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Research Article

Producers Approach to Biogas Production from Waste in Livestock Enterprises: The Case of Seydişehir District of Konya Province

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Abstract

This study aimed to determine the general characteristics of cattle breeding enterprises in Seydişehir district and the owners' perspectives on waste management. The research material of the study consisted of enterprises with 30 or more cattle engaged in animal production in Seydişehir district. Snowball sampling method was used in the application of data collection forms (questionnaire). At the end of the evaluations, 91 enterprises constituted the main material of the study. The surveys were conducted between October 2022 and August 2023. It was determined that the rate of utilization of animal waste was higher in the 1st and 2nd regions than in the 3rd region. It was determined that the fertilizers obtained were mostly preferred to be sold and very few breeders used them in their own lands. In addition to the increase in enterprise income, it was determined that environmental awareness increased in enterprises with more modern production. The statistical difference between the answers given to the questions on the structure of the enterprise and the more economical utilization of manure, storage, environmental awareness and the perspective on biogas production was found to be significant. It was stated that the owners of the enterprises were generally informed about biogas production, which is a renewable energy source, and wanted to contribute to biogas production. It was determined that most livestock farms in Seydişehir district of Konya province are favorable to biogas production and are aware that utilizing manure is to the advantage of the environment and the enterprise.

Keywords: Biogas, Konya, Manure, Seydişehir, Waste management

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Introduction

In addition to adequate and balanced nutrition, animal production fulfills very important socio-economic and biological functions such as employment, providing raw materials to the industrial sector, balanced development between regions, basing the financing of development and industrialization on own resources, reducing and preventing unbalanced migration from rural areas to cities and the social problems that will arise (Günlü et al 2006). In addition, waste products including manure from livestock and poultry, feed losses, litter, washing water and other waste materials constitute a valuable resource that can replace significant amounts of inorganic resources that can be used for agricultural fertilizer, biogas and energy (El Boushy and Vander Poel 2000, Henuk 2001). It is possible to generate energy and produce compost fertilizer with high nutritional value through biomass-energy conversion system by using appropriate disposal methods of animal waste. In this way, economic and feasible solutions to the environmental problems caused by the increasing amount of animal waste can be put forward (Tolay et al 2008).

Animal waste can pose a risk to human and animal health if not properly managed. Therefore, studies are being carried out on effective strategies and techniques for utilizing livestock waste designed to develop sustainable environmentally friendly livestock production systems. With such systems, it is obvious that in addition to providing sustainable use as organic fertilizer, non-conventional feedstuff, biogas source, environmental impacts on human and animal health (air and water pollution, ammonia and greenhouse gas emissions) will also be reduced (Çevik 2016). In addition, the transmission of diseases caused by

microorganisms can also be reduced by appropriate waste treatment methods (Mackenzie et al 1994).

Seydişehir district, located 107 km from Konya province center in Central Anatolia region, is between 37° 25′ 6″ North latitudes and 31° 51′ 2″ East longitudes. The surface area of the district with an altitude of 1 119 m is 1 430 km^2. Beyşehir is in the north, Yalıhüyük, Ahırlı and Antalya province Akseki district in the south, Derebucak in the west and Akören district in the east. Located on the northern foothills of the Toros Mountains in the Suğla Plain along the Carşamba Stream, the district has Suğla Lake to the southeast and Beyşehir Lake to the northwest. Agriculture and animal husbandry are the most important sources of livelihood in Seydişehir. It is seen that the number of dairy cattle in Seydişehir district is approximately 13.6% of Konya. When animal assets are analyzed by years; it is seen that the number of animals has increased since 2013. While the number of pure culture dairy cattle was 7 650 in 2013, it was 13 987 in 2022 (TÜİK 2022). In this study, it was aimed to determine the general characteristics of cattle breeding enterprises in Seydişehir district and the perspective of enterprise owners on waste management.

Material and Methods

Research Materials

The research material of this study consisted of enterprises with 30 or more cattle engaged in animal production in Seydişehir district. Due to the large research area, snowball sampling method (Arıkan 2013, Karabey 2021) was used in the application of data collection forms (questionnaire). In this context, it was aimed to interview and survey all the owners who were thought to answer the data collection form and who could be reached, and 91 enterprises constituted the main material of the study. The data collection forms used in the study were created by considering the characteristics of previous studies on this subject. The data collection forms were made face to face with the enterprise's owners. The data obtained covers the production period of October 2022- August 2023.

