Black Sea Journal of Agriculture
doi: 10.47115/bsagriculture.1194817

Open Access Journal
e-ISSN: 2618 – 6578

Review
Volume 6 - Issue 1: 104-107 / January 2023

SENSITIVE LIVESTOCK AND INFORMATION COMMUNICATION TECHNOLOGY APPLICATIONS TO PREVENT THE SPREAD OF COVID-19

Hatice Nur KILIÇ[1]*, Mustafa BOĞA[2], Demet CANGA BOĞA[3]

[1]*Niğde Ömer Halisdemir University, Ulukışla Vocational School, Department of Forestry, 51900, Ulukışla, Niğde, Türkiye*
[2]*Niğde Ömer Halisdemir University, Bor Vocational School, Department of Food Processing, 51700, Bor, Niğde, Türkiye*
[3]*Osmaniye Korkut Ata University, Bahce Vocational School, Department of Chemistry and Chemical Processing Technologies, 80050, Bahçe, Osmaniye, Türkiye*

Abstract: The epidemic disease called COVID-19 (SARS-CoV-2) has affected the whole world. With the spread of the epidemic, various measures such as distance education, home-office, and especially movement restrictions, have been tried to be taken. These measures have increased people's demand for healthy food. The formation of food safety awareness among in consumers has revealed the necessity of control of the controlling food chain (production, storage, transportation of products, etc.). In this process, animal products gained importance, especially as people paid more attention to their nutrition compared to previous years. Especially in this process, animal production should be systematically sustainable in order to meet the increasing animal protein needs of people. In this review, it aims to compile sensitive livestock systems in order to ensure the sustainability of animal production, the production of healthier animals and the production of the obtained products within the framework of food safety rules, with the cessation of mobility due to the measures taken under quarantine and social distance in the COVID-19 epidemic. Thus, in addition to reducing the human workforce during the epidemic process, the data collected with modern animal husbandry will prevent diseases, and facilitate the diagnosis and treatment processes in the event of a disease. With the use of information and communication technologies (ICT), which have an important place in this system, the data obtained through the modern livestock system can be easily processed, managed, and shared, thus reducing the possibility of disease transmission during the pandemic process.

Keywords: Covid-19, Animal production, Data, Artificial intelligence, Sensitive livestock, Information communication technologies

***Corresponding author:** Niğde Ömer Halisdemir University, Ulukışla Vocational School, Department of Forestry, 51900, Ulukışla, Niğde, Türkiye
E mail: haticenurkilic@ohu.edu.tr (H.N. KILIÇ)
Hatice Nur KILIÇ https://orcid.org/0000-0001-9131-4010
Mustafa BOĞA https://orcid.org/0000-0002-2845-4528
Demet CANGA BOĞA https://orcid.org/0000-0003-3319-7084

Received: October 26, 2022
Accepted: December 20, 2022
Published: January 01, 2023

Cite as: Kılıç HN, Boğa M, Çanga Boğa D. 2023. Sensitive livestock and information communication technology applications to prevent the spread of covid-19. BSJ Agri, 6(1): 104-107.

1. Introduction

The quarantine process, which started with the Covid-19 (Sars-cov-2) epidemic and other epidemics in the past, restrictions on people's interactions with the environment and with each other in order not to spread the disease. While this restriction negatively affected many production branches, it also affected the country's economies. However, the extension of the pandemic period has caused problems not only in production, but also in the required workforce and in the management and marketing of agricultural production.

In order for people to lead a healthy and balanced life, as the demand for agricultural products increased, they were faced with an imbalance of supply and demand. In agriculture, which is one of the production branches, this epidemic has given importance to remote management and production in animal and plant production. This process has shown that industrially innovative systems should be used in agricultural production and modern farming methods should be applied. Industrially innovative systems have started to gain importance in order to change and improve the approach used due to the disrupted agricultural production. Thus, the need for labor will be minimized, increasing productivity and ensuring the continuation of production with artificial intelligence-based smart agriculture systems. The common point in precision livestock and precision crop farming is to increase productivity and reduce input costs. In sensitive livestock, unlike sensitive crop production, the thresholds of action-response are low. This can be used to consider animal health, behavior, efficiency and performance, and electronic systems and information technologies based on direct observation should be used (Yıldız and Özgüven, 2018).

