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# EVALUATING THE MECHANIZATION OF LIVESTOCK PRODUCTION IN TURKEY

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***Abstract***

*Livestock have always been an important part of agricultural production in Turkey. Chores are tedious and time consuming in livestock production. The main chores in livestock production are the preparation of the animal feed, watering, herding, milking, and cleaning of livestock yards. Therefore, mechanization and automation technologies are very important factors in reducing labor and modernizing of livestock production. The aim of this study is to evaluate the current situation of the livestock mechanization in Turkey, main mechanization problems in livestock production and suggestions for development of mechanization. In this purpose, the current data of Turkish Statistical Institute and Republic of Turkey Ministry of Food-Agriculture-Livestock was used to determine the enterprise size according to the number of animals, and the number of machinery per livestock husbandry according to the machinery type commonly used in livestock enterprises. Also, the previous studies carried out on the determination of the mechanization structure of livestock enterprises in different regions of Turkey were evaluated. The results of this study and the previous studies showed that the average size of livestock enterprise is very small in Turkey and the number of machineries per enterprise was very low. The fact that the livestock enterprises was very small prevented the development of mechanization and automation in livestock production and caused costly production. Also, livestock husbandries were not suitable for the development of mechanization. Consequently, it can be said that the Enterprise size according to the number of bovine, sheep and goats and barn construction are very important factors for development of livestock mechanization in Turkey.*

***Key words*****:** *Livestock, mechanization, Turkey*

## INTRODUCTION

Livestock are vital to subsistence and economic development in Turkey as well as in many countries around the world. They provide a flow of essential food products throughout the year, are a major source of government revenue and export earnings, and sustain the employment and income of millions of people in rural areas. The productivity and efficiency of Agricultural and livestock farming sectors in Turkey is lower than those in Europe due to small, fragmented farms, low education attainments and poor economic conditions [5]. Enterprises have to use the mechanization in livestock production in order to make their production easier, better quality and economical. Mechanization of livestock enterprises covers all levels of farming and processing technologies from simple and basic hand tools to more sophisticated and motorized equipment during the practices of livestock production, such as maintenance, feeding, milking and cleaning. It eases hard labor, and improves the efficient use of resources and timeliness of agricultural operations. Also, it improves animal health and welfare, and product quality and productivity [10].

The mechanization in livestock production can be examined under three main aspects:

(i)Feeding and watering of animals (fodder harvest, feed transport, feed preparation, feeding, watering etc. applications)

(ii)Care of animals and yards (manure cleaning, storage, processing, and related applications)

(iii)Producing the product (milk, meat, eggs, etc.).

Special attention is given to the feeding of animals. Livestock need a large proportion of their diet in the form of fresh cut or stored (usually ensiled) herbage from grass, maize, Lucerne (alfalfa), straw and other forage crops. Also, feeds of cereal and other grains are mixed to supplement fresh or conserved feeds that do not provide sufficient nutrients for the animals.

Appropriate mechanization is requirement of fodder production and utilization in any given situation. Livestock feeding and watering mechanization equipment includes all equipment used from fodder harvest to feeding and watering of animal. These equipment are forage mowers, mower conditioners, rakes, balers, bale loader, silage machine, bale and silage wagons, fodder mixer, animal feed grinder, feed delivery and distribution machines, and watering systems. Also, straw chopper is mainly used to process the residues of crops such as wheat, lentil, chickpea e.g. because they are an important alternative feed which should be utilized as much as possible, particularly in a year when feed supplies are limited, in Turkey as well as in developing countries [7]. In livestock production, animals require moderate amounts of water for good production. Many types of containers can be used to supply water for animals.

Regular yard cleaning in livestock production is important because it helps to optimize livestock performance. Numerous types of machines are used for yard cleaning and manure processing. Scrapers, wheeled front-end loaders and double-sided blades mounted on the front of a tractor are commonly used as manure cleaning and processing machines. The straws are used to help building up a manure pack and allow easier manure removal. This is especially important in calving areas [4].