Survey Administration

In the inventory assessment, it was determined that the number of enterprises that could be included in the study was 322 and there were 18 931 cattle in these enterprises. The enterprises were divided into 3 regions according to their residential areas. While determining the regions, the existing biogas enterprise, geographical structure, settlement of the neighborhoods and transportation were taken into consideration. Accordingly, the south side of Seydişehir center was determined as the 1st region, the east side as the 2nd region and the west side of the highway connecting Seydişehir to Konya as the 3rd region. The first region is a region rich in agricultural lands, where large-scale dairy cattle farms are more common and the number of enterprises is high. The second region consists of mountainous lands. The holdings are small-scale, and the animals stay on pasture for half of the year. The third region is on the border of Beyşehir and there is a biogas plant nearby. There are more small-scale enterprises in the region.

Statistical Analysis

The data obtained as a result of face-to-face questionnaires with business owners were transferred to the computer environment and analyzed with the help of a SPSS-Statistics-29 package program. In the analyses, descriptive statistics and descriptive statistics (X2) were used for comparisons between countable characteristics (SPSS 29.0).

Table 1. Education level and working period of enterprise owners in the sector

Region	Educational status of the enterprise's owner (%)		The enterprises owner's working time in the livestock sector (%)		The enterprises owner's annual income (%)		The enterprises owner's working in a different sector because he did not find the sector income sufficient (%)	
	Primary school-middle school	High school-university	1-10 year	>10 year	0-2300$	>23 000 $	Working	Not-working
Region 1	40.48	59.52	28.57	71.43	50.00	50.00	45,24	54.76
Region 2	53.85	46.15	23.08	76.92	76.92	23.08	46.15	53.85
Region 3	63.89	36.11	11.11	88.89	86.11	13.89	50.00	50.00
Mean	51.65	48.35	20.88	79.12	68.13	31.87	47.25	52.75

1 $: 8,70 TRY (June 2021)

Table 2. Number of snimals in the regions and age distribution in the enterprises (%)							
Region	Animal presence/ head	The enterprises owner's working time in the livestock sector (%)			The enterprises owner's annual income (%)		
		30-50	50-100	>100	0-6	6-12	>12
Region 1	3365	40.48	28.57	30.95	12.87	24.10	63.03
Region 2	857	53.85	46.15	0.00	12.29	22.46	65.25
Region 3	2334	41.67	44.44	13.89	5.28	21.55	73.17
Mean	2219/6656	42.86	37.36	19.78	10.08	22.98	66.95

Results

Some selected socio-economic findings of the enterprises included in the study are given in Table 1. When the data in Table 1 are examined, it is seen that approximately 51.65% of the business owners are primary and secondary school graduates and 48.35% are high school and undergraduate graduates. It was found that 79.12% of the enterprises included in the scope of the research had a sector experience of 10 years or more. It was determined that approximately 88.89% of the enterprises in the third region have been in the sector for more than 10 years. It was determined that about half (52.75%) of the owners or entrepreneurs engaged in animal husbandry in Seydişehir district consider animal husbandry activity as the main business and source of income, but the other half earn income by working in additional jobs.

Findings on animal husbandry in the enterprises included in the study are given in Table 2 and some technical characteristics of the enterprises are given in Table 3. In the enterprises included in the study, the ratio of enterprises with more than 100 heads of livestock is 19.78% and the ratio of enterprises with 50-100 heads of livestock is 37.36% (Table 2). This finding is significantly related to the sample size. When Table 3 was analyzed, it was determined that the number of technical personnel (veterinary health technician, veterinarian, etc.) employed in the enterprises was generally between 1-2 (76.92%). It is seen that cattle production in the district is mainly specialized in dairy cattle breeding and milk production is widespread. It was determined that the rate of specialization in cattle breeding was approximately 32%. It was declared that 80.22% of the enterprises in the region are in traditional enterprise status. The general observation is in the same direction with the finding (Table 3). It is understood that silage and hay are used as roughage sources by 94.51% and ready feeds (72.53%) are used as concentrate feed sources (Table 4). Table 5, Table 6 and Table 7 show the findings regarding the practices for the utilization and removal of waste and manure in the participating farms.

