Scientific Papers. Series D. Animal Science. Vol. LXIV, No. 1, 2021
ISSN 2285-5750; ISSN CD-ROM 2285-5769; ISSN Online 2393-2260; ISSN-L 2285-5750

# WASTE MANAGEMENT IN DAIRY FARMS DURING THE COVID-19 PERIOD - THE CASE OF GJILAN REGION - KOSOVO

**Medin ZEQIRI[1*], Ylli BIÇOKU[2]**

[1]University for Business and Technology, Department Food Science and Biotechnology, Pristina, lagja Kalabria, 10000, Kosovo
[2]Agricultural University of Tirana Koder Kamez, Faculty of Agriculture and Environment, 1029 Tirana, Albania

Corresponding author email: medin.zeqiri@ubt-uni.net

***Abstract***

*The purpose of this paper is to analyze the level of education and experience in animal husbandry in terms of waste management on dairy farms in Kosovo during the Covid-19, the case of Gjilan region. It is a descriptive and quantitative study. Random samples were taken in 71 dairy farms in three municipalities of the Gjilan region. Surveys include farms where 5-78 dairy cows are raised. Data on milk production, waste management from detergents, organic manure, cleaning rags, farm certification and water analysis are included. Datas for each farm were recorded during the period of February-April 2020. During these period farmers' reported that the restrictive measures taken as a result of Covid-19 did not have any negative impact on milk production, however, 26.8% of farmers interviewed reported that milk production was reduced. Further, it was observed a major mismanagement of farm waste that was the main focus of the research: 80.3% of farmers stated that compost waste comes out of the farm and is distributed freely in the environment around the farm.*

***Key words:*** *Covid-19, dairy producers, detergent, Gjilan region, manure.*

## INTRODUCTION

Agriculture and rural development continue to play a crucial role in Kosovo's economy, as mentioned in the Green Report (2019), "the sector of great importance in the overall economic development of the country". Kosovo continues to be a predominantly rural economy with 7.2 percent of GDP generated by agriculture, during 2018. However, in the last two years (2017-2018) agricultural production has decreased (MAFRD, 2019). Moreover, agriculture is the largest sector of employers, accounting for about 35 percent of the active labour force. (MAFRD, 2019).

In 2018, livestock production decreased by 8.7%, compared to a year earlier, however livestock production is very important for the economic development of the country, as it is one of the most important sub-sectors in agriculture preducing 98% of milk and 60.4% of meat (Krasniqi, 2019).

Cattle is the most important category within livestock, while cows make up 51% of the total of cattle structure. Cow's milk predominates in the production of raw milk - low milk production that does not freeze is insignificant in Kosovo. About 132,500 dairy cows produce 277,599 tons of milk (MAFRD, 2019).

Milk production is considered as an activity of considerable nutritional, social and economic importance in Kosovo. Therefore, the Kosovo Ministry of Forestry and Rural Development (MAFRD) considers the dairy sector as a priority one, providing direct payment supports and investment supports to dairy farmers in order to improve the competitiveness of milk production and improve the standards of food safety and animal health (Zeqiri et al., 2015).

In Kosovo, milk production suffers from a low level of competition, due to low production efficiency and high production costs, and in many cases, producers are forced to accept low incomes by not competing with imported products. (Zeqiri, 2018).

In Kosovo most dairy farmers still haven't solved the issue of waste management such as manure, farm detergent chemicals and other waste at the time of the Covid-19 pandemic. So, we undertook a regional level research in order to see how farms manage these waste issue, knowing that waste mismanagement

directly affects animals and indirectly the human health.

As mentioned by FAO (2020) and Ceylan (2020), COVID-19 has had an impact in many sectors globally and nationally, including the livestock sector. This contagious disease will cause changes in global economy and politics. Traffic restrictions have resulted in difficulties in transporting live animals and animal products such as milk. These restrictions have also caused limited capacity to purchase the necessary production inputs. In many countries, these difficulties have led to a reduction in processing capacity for animal products, as well as to a loss of sales and a slowdown in market activity.

According to Gürel and Yilmaz (2020), in Turkey, livestock and agricultural activities, especially livestock production on an industrial scale, are seen as one of the main sources of natural environment pollution.