The item of livestock equipment best known to the public is possibly milking equipment and its associated milking parlor. Traditionally the milking of cows has always been a laborious task performed twice a day seven days a week and any aspect of this task that is possible to automate has been looked on positively by farmers [10]

While the use of mechanical and electronic equipment reduces the need for human labor, saves time and increases production, efficiency, accuracy and product quality, it cause high installation and repair costs. Small enterprises rarely apply mechanization and automation technology for animal husbandry because holdings have to be enough large for proper and best utilization of agricultural machines. Therefore, development of mechanization in livestock production depends on the existence of large farms and it is more suitable for commercial and institutional farms.

The aim of this paper is to evaluate the current situation of the livestock enterprises and mechanization in Turkey.

## MATERIALS AND METHODS

In thıs study, the current situation and problems of mechanization in the livestock enterprises is investigated. For this purpose, Statistical Indicators of Turkish Statistical Institute and Republic of Turkey Ministry of Food-Agriculture-Livestock was used to determine the level of mechanization in livestock production in Turkey. Akdemir [1] reported that the main indicator of agricultural mechanization in a country was the number of tractors and machineries per agricultural farm. Therefore, in this study, the level of livestock mechanization was determined by dividing the number of tractors and machineries commonly used in livestock production by enterprises. Also, the results of the previous studies carried out on the determination of the mechanization structure of livestock enterprises in different regions of Turkey were evaluated in concept of this study.

## RESULTS AND DISCUSSIONS

The development of livestock mechanization in a country depends upon farm type, size and structure as well as livestock production systems and social-economic factors. In Turkey as well as many countries in the world, the term mechanization is unfortunately mostly used for crop cultivation, livestock mechanization is not well examined. This may result from that many machineries used in livestock production is not used in crop cultivation and crop cultivation is more common agricultural application than livestock production. In fact, the agricultural mechanization strategy of a country ought to compose both crop and livestock production.

The results of this study are examined in two different subtitles, which named “the structure

of the livestock enterprises in Turkey" and "mechanization status in livestock enterprises" because the structure of enterprises has significant effect on development of mechanization in livestock production.

**The structure of the livestock enterprises in Turkey**

A significant part of the country's population in Turkey is engaged in agriculture. According to agricultural statistical results of Turkish Statistical Institute, there are 3,076,649 agricultural enterprises. Of these enterprises, 62.3% are engaged in both crop and animal production, 37.2% are only crop production, and 0.5% is only animal breeding. In records of Turkish Statistical Institute, it is stated that the number of enterprises engaged in both crop production and animal husbandry was 2,074,439 and that the number of enterprises engaged in only animal husbandry was 72,679 [13].

The Turkish livestock sector is characterized by small-scale farms and domestic breeds, which are better able to adapt to the harsh climate of eastern Turkey but are less productive. Serttas [11] stated that the main livestock producing region of Turkey are the east Anatolia region, despite less suitable topographical and climatic conditions, and according to a new support system announced at the end of 2009, Turkish government pays for 30% of construction costs and 40% of equipment and breeding cattle purchase costs for new livestock farms with over 50 head in East and Southeast Anatolia. Also, it is seen that there are several new investments in large modern farm operations with more than 100 dairy cattle in recent years [11] .

Vural and Fidan [15] reported that livestock production in Turkey is done in different forms. The first one is family farm animal husbandry type, which each family has 1-10 animals on average. This type of livestock production has both an activity for family consumption and an income-generating activity. The second type of livestock enterprises is landless livestock production systems. In this enterprise, the 1-2 animals are bred for family consumption. Another common practice is to make livestock production as a subsidiary activity in addition to crop production. Specialized and modern livestock enterprises follow this animal husbandry. Development of mechanization in livestock production is affected by enterprises type. The level of mechanization is lower in the family type enterprises than in the modern livestock enterprises. The mixed livestock enterprises including both crop and livestock production contribute efficient utilization of land, labor, equipment and other resources.