As a result of the survey, it was stated that the rate of utilization of animal waste was high in regions I and 2, while the opposite approach was preferred in region 3. It was determined that the sale of the obtained fertilizers was preferred and very few (32.97%) breeders used them free of charge or in their own lands. It was observed that fertilizer disposal costs and earnings from fertilizer sales were the highest in region 1, followed by region 3 (Table 5). It was determined that fertilizers were kept in the holdings for a

Table 3. Data on the structural characteristics of the business, the number of technical personal, and production methods (%)													
Region	Number of technical personnel working in the business (%)		Number of workers working in the business (%)		Production method (milk-beef) (%)			Structure of the business (traditional-modern) (%)		Manure is removed mechanically in the business (%)		Separator available in the business (%)	
	≤ 2	≥3	≤2	≥ 3	Milk	Beef	Mixed	Trad.	Mod.	Yes	No	Yes	No
Region 1	100.00	0.00	80.95	19.05	40.48	33.33	26.19	66.67	33.33	40.48	59.59	38.10	61.90
Region 2	100.00	0.00	61.54	38.46	23.08	46.15	30.77	76.92	23.08	23.08	76.92	0.00	100.00
Region 3	100.00	0.00	77.78	22.22	72.22	27.78	0.00	94.59	5.41	2.78	97.22	4.44	55.56
Mean	100.00	0.00	76.92	23.08	50.85	32.97	16.48	80.22	20.88	23.08	76.92	35.16	64.84

Table 4. Data on the feeding method of the enterprise.				
Region	Roughage source used in the enterprises		Concentrated feed used in the farm	
	Silage + dry grass (%)	Dry grass only (%)	Yes	No
Region 1	100.00	0.00	73.81	26.19
Region 2	69.23	30.77	46.15	53.85
Region 3	97.22	2.78	80.56	19.44
Mean	94.51	5.49	72.53	27.47

long time and were generally evaluated as dry. An average of 78.02% of the enterprise owners stated that there is a biogas enterprise in the region, but their connections change seasonally, or they have no connection at all. The rate of those with connections is 53.85% (Table 6 and 7).

In the first region, the amount of waste given to biogas plants is 17 650 tons/year, which is the highest rate among the regions. In the other two regions, very little waste is utilized in biogas plants. On average, 75.82% of the enterprises consider fertilizer as an important source of income. It was determined that 31.87% of the enterprises utilize manure with methods that can be called classical. Approximately half of the enterprises think that it will be possible to make fertilizer more profitable with technological methods. The findings on the level of waste and environmental awareness of the enterprise owners within the scope of the study are given in Table 8.

It was detected that 97.22% of the business owners in the third region did not have any problem in storing manure in the barn and at the edge of the farm. However, 83.33% of the enterprises in the first region reported that manure should be removed from the enterprise quickly. It was observed that the owners of the enterprises in the first region were more sensitive about the damage caused by animal waste to the environment and 90.48% of them thought that studies should be carried out to reduce environmental impacts. It was concluded that 73.81% of the enterprises in the first region would support initiatives to reduce the environmental impacts of manure. This rate was 61.54% in the second region and 25.00% in the third region. In this context, it was evaluated that business owners in the first region had a higher level of awareness about fertilizer and business waste and were aware of the damages that could be caused to the environment (Table 8).

In region 1, 73.81% of the business owners stated that they would support biogas production in their manure and waste and that they could market it to the company. The remaining 26.19% stated that they would use conventional methods or abstain. When this ratio is analyzed in general, it is seen that it is half and half. 92.86% of the enterprises in the 1st region stated that they can cooperate with biogas enterprises throughout the year. This rate was 61.54% in region 2 and only 33.33% in region 3 (Table 9).

Within the scope of the study, the relationships between waste use and some selected variables were analyzed and given as Table 10 and Table 11. As can be understood from the examination of Table 10, it is seen that there are statistically significant differences between regions (except for Question 2) in the behaviors towards the

Table 5. Data on the perspective on manure management in enterprises.									
Region	Animal waste is evaluated (%)		Fertilizer obtained in the enterprises is given free of charge (%)		Fertilizer obtained in the enterprises is sold (%)		Fertilizer removal cost (labor and transportation) ($ /year)	Profit obtained from sales ($/year)	Daily waste amount generated in the enterprises (ton/year)
	Yes	No	Yes	No	Yes	No			
Region 1	73.81	26.19	38.10	61.90	73.81	26.19	61 500	133 735	84 500
Region 2	69.23	30.77	30.77	69.23	46.15	53.85	10 115	33 103	22 000
Region 3	27.78	72.22	27.78	72.22	66.67	33.33	29 140	80 689	58 950
Mean	54.95	45.05	32.97	67.03	67.03	32.97	33 585	82 509	42 050
1 $: 8,70 TRY (June 2021)									

