemes.

Cost benefit analysis conclusion

Sheep lameness represents a significant animal welfare issue, but is also a substantial impact on farm profitability, with lameness estimated to cost the UK sheep industry 28 million pounds (£) a year. Scottish sheep farmers like the benchmark farm who are implementing the advice from the booklet have improved their financial margins (despite infrastructure investment) by reducing their flock lameness percentage. This decrease in lameness has seen savings in certain medicines and in vet inputs. Whilst also increasing lamb survival post-partum, rearing heavier lamb carcass weights with faster growth rates. Lameness reduction is achievable within a relatively short time scale but does require farmers to be committed for the longer-term in order to maintain success. Thus, the booklets suggestions are very practical and a necessary technical support for sheep farmers, but the content needs to be continually revisited.

Sustainability analysis

Environmental indicators	Increase	Decrease	Not applicable
Feed efficiency	☐	☐	☒
Grazing efficiency	☒	☐	☐
Feed self-sufficiency	☐	☐	☒
Manure/slurry “production”	☐	☐	☒

Effluents “production” (water for washing milking machine or with chemical treatment for footbath)	☐	☐	☒
Waste (plastics, etc.)	☐	☐	☒

Global Environmental assessment	Positive	Negative	No change
Atmosphere (Emissions and air quality)	☐	☐	☒
Water (Use and quality)	☒	☐	☐
Land (Soil quality and degradation)	☐	☐	☒
Materials and energy (Use, waste reduction and disposal)	☒	☐	☐
Biodiversity	☒	☐	☐

Other benefits	
• More leisure/family time	☐
• Improved animal welfare	☒
• Improved farm/farmer “image” (social acceptance)	☒
• Better work environment	☐
• Improve health and safety for farmers	☒
• Less physical labour	☒
• Improve environment/landscape	☐
• Improve biodiversity	☐
• Other (specify) ……..	☐

Sustainability analysis conclusion

Grazing efficiency is improved as animals that start being lame are being identified earlier. The water quality may be improved, as less footbath product is potentially released. There is less need for product disposal. This may improve biodiversity. It also has a beneficial effect on the animal productivity.

This solution also improves animal welfare, by targeting animals early, and by extension, improve farmer’s image by using less treatment. It could also improve health and safety for farmers, as less footbath (and product) is potentially needed, and by extension reduces physical labour.

Best practice guidelines for biosecurity and iceberg diseases

Need/issue: Biosecurity in relation to iceberg diseases needs addressing as there is a lack of practical advice at present.
Topic: Management

Country: UK

Dairy or/and meat sheep: Both
Category of Animal (ewe, replacement, lamb): All

Short description of the "benchmark" farm for which the analysis is performed: Lowland sheep farm of 500 breeding ewes with endemic Johnes disease and flock prevalence of 10%. Intervention involves testing all homebred ewes for Johnes disease and sourcing replacements from accredited free flocks. Positive animals and their offspring are culled or not retained as replacements.

Cost benefit analysis

• **Additional Costs**				
	Increase	Decrease	Percentage	Euro
– Fuel	☐	☐	… %	… €
– Labour (man-hours)	☒	☐	1%	… €
– Equipment/materials (e.g. weigh scales, formalin etc.)	☐	☐	… %	… €
– Feeding : concentrates	☐	☐	… %	… €
– Feeding : forages			… %	… €
– Electricity	☐	☐	… %	… €
– Water (water, troughs, piping etc.)	☐	☐	… %	… €
– Seed	☐	☐	… %	… €
– Fertilizer	☐	☐	… %	… €
– Sprays (herbicides, pesticides etc.)	☐	☐	… %	… €
– Contractor charges (ploughing, spraying, harvesting etc.)	☐	☐	… %	… €
– Medicine (antibiotics, anthelmintics, vaccinations)	☐	☒	10%	… €
– Technical advise	☒	☐	2%	… €
– Vet services	☒	☐	5%	… €
– Lab services	☒	☐	2%	… €
– Other external services	☐	☐	… %	… €
- Others (specify): ……..	☐	☐	… %	… €
Total	☐	☐		
• **Additional Incomes**				

	Increase	Decrease	Percentage	Euro
– Output (e.g. meat, milk, wool)	☒	☐	5-20%	… €
– Quality bonus (carcass confirmation, fat and protein composition etc.)	☐	☐	… %	… €
– Farm schemes and direct payments	☐	☐	… %	… €
Others (specify): ……	☐	☐	… %	… €
Total	☒	☐	**+5-20%**	
Average increase in earning (per ewe, ha, etc.)			(€/…)	**…** €
Other benefits				
• More leisure/family time				☒
• Improved animal welfare				☒
• Improved farm/farmer "image" (social acceptance)				☒
• Better work environment (appeals to new entrants)				☐
• Less physical labour (suitable for females and aging farmers)				☐
• Improve environment/landscape				☐
• Other (specify) ……				☐

Cost benefit analysis conclusion

1. The impact of iceberg diseases within a flock varies hugely. The economic benefits of employing biosecurity measures will depend on multiple factors including: flock prevalence, which iceberg diseases are involved, the type of sheep farm, the ability of the farm to quarantine and test stock, and the costs of screening for disease
2 It is not possible to screen incoming animals for some iceberg disease with adequate sensitivity and specificity to completely eliminate the possibility of purchasing in diseased stock. Not purchasing in added animals would be a better solution but is not suitable for all farms.