Manure management depends on many factors such as herd size and manure type, workforce, soil type, climate and region (Mac-Safley et al. 2011; Smith & Williams, 2016). Moreover, intensive animal production can be significantly problematic in relation to the storage and disposal of manure (Malomo et al., 2018).

FAOSTAT (2020): The amount of wet manure (from animals) can be a major problem for farms. If liquid manure is not used properly, it can create a risk of pollution with a potentially devastating impact on the environment. Improperly deposited manure can flow directly or indirectly into surface waters, as a result, gas emissions and odors can also be released after decomposition of manure, with negative consequences for farmers and ranchers (Font-Palma, 2019). Fangueiro (2008) reported that greenhouse gas emissions ($NH_3$, $N_2O$, $CH_4$), during storage, depend on the type of fertilizer, i.e. emissions from separated solids are usually higher than from liquid or indivisible manure.

Livestock manure contains a wide range of microorganisms that can be a source of risks to human and animal health. These microorganisms can cause food pollution and epidemics and are dangerous to public health (Manyi-Loh, 2016; Malomo et al., 2018).

Therefore, sustainable fertilizer management systems should minimize the environmental risks associated with the storage, treatment and use of manure.

But in recent years, environmental pollution caused by nitrates has been observed, while it is a result of irrational use of natural fertilizers in agriculture (Hokeem et al., 2016). Fertilizers are applied to the soil at a time (usually spreading in the field), so, compared to chemical fertilizers, more leakage occurs and the N content can reach groundwater and surface water (Webb et al., 2010).

As quoted by Hubbard and Lowrance (1989), in the US, there are government regulations that have been imposed on a number of states to protect surface water and groundwater quality from the negative impact of dairy producers, namely dairy cow manure. These regulations may specify the size of land use areas required in relation to the number of cows and may also require monitoring of wells.

But according to FoodPrint (2020), animal manure, unlike human waste, is not treated before it is disposed of. Untreated manure releases chemicals and gases into the air, and when leakage occurs, dangerous pollutants enter our waterways. While human waste is treated in municipal sewage systems and is subject to strict regulation, animal waste are stored in open ponds (called as lagoons) or pits and are used as fertilizer to farm fields. The mixture in the lagoon consists not only of animal feces, but also of bed waste, antibiotic residues, and cleaning solutions as well as other chemicals. Most lagoons are clad only in clay and can flow, allowing wastes to seep into groundwater.

Ammonia, methane and nitrous oxide are prominent pollution concerns in current livestock production (Neumeier & Mitloehner, 2013).

Kosovo promotes and supports legal and natural persons that implement the certified environmental management systems ISO 9000, ISO 14001 and EMAS. Legal and natural persons, who implement certified systems for environmental management, are provided with procedural facilities in the EIA process and in obtaining the environmental permit. (LAW No. 03/L-025, 2009).

European Council Directive 86/278/EEC (1986) on the protection of the environment, and in particular of land where sewage sludge is used in agriculture (the link is external)

regulates the use of sewage sludge in agriculture for prevent harmful effects on soil, vegetation, animals and humans.
Today, many farmers do not have the information to improve fertilizer management or have faced institutional, technical, and socio-economic constraints that prevent them from adopting new practices (CCAC, 2015).
Livestock production is important for food security, food and landscape maintenance, but it also has some environmental impacts. Trans-parental and robust indicators, such as those provided by life-cycle assessment, are required to assess the risks and benefits of livestock production (Leip et al., 2019).

## MATERIALS AND METHODS

The study was conducted in three municipalities of the Gjilan region (Gjilan, Kamenica and Viti), Kosovo. Datas were collected during February-April 2020. A structured questionnaire was used to collect all the information related to milk production during the quarter of 2020 consisting to period of the Covid-19 pandemic and the same quarter of 2019. Further, questionnaire was used to collect also information on the farm waste management as fertilizer, use of detergents as chemicals for cleaning equipment that had contact with milk, etc. To avoid confusing questions and to assure clarity, the questionnaire was pre-tested with 6 farmers. Datas from pilot farmers' groups for pre-testing the questionnaire could not be used as Covid-19 restriction measures did not allow collection. 71 face-to-face interviews were conducted, while farms were randomly selected (from the list of farmers of the Agricultural Offices of the Gjilan/Gnjilane Region). Farmers bred 5-78 cows on each of the interviewed farms. The interviewers did not encounter any major problems in terms of willingness to participate, especially after the participants were informed about the purpose of the interview and the survey.
The questionnaire was created to collect information about the general characteristics of the farm, the number of dairy cows, milk yield at different farm sizes; age, educational level of the head of the household, experience as well as the size of the family. Fertilizer waste management, detergents, water analysis from farms are also collected for the period of February - April 2020.
The obtained data were stored in Excel-2000 and imported into SPSS 22.0 for analysis. The stored data were tabulated and adjusted as a percentage value. Descriptive statistics (i.e., frequencies, etc.) were made to estimate the various variables.