Table 6. Data on manure utilization and relations with biogas enterprises								
Region	Fertilizer is sent without waiting (%)		Fertilizer is sent in wet form (%)		There are biogas enterprises in the region (%)		I have connections with biogas enterprises (%)	
	Yes	No	Yes	No	Yes	No	Yes	No
Region 1	47.62	52.38	40.48	59.52	100.00	0.00	54.76	45.26
Region 2	15.38	84.62	23.08	76.92	76.92	23.08	23.08	76.92
Region 3	2.78	97.22	2.78	97.22	52.78	47.22	44.44	55.56
Mean	25.27	74.73	23.08	76.92	78.02	21.98	46.15	53.85

environmental risk status, evaluation and disposal of fertilizers and solid waste in livestock enterprises. This finding reveals that regional development and clustering is an important finding in terms of behavior and learning. Similarly, it reveals that the educational status of producers is the source of significant differences between regions in terms of waste management and utilization. Within the scope of the study, it is understood that the duration of activity in the sector is a significant difference in terms of some variables (questions 3, 4, 8, 9 and 10). This finding reveals that experience and observations that increase with experience should be considered as an important variable in policy making for waste management.

As can be understood from the examination of Table 11, it is understood that business income has significant differences (except for Question 2) in the perception and change of the problems identified in fertilizer and waste management. It can be argued that environmental awareness can be improved with the increase in the income of these enterprises, in other words, with the improvement of the economic performance of the enterprise. Similarly, it was observed that manure can be improved in a more conscious way for both the enterprise and the environment with the transition of enterprises to modern livestock production techniques. Moving away from the traditional structure and increasing scales can increase the level of awareness in terms of environmental protection. However, within the scope of the study, it was determined that the specialization of the enterprises in the type of production (dairy, fattening or mixed) revealed generally similar approach results in terms of manure and solid waste (the difference was only in Questions 1 and 7).

Discussion

The use of renewable energy resources will make an important contribution to the protection of the environment, global warming, and therefore human health. Efforts to increase the capacity to produce biogas, which is increasingly being used among renewable energy sources, and to make it widespread are increasing. Sustainability in animal production is defined as environmentally healthy, economically profitable and socially acceptable production (Deri 2022). In this respect, manure and solid waste management is closely related to the sustainability of the sector.

In the study, it was determined that the education level of about half of the business owners was high school and above, and the rate of those with 10 years or more of professional experience was 75%. It was seen that 68% of the annual business revenues have an income below 23 000 $ and that the incomes vary proportionally between regions. From this point of view, the utilization

Table 7. Data on fertilizer evaluation by enterprises							
Region	Amount of waste given to biogas enterprises	Manure is considered as an important source of economic income in livestock enterprises (%)		Manure is evaluated only with classical methods in livestock enterprises (%)		Manure can become more economically profitable with technological methods in livestock enterprises (%)	
	Ton/year	Yes	No	Yes	No	Yes	No
Region 1	17 650	100.00	0.00	23.81	76.19	61.90	38.10
Region 2	1 500	61.54	38.46	30.77	69.23	69.23	30.77
Region 3	1 000	52.78	47.22	45.45	54.55	25.00	75.00
Mean	6 717	75.82	24.18	33.35	66.66	48.35	51.65

Table 8. Findings on waste and environmental awareness level by enterprises

Region	In livestock farms, manure can be stored in barns and farm sides (%)		In livestock farms, manure should be removed quickly from barns (%)		In livestock farms, can manure cause some damage to the environment? (%)		If your answer is agree, what are these damages? (%)*					Studies should be conducted to reduce the environmental impacts of manure and waste in livestock farms (%)		I support initiatives to reduce the environmental impacts of manure and waste in livestock farms (%)	
	Yes	No	Yes	No	Yes	No	Visual pollution	Odor	Disease problem	Climate change		Yes	No	Yes	No
Region 1	42.86	57.14	83.33	16.67	83.33	16.67	80.95	83.33	83.33	14.29		90.48	9.52	73.81	26.19
Region 2	76.92	23.08	38.46	61.54	38.46	61.54	25.00	41.67	33.33	0.00		53.85	46.15	61.54	38.46
Region 3	97.22	2.78	29.73	70.27	30.56	69.44	30.56	30.56	30.56	2.78		52.78	47.22	25.00	75.00
Mean	69.23	30.77	56.05	45.05	56.05	45.05	52.75	56.04	54.95	7.69		70.33	29.67	52.75	47.25

*Since the respondents marked more than one answer, the sums may be more than 100.00.

of waste can contribute to an increase in the income of the enterprises.