Sustainability analysis

Environmental indicators	Increase	Decrease	Not applicable
Feed efficiency	☒	☐	☐
Grazing efficiency	☐	☐	☒
Feed self-sufficiency	☐	☐	☒
Manure/slurry "production"	☐	☐	☒
Effluents "production" (water for washing milking machine or with chemical treatment for footbath)	☐	☐	☒
Waste (plastics, etc.)	☐	☐	☒

Global Environmental assessment	Positive	Negative	No change
Atmosphere (Emissions and air quality)	☐	☐	☒
Water (Use and quality)	☐	☐	☒
Land (Soil quality and degradation)	☐	☐	☒
Materials and energy (Use, waste reduction and disposal)	☐	☐	☒
Biodiversity	☐	☐	☒

Sustainability analysis conclusion

This solution improves feed efficiency per ewe, as Johnes disease will impact nutrient absorption in the gut. Less supplementary feed may also need to be given as ewes will retain body condition score better.

Practical information on Iceberg diseases

Need/issue: Poor body condition (ewe & replacement**)**

Topic: Management

Country: UK

Dairy or/and meat sheep: Both
Category of Animal (ewe, replacement, lamb): All

Short description of the "benchmark" farm for which the analysis is performed:
Lowland sheep farm of 500 breeding ewes with endemic Johnes disease and OPA. Investigation intervention centres around screening post-weaning ewes which fail to gain weight as expected. These are blood tested for Johnes and any dead adult ewes examined for OPA lesions throughout the year. Positive animals and their lambs are culled and not retained as replacements.

Cost benefit analysis

• **Additional Costs**				
	Increase	Decrease	Percentage	Euro
– Fuel	☐	☐	… %	… €
– Labour (man-hours)	☒	☐	2 %	… €
– Equipment/materials (e.g. weigh scales, formalin etc.)	☒	☐	2 %	… €
– Feeding : concentrates	☐	☐	… %	… €
– Feeding : forages			… %	… €
– Electricity	☐	☐	… %	… €
– Water (water, troughs, piping etc.)	☐	☐	… %	… €
– Seed	☐	☐	… %	… €
– Fertilizer	☐	☐	… %	… €
– Sprays (herbicides, pesticides etc.)	☐	☐	… %	… €
– Contractor charges (ploughing, spraying, harvesting etc.)	☐	☐	… %	… €
– Medicine (antibiotics, anthelmintics, vaccinations)	☐	☒	10 %	… €
– Technical advise	☒	☐	2 %	… €
– Vet services	☒	☐	2 %	… €
– Lab services	☒	☐	2 %	… €
– Other external services	☐	☐	… %	… €
- Others (specify): ……..	☐	☐	… %	… €
Total	☐	☐		

• **Additional Incomes**				
	Increase	Decrease	Percentage	Euro
– Output (e.g. meat, milk, wool)	☒	☐	2-20 %	… €
– Quality bonus (carcass confirmation, fat and protein composition etc.)	☐	☐	… %	… €
– Farm schemes and direct payments	☐	☐	… %	… €
Others (specify): ……	☐	☐	… %	… €
Total	☐	☐	**+2-10%**	
Average increase in earning (per ewe, ha, etc.)			(€/…)	**…** €

Other benefits	
• More leisure/family time	☒
• Improved animal welfare	☒
• Improved farm/farmer "image" (social acceptance)	☒
• Better work environment (appeals to new entrants)	☐
• Less physical labour (suitable for females and aging farmers)	☐
• Improve environment/landscape	☐
• Other (specify) ……..	☐

Cost benefit analysis conclusion

The impact of iceberg diseases within a flock varies hugely. The economic benefits of employing biosecurity measures will depend on multiple factors including: flock prevalence, which iceberg diseases are involved, the type of sheep farm, the ability of the farm to quarantine and test stock, and the costs of screening for disease

Sustainability analysis

Environmental indicators	Increase	Decrease	Not applicable
Feed efficiency	☒	☐	☐
Grazing efficiency	☐	☐	☒
Feed self-sufficiency	☐	☐	☒
Manure/slurry "production"	☐	☐	☒
Effluents "production" (water for washing milking machine or with chemical treatment for footbath)	☐	☐	☒
Waste (plastics, etc.)	☐	☐	☒

Global Environmental assessment	Positive	Negative	No change
Atmosphere (Emissions and air quality)	☐	☐	☒
Water (Use and quality)	☐	☐	☒

Land (Soil quality and degradation)	☐	☐	☒
Materials and energy (Use, waste reduction and disposal)	☐	☐	☒
Biodiversity	☐	☐	☒

Sustainability analysis conclusion

This solution improves feed efficiency per ewe, as Johnes disease will impact nutrient absorption in the gut. OPA will also impact the feed efficiency of ewes, by general debilitation. Less supplementary feed may also need to be given as ewes will retain body condition score better.