## RESULTS AND DISCUSSIONS

### Socio-demographic indicators of farmers

During this period, the situation of the dairy sector was analyzed with a focus on the relationship between the level of education, experience and practices of farmers for milk production, waste management such as: manure, detergents, water analysis and certification in the three municipalities of the Gjilan region (Gjilan, Viti and Kamenica).
For this purpose, the level of education is included using the Liquid scale of six points: 0 - education or no education, 1 - compulsory education (up to 9 years of school), 2 - agricultural high school (12 years of school), 3 - school other high school (12 years of school), 4 - university degree in environment, 5 - university degree.
The results of group 0-1 (primary education) were compared with those of the group of farmers with better education 2-5 (secondary education +).
Most respondents belong to the age group 30-49 years (56.3%) and 16.9% are over 60 years old. For the group of primary education 66.7% belongs to the age group 30-49 years and for the group of secondary education 55.4%.

Table 1. Main sample socio-demographic and farm indicators

| Education Level | Sample farm household indicators | | | | Number of cows | | | |
|---|---|---|---|---|---|---|---|---|
| | Age | | Working experience (years) | | 2019 | | 2020 | |
| | Mean | Stand. Dev. | Mean | Stand. Dev. | Mean | Stand. Dev. | Mean | Stand. Dev. |
| Primary | 49.2 | 11.55 | 19.8 | 13.55 | 14.53 | 16.34 | 14.4 | 18.31 |
| Secondary | 45.3 | 11.14 | 15.09 | 11.27 | 13.55 | 9.16 | 12.48 | 7.66 |
| **Average** | **46.1** | **11.34** | **16.08** | **11.81** | **13.76** | **10.93** | **12.89** | **10.67** |

Most respondents had less than 20 years of experience in agriculture. The agricultural experience of 53.3 & of respondents was less than 20 years for the primary education group; while in the + secondary education group, 71.4

percent of farmers had less than 20 years of experience. In the group of the most educated farmers 28.6% had less than 10 years of experience. All farms surveyed had more than 4 cows, so they were market oriented. We have targeted market-oriented farms because they are usually more aware of "new situations" and market distortions problems and compared to small subsistence farms (1-2 cows) are more likely to "survive" competition in future growth.

Table 2. Education level of the observed farmers

| | Education | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 0[1] | 1[2] | 2[3] | 3[4] | 4[5] | 5[6] | Total | Mean | Std. Dev. |
| **Total** | 5 | 10 | 10 | 40 | 0 | 6 | 71 | 2.54 | 1.217 |
| **%** | 7.0 | 14.1 | 14.1 | 56.3 | 0 | 8.5 | 100 | | |

The majority (56.3%) of the interviewed farmers have a secondary school level and only 8.5% have a university degree.

**Milk production**

Milk production for the period of February - April 2020 when compared to the same period of 2019 has increased by 6.7%.

Table 3. Milk production for the period of February-April (2019-2020

| Farms | February- April | | | |
|---|---|---|---|---|
| | 2019 | | 2020 | |
| | Milk production (litre) | Standard deviation | Milk production (litre) | Standard deviation |
| **71** | 13118 | 8967.762 | 13998 | 9276.314 |
| **Minimum** | 2330 | | 2430 | |
| **Maximum** | 47830 | | 52800 | |

However, 25 farms (35.2%) report a decrease in milk production by 12.7%. The main reason for the decrease in milk production is the inability to buy food for the cattle, especially during the closure period in the Covid pandemic 19.