Considering the presence of animals, it is understood that there is a difference between the regions in terms of the presence of animals throughout the district, and 42% of the enterprises have between 30-50 heads of animals. It is seen that the number of enterprises with one hundred and more animals is around 19%. The difference in animal existence between regions reveals that the place of establishment will be an important factor in the utilization of waste. In this respect, in determining the establishment location of the first region, animal wealth, education level, enterprise income and specialization in the livestock sector are important.

The level of education and sector experience of the enterprises in the region was higher than the 42.5% reported in previous studies in Konya (Günlü and Sakarya 2001). In a study conducted in Konya Eregli District, 54% of the owners of small-scale enterprises and 54% of the owners of qualified enterprises. It is reported that 54.07% of this rate is primary school graduates (Yener 2013). In the present study, it was determined that the average rate of primary and secondary school graduates was 51.65%, the lowest rate was 40.48% in region 1, and this rate was like the study conducted in the same province. The findings obtained in terms of education level are similar to the studies conducted in different regions (Peypazar 2019). Within the scope of the study, it was understood that 50.85% of the enterprises are engaged in dairy cattle production, 72.22% of dairy enterprises are in the 3rd region and 46.15% of fattening enterprises are in the 2nd region. The rate of those employing 3 or more workers in which technical personnel are employed in the enterprises is calculated as 23%. This is significantly related to the scale of the enterprise.

In the study, the rate of enterprises that have infrastructure investments and equipment (e.g. scrapers) for the removal of solid waste, especially fertilizers, from the enterprise was determined as 23% and it was determined that they were generally in the 1st region. This rate is close to the value reported in previous studies on this subject (25%) (Peypazar 2019). It was determined that such investments also differed in holdings divided into different regions and were proportionally lowest in the 3rd region where livestock investments were less (Table 3). This may be closely related to the fact that livestock investments are more developed in certain regions.

Within the scope of the research, it was detected that 72.53% of the livestock holdings used prepared feed and 94.51% used silage and hay for animal feeding (Table 4). In region 1, it was determined that all the enterprises in the region use silage and hay and feed mixers and mixed feeds

Table 9. Findings regarding the perspectives on the utilization of manure in enterprises

Region	I support production of biogas from manure and waste in livestock farms (%)		I market/deliver waste to the company for production of biogas from manure and waste in livestock farms (%)		My cooperation with the company for production of biogas from manure and waste in livestock farms (%)	
	Yes	No	Yes	No	Continues all year round	Only during winter months
Region 1	73.81	26.19	73.81	26.19	92.86	7.14
Region 2	61.54	38.46	61.54	38.46	61.54	38.46
Region 3	25.00	75.00	25.00	75.00	33.33	66.67
Mean	52.75	47.25	52.75	47.25	64.84	35.16

are prepared in the enterprise, which can be considered as an advantage in terms of continuity in biogas production in the region.

Within the scope of the study, it was reported that the rate of solid waste utilization by business owners was around 54.95%. It was seen that 32.97% of the enterprises disposed of the fertilizers obtained from the enterprises free of charge, while the rate of enterprises selling their fertilizers was 67.03%. The region with the highest daily waste amount is Region 1, which is approximately 84.5 tons. In the 1st region, where the most profit is obtained from the sale of fertilizer, a total income of 133 735 $ was obtained and the annual disposal cost was approximately 61 500 $. These data reveal that the disposal of manure from the enterprises is a problem and that there is a potential to establish a possible facility.

The rate of enterprises that dispose of manure without waiting was determined as 25,57%. In general, manure is kept for an indefinite period and then disposed of. It is seen that 23.08% of the enterprises that remove manure from their barns wet. The rate of enterprises that know that there is a biogas facility in the region is 78.02%. It was determined that 46.15% of the enterprises have a connection with a biogas plant (Table 6).