Vertical agriculture, digital agriculture, satellite technology, robotic systems and the use of drones, which were referred to as precision agriculture during the epidemic, started to accelerate the management of new generation animal and plant production. Therefore, it has been started to be used to increase the amount and quality of production, to meet the technology need, to

make more efficient, profitable, environmentally friendly and safe production (Yaman et al., 2021). While it is obligatory to keep some animal records such as birth and disease vaccination, some records are not compulsory, causing problems in herd management by the enterprise, especially these problems are more prominent in the control, production and management of large herds. Especially since large herds are more difficult to manage than small herds, recording them also makes animal mechanization widespread and reduces the time spent on the workforce (Yıldız and Özgüven, 2018).

Unlike traditional agriculture, precision livestock farming requires a combination of technology and computer modeling to facilitate its applicability on the farm (Wolfert et al., 2017). It includes the use of precision agriculture in plant and animal production, and the Global Positioning System, geographic information system, remote sensing technologies, yield map systems, electronic measurement systems and control systems. Precision livestock breeding, which is one of the developments in information and communication technologies (ICT), allows eliminating the negativity. Developments in information and communication technologies have affected agricultural production and technologies, revealing smarter agriculture and machinery systems, allowing management and production to continue without interruption (Türker et al., 2015). The basic principle in animal husbandry practices intertwined with sensitive animal husbandry and technology is to increase productivity with a low labor force, to sustain animal husbandry, and to protect animal health and welfare (Walter et al., 2017).

2. Sensitive Livestock Practices (PLF)

The sensitive livestock concept; although it is known as an individual approach to the animal, it is defined as a technological system for real-time monitoring of animals in farm management (Hoque et al., 2022). Precision livestock farming (PLF) reveals an innovative farming system by presenting technology and knowledge in a combined way.

Real-time monitoring and management of sensitive livestock allow immediate intervention with a real-time warning in case of any problem. However, in this system, animals are monitored undisturbed and without contact, and it provides information about the condition of the animal by considering the abnormal differences in behavior and ongoing differences (Türker et al., 2015). In this way, observation-based factors such as estrus, birth and disease can be determined, and necessary precautions will be taken, therefore, it will contribute to healthy and sustainable animal husbandry and increase the amount and quality of the product.

Especially in dairy cattle breeding, monitoring sensitive livestock gives information about the health, reproduction, nutrition and general condition of the animal. Devices called biosensors, which measure different behavior and physiological conditions used in farm management, take into account the physiological state of the animal and provide convenience in feeding and care. As biosensors are a combination of technology and knowledge, they provide continuous and real-time measurement of the physiological parameters and behaviors of the animal, causing the problem to be addressed objectively. Thus, interfering with the problem determined in real-time helps to reduce the risk of disease, to be healthier and to keep the yield and performance in the desired range (Canga et al., 2022).

3. Advantages of Sensitive Livestock Practices

By monitoring animal functions and conditions in precision agriculture, the relationship between animal behavior and health and welfare is revealed, and it is possible to monitor the health status of the animal. In general, animal welfare can be evaluated by force and pressure sensors, image processing and identification systems and animal movement (Tarhan et al., 2015). However, better decision-making and resolution of analytical deficiencies due to objective data are also included (Hoque et al., 2022). There are some advantages in adapting and applying technology and science to animal husbandry. Individual handling, sustainable livestock breeding, increased milk yield, a 30% reduction in methane emissions, and early disease detection, particularly in large farms, improve animal welfare (Bewley, 2008; Uzmay et al., 2010). In addition, limitations and problems arising from labor in sensitive livestock are reduced, and it allows observing animal behavior without restriction (Türker et al., 2015).

Sensitive livestock requires continuous monitoring of animal variables and consistent analysis of data, realistic prediction of animal response to environmental changes, automatic tracking and management of the animal with predictions obtained by digital measurements, and an analytical algorithm for online examination of animal welfare and health. Cameras, sensors, wireless network systems, cloud storage, microphones, and internet connections are all used in sensitive livestock (Hoque et al., 2022).