Table 1 shows that the total number of cattle in 2016 was 58,673,710 which 24.4 % were bovine animals including cattle, culture, cross-bred and, domestic; 75% were sheep and goat; and 0.5% were the animals including horse, camel, donkey, pig [13].

Table 1. Number of animals by type and races in Turkey

| Types of animals | Number (Head) | Share in bovine animals, sheep and goat and others (%) | Share in total animals (%) |
|---|---|---|---|
| **Total** | **58,673,710** | | **100.0** |
| **Bovine animals** | **14,323,941** | **100.0** | **24.4** |
| Cattle | 14,182,876 | 99.0 | 24.2 |
| Culture | 6,501,105 | 45.8 | 11.1 |
| Cross bred | 5,845,759 | 41.2 | 10.0 |
| Domestic | 1,836,012 | 12.9 | 3.1 |
| Buffalo | 141,065 | 1.0 | 0.2 |
| **Sheep and goat** | **44,034,062** | **100.0** | **75.0** |
| Sheep | 33,239,147 | 75.5 | 56.7 |
| Merino | 2,261,507 | 6.8 | 3.9 |
| Domestic | 30,977 640 | 93.2 | 52.8 |
| Goat | 10,794,915 | 24.5 | 18.4 |
| Ordinary goat | 10,566 011 | 97.9 | 18.0 |
| Angora goat | 228,904 | 2.1 | 0.4 |
| **Other** | **315,707** | **100.0** | **0.5** |

Source: TUIK, 2017. [13].

The Enterprise size according to number of bovine, sheep and goats in Turkey is given in Table 2. It is seen in Table 2 that the enterprises having 1-9 head bovine animals is 81% of the bovine enterprises and the enterprises ratio having 10-50 head sheep and goat has the highest ratio among the enterprise size according to number of sheep and goats. This shows that the average size of livestock enterprise is very small in Turkey. The fact that the livestock enterprises are very small results in low productivity and prevents establishment of mechanization and automation in production and causes costly production and low marketability; and also makes the production

fragile against economic fluctuations. As farm sizes increase and as extensive livestock production becomes more intensive, old farm buildings may be abandoned (or used for other purposes) and are replaced by new buildings. These new buildings may incorporate new technologies including one or more of the following: mechanized feeding, mechanized manure handling, automatic ventilation control, and heating/cooling systems using autonomous or conventional energy supplies [10].

Table 2. The Enterprise size according to number of bovine, sheep and goats in Turkey

| Enterprise size according to number of bovine animals (head) | Ratio of enterprise having bovine animals to total enterprise | Ratio of animals in enterprises to total Bovine animals | Enterprise size according to number of sheep and goats (head) | Ratio of enterprise having sheep and goats to total enterprise | Ratio of animals in enterprises to total sheep and goats |
|---|---|---|---|---|---|
| 1-4 | 59.7 | 21.6 | 1-4 | 18.6 | 1.0 |
| 5-9 | 21.3 | 21.3 | 5-9 | 10.8 | 1.6 |
| 10-19 | 12.8 | 25.4 | 10-19 | 17.2 | 4.9 |
| 20-49 | 5.4 | 22.9 | 20-49 | 25.3 | 16.8 |
| 50-149 | 0.7 | 7.0 | 50-149 | 21.1 | 36.1 |
| 150-299 | 0.0 | 1.2 | 150-299 | 5.6 | 24.1 |
| 300 + | 0.0 | 0.6 | 300 + | 1.5 | 15.6 |
| **Total** | **100.0** | **100.0** | **Total** | **100.0** | **100.0** |

Source: TUIK, 2017. [13]