Table 4. Daily milk production - Paired sample analyse

| Pair | Paired Differences | | | | | T | Df | Sig. (2-tailed) |
|---|---|---|---|---|---|---|---|---|
| | Mean | Std. Dev. | Std. Error Mean | 95% Confidence Interval of the Difference | | | | |
| | | | | Lower | Upper | | | |
| Milk 2020 | 4.8169 | 46.1935 | 5.4822 | -61169 | 15.7505 | 0.879 | 70 | 0.383 |

[1] No Education
[2] Nine years of education
[3] High agricultural school
[4] High School
[5] Agricultural University
[6] University

The results created for the effect of education level on milk production show that there is no significant difference between groups with different levels of education and milk production in 2019 and 2020.

Table 5. The effect of education level and milk production

| Description | | Education | Milk 2020 | Milk 2019 | Education merged |
|---|---|---|---|---|---|
| Education | Pearson Correlation | 1 | -.023 | .020 | .945** |
| | Sig. (2-tailed) | | .849 | .866 | .000 |
| | N | 71 | 71 | 71 | 71 |
| Milk 2020 | Pearson Correlation | -.023 | 1 | .913 | .032 |
| | Sig. (2-tailed) | .859 | | .000 | .791 |
| | N | 71 | 71 | 71 | 71 |
| Milk 2019 | Pearson Correlation | .020 | .913 | 1 | .063 |
| | Sig. (2-tailed) | .866 | .000 | | .602 |
| | N | 71 | 71 | 71 | 71 |
| Education merged[7] | Pearson Correlation | .945** | .032 | .063 | 1 |
| | Sig. (2-tailed) | .000 | .791 | .602 | |
| | N | 71 | 71 | 71 | 71 |

Table 6. Use of detergents for cleaning milking machines and milk containers (Descriptive Statistics)

| Use of detergents (chemicals) | N | Minimum | Maximum | Mean | Std. Deviation |
|---|---|---|---|---|---|
| **Detergent for cleaning milking machines and dishes in contact with milk** | 71 | 1.0 | 2.0 | 1.254 | .4381 |

Table 6 combines the variables on the education levels and experience, in order to see the degree of detergent use with descriptive statistics and we see that out of 71 farms in the research most of them have used detergent minimum once and maximum twice a day.

Table 7. Detergents for cleaning dishes and other milk equipment (Frequency Distribution)

| Answering Options | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | **1.0** | 53 | 73.6 | 74.6 | 74.6 |
| | **2.0** | 18 | 25.0 | 25.4 | 100.0 |
| | **Total** | 71 | 98.6 | 100.0 | |
| Missing | System | 1 | 1.4 | | |
| Total | | 72 | 100.0 | | |

In Table 7 with the same variables on education levels and experience but with the distribution of statistical frequencies we see that 74.6% of farmers have used detergents for cleaning milking machines and dishes which

[7] Education merged has been recalculated to measure the level of education by degree. Respondents are grouped in three categories: (i): without education + primary education (compulsory), (ii) general high scool;

had contact with milk, while 25.4% have not used at all. To research manure management farmers were asked how they managed manure waste, with many question options being dominated by the answer that manure waste comes out free and is distributed in the yard. From this answer we have derived the essential results of our research see Table below no.8 and see that the majority or (80.3%) of farmers have declared that organic fertilizer waste comes out of the farm and is distributed freely in the environment around the farm (option 2).

Table 8. The effect of education and experience on manure management

| Answering Options | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | 1.0 | 8 | 11.1 | 11.3 | 11.3 |
| | 2.0 | 57 | 79.2 | 80.3 | 91.5 |
| | 3.0 | 4 | 5.6 | 5.6 | 97.2 |
| | 4.0 | 2 | 2.8 | 2.8 | 100.0 |
| | Total | 71 | 98.6 | 100.0 | |
| Missing | System | 1 | 1.4 | | |
| Total | | 72 | 100.0 | | |

Table 9. Joint education in relation to the use of detergents through the cross table

| | | Detergent – Machine | | Total |
|---|---|---|---|---|
| | | 1.0 | 2.0 | |
| Joint education | 0 | 5 | 0 | **5** |
| | 1 | 5 | 5 | **10** |
| | 2 | 38 | 12 | **50** |
| | 3 | 5 | 1 | **6** |
| **Total** | | **53** | **18** | **71** |

We have also shown the choices that farmers have made regarding the use of detergents through crosstabs (table above), and it is noticeable that farmers with primary education, half of them use detergent, while half of them do not use it at all, those with zero education all use, while of those with high school 38 use, while 12 do not use. To see if the differences are random, we use the Chi Square test, and see that the differences are random (not significant), a result which can be affected by the sample size.