Many dairy farms with modern structures are in the first region. It is seen that the amount of waste given to biogas plants is 17,650 tons/year, 1,500 tons/year in the second region and 1,000 tons/year in the third region. 75.82% of the business owners think that fertilizer is an important source of income. The rate of enterprises stating that fertilizers can be made more profitable with technological methods is 48.35%.

In the regions where the enterprises are located; it was observed that the rates of utilization of animal waste and the answers given to the question of giving or selling manure free of charge and the income and expenses obtained from the sale of manure are compatible. However, even in the regions where manure was reported to be sold, it was observed that the rate of sending the manure without waiting was low and some of the business owners in the regions were not aware of the existing biogas enterprise or had no connection at all. The business owners who reported that the manure was not economically utilized stated that they used the manure in their own and their relatives' agricultural lands and therefore did not feel the need to sell it. In a similar study, it was reported that 87% of the farms used the waste in agricultural lands, 5% gave them to neighboring farms and only 8% sold the waste (Karaman 2005). In another study conducted in Aydın province, it was reported that approximately 90% of the enterprises utilize the manure in agricultural lands (Soyer 2014). These findings reveal that solid waste should be supported with training and guidance activities for more effective utilization of solid waste.

69.23% of the business managers reported that manure can be kept at the edge of the barn or farm. However, businesses in the 1st region stated that manure should be removed quickly. 56.05% of the business owners stated that manure will cause some damage to the environment. Approximately 52.75% stated that there may be visual pollution, odor and disease problems, and 7.69% believed it will affect climate change. 70.33% of the business owners surveyed reported that studies should be carried out to reduce the environmental impacts of manure and waste in animal husbandry businesses. According to the results obtained, it was determined that the owners in the 1st region were more sensitive and conscious about the damages that can be caused by manure and waste in livestock farms.

It is known that N_2O emission can be reduced by storing manure in a suitable environment and CH_4 can be converted into biogas energy with the right investments. Livestock breeding is an important source of income in our country and converting greenhouse gases emitted by livestock waste into electrical energy will make a

Table 10. Analysis results of the relationships between some selected variables and waste management

		Region						Educational status of the enterprise's owner					The length of time the enterprises owner has worked in the livestock industry				
		1	2	3	Total	X^2	P	Primary	High-Uni	Total	X^2	P	1-10 year	≥ 11	Total	X^2	P
1-Is manure an important source of economic income in animal husbandry enterprises?	Yes	42	8	19	69	25.269	0.001	36	33	69	0.320	0.859	14	55	69	0.600	0.807
	No	0	5	17	22			11	11	22			5	17	22		
2-Manure is only evaluated with classical methods in animal husbandry enterprises.	Yes	10	4	15	29	2.855	0.240	10	19	29	5.022	0.025	5	24	29	0.341	0.559
	No	32	9	21	62			37	25	62			14	48	62		
3- Manure can become economically more profitable	Yes	26	9	9	44	13.219	0.001	21	23	44	0.524	0.469	15	29	44	9.002	0.003
	No	16	4	27	47			26	21	47			4	43	47		
4- Manure can be stored in barns and on the edge of the farm in animal husbandry enterprises	Yes	18	10	35	63	27.317	0.001	42	21	63	18.493	0.001	6	57	63	15.982	0.001
	No	24	3	1	28			5	23	28			13	15	28		
5- Manure should be quickly removed from the barn in animal husbandry enterprises	Yes	35	5	11	51	23.822	0.001	21	30	51	5.095	0.024	14	37	51	3.033	0.082
	No	7	8	25	40			26	14	40			5	35	40		
6- Manure can cause some damage to the environment in animal husbandry enterprises	Yes	35	5	11	51	23.822	0.001	21	30	51	5.095	0.024	14	37	51	0.082	0.068
	No	7	8	25	40			26	14	40			5	35	40		
7- Studies should be carried out to reduce the environmental impacts of manure and waste in animal husbandry enterprises.	Yes	38	7	19	64	15.177	0.001	34	30	64	0.188	0.664	14	50	64	0.129	0.719
	No	4	6	17	27			13	14	27			5	22	27		
8- I support/participate in initiatives to reduce the environmental impacts of manure and waste in animal husbandry enterprises	Yes	31	8	9	48	18.999	0.001	20	28	48	4.053	0.044	15	33	48	6.614	0.010
	No	11	5	27	43			27	16	43			4	39	43		
9- I support the production of biogas from manure and waste in animal husbandry enterprises.	Yes	31	8	9	48	18.999	0.001	20	28	48	4.053	0.044	15	33	48	6.614	0.010
	No	11	5	27	43			27	16	43			4	39	43		
10-I market/deliver the waste to the company to produce biogas from manure and waste in animal husbandry enterprises	Yes	31	8	9	48	18.999	0.001	20	28	48	4.053	0.044	15	33	48	6.614	0.010
	No	11	5	27	43			27	16	43			4	39	43		
11-My cooperation with the company to produce biogas from manure and waste in animal husbandry enterprise	All year	31	8	9	48	18.999	0.001	28	31	59	1.180	0.277	15	44	59	2.098	0.148
	Winter	11	5	27	43			19	13	32			4	28	32		