Technologies to be used in sensitive animal husbandry are; electronic radio frequency recognition systems, image analysis systems, robotic milking and calf feeding systems, automatic classification systems, pedometers (step counters), rumination sensors, ultrasonographic imaging devices, electronic scales, automatic dense feed units, automatic calf feeding systems, water and roughage systems that measure feed consumption, coarse-concentrated feed mixers and dispensers, milk measurement systems, animal temperature measurement systems (thermal cameras), ruminal pH, heart rate blood tests, rumination time, respiratory rate and herd management software (Türker et al., 2015; Tarhan et al., 2015). As their names suggest, these systems are used for different purposes and are effective

in producing the best results and estimates. Thus, in times when the number of animals is high since the animals will be taken on an individual basis, it is possible to collect data individually by using image analysis and other technological factors, and the performance, yield, and health of an animal are kept under control (Yıldız and Özgüven, 2018).

3.1. Animal Health in Precision Farming

Animals exhibit different behaviors (such as lying down, water and feed consumption, rumination) at certain times of the day. Considering whether the animal exhibits normal behavior at these different times, it gives information about animal health. Biosensors, which are generally preferred in the analysis of the farm environment, provide important benefits in monitoring animal health. Biosensors can reduce the negative effects of potentially communicable diseases in animals (accelerating the tendency to treatment due to the recognition of the disease and ensuring that sick animals are easily separated from the herd) and enable animals to be controlled more easily (Canga et al., 2022).

Kinematic (image) analysis, animal movements can be observed by determiningto determine the health and welfare of the animal. The evaluation of abnormal gait, abnormal behaviors that appear suddenly after being inactive for a long time, repetitive behaviors and small deviations with dynamic video images is provided by objective observation (Nääs et al., 2006). In image analysis, deviations are determined by considering animal behaviors and gaits, and these deviations play an important role in scoring foot diseases and lameness (Yıldız and Özgüven, 2018). Since feed consumption will decrease in animals with a high lameness score, the animal's fertility and milk yield will also deteriorate. Not only does it affect performance and yield, but also treatment costs, additional labor, lengthening of calving intervals, additional insemination costs may also cause economic losses (Yaylak, 2008). Image analysis is obtained by using video cameras, electron microscopes, radar, ultrasound and x-ray devices (Nääs et al., 2006).

Another sensitive livestock system that provides information about gait disturbance by evaluating the pressure under the nail during walking is foot pad pressure sensitive mats consisting of force measurement elements, platform scales and pressure plates (Nääs et al., 2006). Thanks to these mats, the lameness score can be determined.

3.2. Feeding in Precision Livestock

Biosensors not only enable the examination of animal health, but also help determine values such as animal feeding behavior and feed consumption. Feed consumption frequency, rumination interval and duration, feed consumption time, amount of feed consumed are important behaviors in animal feeding (Canga et al., 2022). In order to determine the signals related to the chewing movements, the electrodes can be placed on the jaw muscles and information about the nutritional values of the animal can be obtained (Nunes et al., 2021).

The presence of health problems in animals (especially lameness) reduces feed consumption and feeding, thus negatively affecting feeding. Video recordings used on farms allow the analysis of feed consumption and other feeding-related factors. In addition to this situation, the body condition score, which is usually based on individual observation, gives information about the nutritional status of the animal (Canga et al., 2022)

3.3. Reproduction and Performance in Precision Livestock

Animal health and nutrition affect reproduction. Therefore, sensitive livestock systems examining these parameters also give general information about reproduction and performance. With image analysis, animal movements can be examined, and animal performance and reproductive characteristics can be examined. Especially following the heat at the right time has a positive effect on reproduction, and in connection with this, it also positively affects the productivity of dairy cows (Nääs et al., 2006). However, the occurrence of foot diseases can negatively affect the yield as it will reduce feed consumption. Not only does it affect performance and yield reduction, but also treatment costs, additional labor, prolongation of the calving interval, additional insemination costs can also cause economic losses (Yaylak, 2008). In addition, since foot diseases restrict the movements of the animal, they cause negative effects on reproduction and performance. Image analysis is obtained by using video cameras, electron microscopes, radar, ultrasound and X-ray devices (Nääs et al., 2006).

4. Conclusion

Sensitive livestock systems have started to gain importance for sustainable livestock production during the COVID-19 pandemic. Epidemic diseases experienced from the past to the present have caused problems in production, especially in plant and animal production, considering the risk of transmission of the disease and the number of death rates. Therefore, the production shortage has disrupted the supply-demand balance and caused problems in the food supply. People have started to pay attention to nutrition in order to stay healthier. Therefore, as this situation increased the demand for animal products, it also led to an increase in animal husbandry. During the COVID-19 pandemic, precision agriculture and precision livestock systems have come to the fore as they allow remote management and control. Because precision agriculture is based on science and technology, it can reduce the risk of disease transmission by allowing animals to be handled individually and without contact. However, this system is focused on increasing efficiency, protecting the environment and reducing costs.