Table 10. Chi-Square Tests

| | Value | Df | Asymp. Sig. (2-sided) |
|---|---|---|---|
| Pearson Chi-Square | 5.196[a] | 3 | 0.158 |
| Likelihood Ratio | 6.019 | 3 | 0.111 |
| Linear-by-Linear Association | 0.032 | 1 | 0.858 |
| N of Valid Cases | 71 | | |

a. 5 cells (62.5%) have expected count less than 5. The minimum expected count is 1.27.

Table 11. Group Statistics

| | DetMak | N | Mean | Std. Deviation | Std. Error Mean |
|---|---|---|---|---|---|
| Exp cow | 1.0 | 52 | 17.56 | 12.314 | 1.708 |
| | 2.0 | 18 | 11.83 | 9.691 | 2.284 |

From the Table above we see that farmers who use detergents, on average have more experience (average 17.5 years), while those who do not use have less experience (11.8 years). To see if these differences are significant, we used the Independent Sample T test, from which we saw that the difference is nonsignificant, which is most likely influenced by the sample size.

Table 12. Independent Samples Test

| | | t-test for Equality of Means | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | T | Df | Sig. (2-tailed) | Mean Difference | Std. Error Difference | 95% Confidence Interval of the Difference | |
| | | | | | | | Lower | Upper |
| Exp cow | Equal variances assumed | 1.787 | 68 | 0.078 | 5.724 | 3.203 | -.667 | 12.116 |
| | Equal variances not assumed | 2.007 | 37.416 | 0.052 | 5.724 | 2.852 | -.052 | 11.501 |

Level of Education and Experience is compared to the question: How far from the farm is the well you get drinking water for households and where you throw waste like cleaning cloths, their detergents after cleaning the cow's breast, car and other equipment that have contact with milk? Analyzed variables: educations levles merged, Farm experience in breeding dairy cows, distance from the farm used for drinking water by farmers and waste disposal. In the following two Tables we see that on average the well from which farmers get drinking water for the family is about 186 meters away from their farm. While from Frequency Distribution we see that the majority of farmers (40.8%) throw waste in the sewer, followed by 23.9% who said they throw it in the stable, and 21.1% who said they throw it in the yard.

Table 13. Descriptive Statistics

| | N | Minimum | Maximum | Mean | Std. Deviation |
|---|---|---|---|---|---|
| Wells per farm | 71 | 5.0 | 5000.0 | 185.930 | 612.0533 |

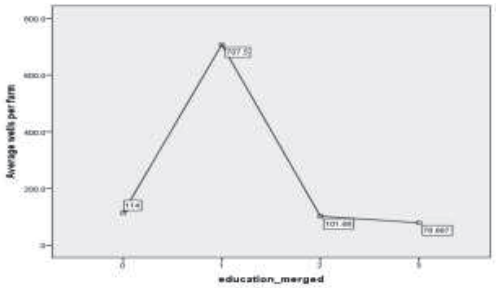


Figure 1. Education in relation to the proximity of the well from the farm

From the Figure above we see that farmers who have completed primary school, have the well on average about 707 meters away from their farm, while it seems that the higher the education, the closer the well. From the table below we see that through the ANOVA analysis we have managed to see that there is a significant difference, at a rate of 95% (sig. = 0.034) between farmers with different levels of education and the distance from where they receive water per family.

Table 14. The distance of the well from the farm

| | Sum of Squares | Df | Mean Square | F | Sig. |
|---|---|---|---|---|---|
| **Between Groups** | 3170157.935 | 3 | 1056719.312 | 3.071 | .034 |
| **Within Groups** | 23052486.713 | 67 | 344066.966 | | |
| **Total** | 26222644.648 | 70 | | | |

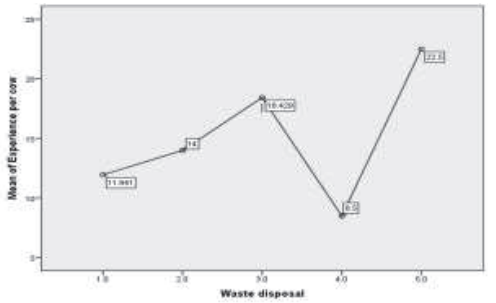


Figure 2. Experience in relation to waste disposal

With waste management there seem to be differences between farmers with different experience levels. Farmers who dump waste in the river (option 4) from the figure above seem to have on average less experience (8.5 years), while those who dump it in the sewer (option 3) or special pits (option 5) have more experience (18.4 years and 22.5 years). To see if the farms are Certified and if they eventually do water analyzes like the chemical and microbiological ones the level of Education and experience has been tested.