Table 11. Results of the relationship between income, production type and enterprises structure and solid waste and utilization method in the investigated enterprises

		Region					Educational status of the enterprise's owner						The length of time the enterprises owner has worked in the livestock industry				
		<2300 $	<23 000 $	Total	X^2	P	Milk	Beef	Mix	Total	X^2	P	Traditional	Modern	Total	X^2	P
1-Is manure an important source of economic income in animal husbandry enterprises?	Yes	43	26	69	4.442	0.031	30	25	14	69	6.255	0.044	51	18	69	7.154	0.070
	No	19	3	22			16	5	1	22			22	0	22		
2-Manure is only evaluated with classical methods in animal husbandry enterprises.	Yes	23	6	29	2.450	0.118	16	6	7	29	3.639	0.162	28	1	29	7.155	0.007
	No	39	23	62			30	24	8	62			45	17	62		
3- Manure can become economically more profitable	Yes	23	21	44	9.868	0.002	27	10	7	44	4.698	0.095	26	18	44	23.968	0.001
	No	39	8	47			19	20	8	47			47	0	47		
4- Manure can be stored in barns and on the edge of the farm in animal husbandry enterprises	Yes	58	5	63	54.008	0.001	26	22	15	63	10.392	0.006	63	0	63	50.486	0.001
	No	4	24	28			20	8	0	28			10	18	28		
5- Manure should be quickly removed from the barn in animal husbandry enterprises	Yes	27	24	51	12.331	0.001	23	20	8	51	2.101	0.350	33	18	51	17.599	0.001
	No	35	5	40			23	10	7	40			40	0	40		
6- Manure can cause some damage to the environment in animal husbandry enterprises	Yes	27	24	51	12.331	0.001	23	20	8	51	2.101	0.350	33	18	51	17.599	0.001
	No	35	5	40			23	10	7	40			40	0	40		
7- Studies should be carried out to reduce the environmental impacts of manure and waste in animal husbandry enterprises.	Yes	38	26	64	7.619	0.006	30	26	8	64	6.490	0.039	46	18	64	9.466	0.002
	No	24	3	27			16	4	7	27			27	0	27		
8- I support/participate in initiatives to reduce the environmental impacts of manure and waste in animal husbandry enterprises	Yes	22	26	48	23.263	0.001	27	15	6	48	1.722	0.423	30	18	48	20.101	0.001
	No	40	3	43			19	15	9	43			43	0	43		
9- I support the production of biogas from manure and waste in animal husbandry enterprises.	Yes	22	26	48	23.263	0.001	27	15	6	48	1.722	0.423	30	18	48	20.101	0.001
	No	40	3	43			19	15	9	43			43	0	43		
10-I market/deliver the waste to the company to produce biogas from manure and waste in animal husbandry enterprises	Yes	22	26	48	23.263	0.001	27	15	6	48	1.722	0.423	30	18	48	20.101	0.001
	No	40	3	43			19	15	9	43			43	0	43		
11-My cooperation with the company to produce biogas from manure and waste in animal husbandry enterprise	All year	33	26	59	11.501	0.001	27	21	11	59	1.587	0.452	42	17	59	8.628	0.003
	Winter	29	3	32			19	9	4	32			31	1	32		

significant contribution to our economy (Ersoy 2017). It is reported that an animal with an average live weight of 454 kg in dairy cattle can produce 39 kg of manure per day (Varol 2017) and the manure density is 992 kg/m^3. A dairy cow can produce approximately 1 m^3 of manure per month (Sommer 2008). In a study, it was reported that when manure is stored uncovered next to the barn, 1 m^3 of manure decreases to 495 kg due to fluid loss (Ünlü and Padem 2010). When the amount of CH_4 released from manure stored outside is calculated, it is stated that 1 m^3 of manure releases 2.3 kg CH_4 and 72 kg CO_2 per year (Chianese et al. 2009). It is also stated that the methane production of manure stored openly is lower than that of manure stored closed (Aydın 2022).