In short, while agricultural inputs are applied uniformly in traditional agriculture, many technologies are used in line with agricultural needs in precision agriculture, so

that sustainable animal husbandry can be made for healthy animals and humans, preventing economic losses and diseases. It is possible to examine the efficiency, reproduction, health, welfare and behavior of the animal by means of herd monitoring and control systems by making use of the latest developments in technology in sensitive livestock. In the sensitive livestock system, there are problems such as data science, prediction interpretation, high capital, lack of wireless internet connection, lack of power supply, security and privacy problems, and the investment cannot be met due to the low number of animals. However, it is thought that these problems will not be encountered in providing the necessary equipment and equipment in farms where the number of animals is high. The fact that these systems were not preferred much before Covid-19 increased the risk of transmission of epidemic diseases. Not using technological systems in animal husbandry will allow individual animal husbandry, mismanagement and feeding, as well as prevent the handling of animals individually. Therefore, since contactless animal husbandry is not carried out and the data is not recorded (for example, cloud database), the health, nutrition, reproduction and performance of the animal cannot be evaluated correctly.

Author Contributions

The percentage of the author(s) contributions is present below. The authors reviewed and approved final version of the manuscript.

	H.N.K.	M.B.	D.Ç.
C			50
D	50	50	
S			50
L	50	50	
W	50	50	
CR	50	50	
SR	50	50	

C=Concept, D= design, S= supervision, L= literature search, W= writing, CR= critical review, SR= submission and revision.

Conflict of Interest

The authors declare that there is no conflict of interest.

References

Bewley J. 2008. Precision dairy farming: What is it and when does it pay. In Proceedings of the Kentucky Dairy Partners Meeting, April 15, Cave City, USA, pp. 14-18.

Canga D, Boğa M, Kılıç HN, Bulut M. 2022. Information and communication technologies (ICT) and precision livestock (PLF) applications in farm conditions. Livre de Lyon, 1-39.

Düzgün D, Or M. 2009.Application of thermal camera on the medicine and veterinary. Tubaw Sci J, 2(4): 468-475.

Hoque M, Mondal S, Adusumilli S. 2022. Sustainable livestock production and food security. Biol Tools Technique, 71-90.

Nunes L, Ampatzidisa Y, Costaa L Wallaub M. 2021. Horse foraging behavior detection using sound recognition techniques and artificial intelligence. Comput Electron Agric, 183:106080.

Nääs IA. Carvalho VC. Moura DJ. Mollo M. 2006. Precision livestock production. Agric Eng Int CIGR J, 313-315.

Tarhan S, Özgüven MM, Ertuğrul M. 2015.Applications of information technologies on dairy cattle enterprises. In Proceedings of the GAP VII. Agriculture Congress, 28 April-1 May 2015, Şanlıurfa, Türkiye, pp. 510-513.

Tömek B. 2007.An evaluation of modern technology applications used by herd management in dairy cattle husbandrysüt. MSc thesis, Ege University, Graduate School of Natural and Applied Sciences, İzmir, Türkiye, ss. 58.

Türker U, Akdemir B, Topakcı M, Tekin B, Aydın İÜA, Özoğul G, Evrenosoğlu M. 2015. Advances in precision farming technologies. In Proceedings of Agricultural Engineering VIII. Technical Congress, 16 February, Ankara, Türkiye, pp. 1: 295.

Walter A, Finger R, Huber R, Buchmann N. 2017. Opinion: smart farming is key to developing sustainable agriculture. Proc Natl Acad Sci, 114: 6148–6150.

Wolfert S, Ge L, Verdouw C, Bogaardt MJ. 2017. Big data in smart farming–a review. Agric Syst, 153: 69-80.

Yaman H, Sungur O, Dulupçu MA. 2021. Transformation of agriculture and livestock in the world: technology-based applications and revolutions. TJAE, 27(2): 123-133.

Yaylak E. 2008.Lameness in dairy cattle and its effects on some characters. J Anim Prod, 49:1.

Yıldız AK, Özgüven MM. 2018. Precision animal production practices and applicability in Yozgat livestock. 3. International Bozok Symposium, May 3-5, Yozgat, Türkiye, pp. 59-72.