Table 15. Certification of the farms

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| **Valid** | 4.0 | 71 | 98.6 | 100.0 | 100.0 |
| **Missing** | System | 1 | 1.4 | | |
| **Total** | | 72 | 100.0 | | |

When asked if the farms are certified, all farmers answered that their farms are not certified to any standard (option 4). When asked if they do water analysis, 93% (66 out of 71 farmers) stated that they do not do water analysis.

Table 16. Water analyses

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| **Valid** | **1.0** | 5 | 6.9 | 7.0 | 7.0 |
| | **2.0** | 66 | 91.7 | 93.0 | 100.0 |
| | **Total** | 71 | 98.6 | 100.0 | |
| **Missing** | **System** | 1 | 1.4 | | |
| **Total** | | **72** | **100.0** | | |

## CONCLUSIONS

This is an exploratory study, which aims to assess the level of awareness of dairy producers about farm waste management such as stable manure, detergents, rags, water analysis and farm certifications. On the other hand, it also aims to assess the level of the knowledge that they have for the protection of the environment and the side effects that may be caused by waste in public health.

Furthermore, the relationship between the variables of the level of education of farmers and the work experience of farmers was noticed. The sample includes only 3 municipalities in the Gjilan region, due to restrictive measures during the COVID-19 period and financial constraints, however, the findings can be considered indicative of Kosovo as a whole, as the blockade was nationwide .

Statistical analyzes show a high degree of poor waste management as 80.3% of farmers leave manure waste free to leave the farm and they are distributed in the environment around the farm (option 2).

The half of farmers with primary education use detergent, while the other half do not. 38% of

those with high school use it, while 12% do not use. Farmers who use detergent, on average have more experience (17.5 years of experience in avarage), while those who do not use have less experience (11.8 years in avarage). It shows that experience had influenced the use of detergents more than the education had. Thus, it is to be said that knowledge that farmers have gained from non-formal education such as trainings, advices and cooperations with each other had influenced more.

Some farms (38.02%) take drinking water from wells at a distance of 5 to 30 meters away from the farm, which poses a permanent risk of water contamination with bacteria such as *Escheria coli*, etc., thus it is recommended that in these farms water analysis with special emphasis on microbiological ones should be made.

The majority of farmers (40.8%) throw waste from detergents and cleaning cloths in the sewer, followed by 23.9% who stated that they throw them in stables, and 21.1% who stated that they throw them in the yard, without knowing they cause environmental side effects.

It seems that farmers dumping waste into the river (option 4 from Figure; 2 Experience in relation to waste disposal) have less experience in average (8.5 years), while those who dump it in the sewer (option 3) or special pits (option 5) have more experience (18.4 years and 22.5 years respectively)

All farmers responded that their farms are not certified with any standard (option 4), where neither education nor experience had any effect in these terms. Thus, this segment should be addressed by decision-making bodies, due to the fact that such uncertified farms cannot be competitive in international markets.

When asked if they do water analysis, 93% (66 out of 71 farmers) stated that they do not do water analysis at all, which is very worrying for the fact that they are not aware of what water they consume, as well as the potential consequences in case of consuming unhealthy water.

Local and central inspection to implement applicable laws on environmental protection.

MAFRD through ADA to increase funds for the establishment of new farms which aim treating the waste, certification and doing chemical, microbiological and other water analysis in order to protect the health of human and animals.

## REFERENCES


CCAC (2015). Livestock and manure management: https://www.ccacoalition.org/en/activity/livestock-and-manure-management.

Ceylan, F.R., Ozkan, B., & Mulazimogullari, E., (2020). Historical evidence for economic effects of COVID-19. *The European Journal of Health Economics*.