In a study conducted in Niğde Province, a survey was conducted on 187 farms, and it was reported that 114 of the enterprises did not have a waste storage area, that the waste was thrown into the city dump, that it was collected in bags behind the trailer, in a pit or on the soil (Can and Boğa 2019). In another study conducted in Burdur Province, it was reported that 95% of the enterprises collected their waste inside or next to the barn (Çayır and Atılgan 2012). Enterprises that prefer to use fertilizer in plant production especially prefer to store the fertilizer next to the barn (Can and Boğa 2019). Medium-sized enterprises need large areas in terms of volume to store their waste. They need to allocate additional resources for storage area construction investments. Animal enterprises that agree to cooperate with biogas enterprises throughout the year will contribute to saving on the budgets allocated for storage areas. In studies conducted nationwide, it was understood that the level of awareness in livestock enterprises about the negative effects of animal waste on the environment was not sufficiently developed. Although the majority of the enterprise owners stated that manure could harm the environment, it was observed that they thought there was no harm in storing manure near the barn, and that the enterprise owners in the first region were more sensitive to the damage that would be done to the environment (visual pollution, odor, diseases and climate change) and were more conscious about supporting the reduction of environmental impacts (Table 10 and Table 11).

In the study, it was stated that almost half of the enterprises volunteered to cooperate with facilities to be established in the region for the evaluation of waste, their awareness levels were high, and the differences were statistically significant at different levels (Tables 9, 10 and 11). However, in a study conducted in Afyonkarahisar, it was reported that 86.6% of the enterprises did not consider allocating a budget for a possible in-house manure evaluation system, 12.9% would not establish a connection even if a facility was established in their region, and 0.5% thought that waste evaluation would be beneficial (Varol 2017). In this respect, it was revealed that Konya and the animal husbandry region determined as the research area have significant potential in this respect and that progress will be made in this area with the support, incentives and guidance to be provided. Based on the results of this study, it was determined that the presence of animals did not have an effect on the perspective of the enterprise owner on manure, and that the region where the enterprise is located significantly affected the perspective of manure, especially the economic value of manure, storage, environmental effects and biogas production. It was determined that there was a significant difference between the education level of the business owner, the storage of manure, the awareness of the damage it causes to the environment and the evaluation of manure. It was seen that education increased the level of awareness and contributed to the awareness of the economic value of manure. It was determined that the answers were significant in terms of the duration of the business, the manure could become more profitable and its storage at the edge of the farm, the reduction of its environmental impacts and its use in biogas.

It was determined that the statistical difference between the answers regarding the evaluation of manure in the annual income of the enterprise with the classical method was insignificant, but the difference between the answers in the other 10 questions was very significant. It was observed that in enterprises with low annual income, manure evaluation and environmental awareness were lower, and as the income increased, more profitable, environmentally friendly and conscious animal husbandry was preferred. It was determined that the positive approach generally prevailed in the answers given.

A statistical difference was found significant between the production method of the enterprise and the economic evaluation of manure, storage and reducing environmental impacts. It was seen that the positive perspective was more in all types of enterprises. A statistical difference was found significant between the answers given to the questions regarding the enterprise structure and the more economic evaluation of manure, storage, environmental awareness and perspective on biogas production. After the survey, it was determined that many of the enterprise owners were knowledgeable about biogas production, which is a renewable energy source, wanted to contribute to biogas production to the extent of the enterprise's economic power, and thought that manure disposal would contribute to their farm.

Conclusion

As a result, it was determined that the majority of livestock enterprises in Seydişehir district of Konya Province are positive about biogas production, that they can give

their waste to biogas enterprises and that they are aware that the evaluation of manure is to the advantage of the environment and the enterprise.

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Competing Interests
Authors declare that there are no conflicts of interest related to the publication of this article.

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