Council Directive 86/278/EEC of 12 June 1986 on the protection of the environment, and in particular of the soil, when sewage is used in agriculture (https://www.municipalwasteeurope.eu/summary-current-eu-waste-legislation)

Fangueiro, D., Dave, J.C., Chadwick, R., & Trindade, H. (2008). Effect of cattle slurry separation on greenhouse gas and ammonia emissions during storage. *J. Environ. Qual*, 37, 2322–2331.

FAO (2020). Guidelines to mitigate the impact of the COVID-19 pandemic on livestock production and animal health. https://doi.org/10.4060/ca9177en.

FAOSTAT (2020). Available online: http://faostat3.fao.org/home (accessed on 20 January 2020).

FoodPrint (2020). What Happens to Animal Waste? https://foodprint.org/issues/what-happens-to-animal-waste/

Font-Palma, C. (2019). Methods for the treatment of cattle manure - A review. *Journal of Carbon Research*, *5*(3), 1-20.

Gürel., S., & Yilmaz, E. (2020). Waste Management in Dairy Cattle Farms in Aydın Region. Potential of Energy Application. *Sustainability, MDPI, Open Access Journal, 12*(4), 1–11.

Hubbard, R.K., & Lowrance, R.R. (1998). Management of dairy cattle manure, chap. 5, p. 91–102. In R. J. Wright, W. D. Kemper, P. D. Millner, J. F. Power, and R.F. Korcak. (ed.), *Agricultural uses of municipal, animal, and industrial byproducts*. USDA research report 44. U.S. Department of Agriculture, Washington, DC.

Krasniqi, F. (2019). Vlerësimi i Ndikimit të të Ushqyerit në Treguesit Zooteknikë dhe Ekonomikë të Lopëve të Racës Holstein, në Kushtet e Fermave të Qumështit në Kosovë. *Disertacion,Tirane.* https://drive.google.com/file/d/0BëtAcAxc99ZVR3pQX1JuUnZJRUFkZ2ZyT3BUcklJNmFEVm5r/view

Leip, I., et al. (2019). The value of manure - Manure as co-product in life cycle assessment. *Journal of Environmental Management*, 241, 293–304

Mac-Safley, L.M., Boyd, W.H., & Schmidt, A.R. (2011). Agricultural Waste management systems. In Hickman, D., Owens, L., Pierce, W., Self, S., (Ed). *Agricultural Waste Management Field Handbook*, USDA. pp. 9–31.

Malomo, G.A., Madugu, A.S., Bolu, S.A. (2018). *Sustainable Animal Manure Management Strategies and Practices*; In. A. Aladjadjiyan (Ed). *Agricultural Waste and Residues.* London, UK: Intech Open.

Manyi-Loh, C.E., Mamphweli, S.N., Meyer, E.L., Makaka, G., Simon, M.I., & Okoh, A.I. (2016). An overview of the control of bacterial pathogens in cattle manure. *Int. J. Environ. Res. Public Health, 13*, 843.

MAFRD (2019). Green Report 2019. Publication of MAFRD.

Neumeier, C.J., & Mitloehner, F.M. (2013). Cattle biotechnologies reduce environmental impact and help feed a growing planet. *Animal Frontiers*, 3(3), 36–41.

Smith, K.A., & Williams, A.G. (2016). Production and management of cattle manure in the UK and implications for land application practice. *Soil Use Manag., 32*, 73–82.

Zeqiri, M., Bytyqi, H., Imami, D., & Biçoku, Y (2015). Dairy Farmers Awareness about Food Standards - the Case of Kosovo. *Albanian J. Agric. Sci.,* 14(2), 93-101.

Zeqiri, M., (2018). Konkurrueshmëria e Qumështit dhe Mishit të Gjedhit në Republikën e Kosovës. *Disertacion, Tirane 2018.*

https://drive.google.com/file/d/1NLDXhK8lSYhVL12mhZ6uLj50CCU6PqCw/edit

Webb, J., Pain, B.F., Bittman, S., & Morgan, J. (2010). The impacts of manure application methods on emissions of ammonia, nitrousoxide and on crop response-A review. *Agric. Ecosyst. Environ, 137*, 39–46.

# TECHNOLOGIES OF THE AGRO FOOD PRODUCTS PROCESSING