## Mechanization status in livestock enterprises

Livestock mechanization has involved using of equipment by engine-driven equipment instead of human energy. These equipment are driven by tractors or they are self-propelled equipment. The number of machine used in livestock enterprises and the number of machine per enterprise is given in Table 3. In Turkey, unlike agriculture, the studies relating to adoption and impact of technologies in animal husbandry are limited and sporadic. As looking at Table 3, it is seen that the number of tractor and the number of tractor per livestock enterprise were 1,273,531 and 0.59, respectively in Turkey. The number of agricultural trailers per enterprises was the highest and mobile milking machine followed this machine. The number of tractor and agricultural trailers per livestock enterprise is higher than other machines used in livestock husbandry. This situation result from intensive use of those machines in field crop production as well as animal production. In Turkey, the mixed livestock enterprises including both crop and livestock production is included the 62.3% of agricultural enterprises. Therefore, some of agricultural machineries such as tractor, trailer, leveling blade can be used in both livestock and crop production. The most of enterprises does not have the equipment necessary for barn cleaning, watering, feeding and milking.

There have been the previous studies on the determination of the mechanization structure of livestock enterprises in different regions of Turkey. Elmaz et al [6] assessed the status of dairy cattle farming in Burdur province, an important region for milk production in Turkey. They determined that Milking was performed using portable milking machines in most enterprises (93%) and manure was hand-cleaned in 72.8% of the barns, and cleaned with a tractor scraper in 27.2%. They reported that the farms are smaller than in developed countries although larger than the mean size in Turkey. This situation significantly affects the development of mechanization in livestock husbandry. Bakir [2] determined the structure, barns properties, ventilation, lighting, drinking, feeding, dung cleaning facilities and the effect of barns on the cattle in Van province In the result of the study, it was found that a hand-milking rate was 90.9%. Also, VGTHM [14] reported that using of milking machine is very low in Van region. This shows that there are great differences among regions with regard to the development of livestock mechanization in Turkey. Güzel and Aybek [8] evaluated the structural and mechanization features of Kahramanmaraş dairy farms. They determined that the number of tractors and agricultural machinery in livestock enterprises increased as the size of the farm increased. The authors found that the number of tractor and machine per livestock enterprise were 0.76 tractor/enterprise and 8.59 machine/ enterprise, respectively. They stated that the most and the least labor used in enterprises were in barn cleaning (3 labors) and in watering (1 labor),

respectively, and both feeding and milking tasks sustained two labor for each. Kırmacı and Pınar [9] reported that the mechanization level of cattle breeding were not enough level in Samsun Region. Selli et al. [12] reported that one of the main problems of the animal husbandry sector in GAP Region of Turkey is that the enterprises are very small and fragmented. They stated that approximately 80% of more than 3 million rural enterprises in Turkey have 1-4 animals and 85% of the active cattle breeding enterprises have less than 10 animals and the same situation is also valid for the sheep breeding enterprises. Such a situation is one of the main reasons of low productivity and prevents establishment of organization in production and causes costly production and low marketability; and also makes the production fragile against economic fluctuations. Boyar and Yumak [3] determined the level of mechanization of feed and forage production, using of mechanization equipment and its problems in Isparta and Burdur provinces. They reported that 60.4 % of dairy cattle farmers were the owners of fodder mechanization equipment. Especially baler and silage machine have been used by rent. Several types of mowers were used for forage harvest, but generally two-drum type mower was preferred. The using of silage in these provinces was found to be higher than that of average of Turkey. Feed mills have been used by 66 % of all dairy cattle farmers.

In Turkey, although livestock mechanization problems may vary according to regions, the main problems can be defined as follows:

-The fact that the livestock enterprises are very small results in low productivity and prevents development of mechanization.

-Most of the farms have no specific designed farm building with specific space per animal, feeding alley, manger, gutter and drainage system, ventilation system.

-Lack of knowledge on effective usage and maintenance of machineries used in livestock farms.

The analysis of the current livestock production in Turkey shows that the development of livestock production can be achieved only at using effectively new technologies. Innovations allow producers to realize fully the genetic potential of animal, use rationally fodder, energy, financial and human resources and fixed assets as well as to produce high quality and environmentally safe products. Also, using of new technologies in livestock production will result in positive effect on social life of rural area, including the decrease in the use of hard dairymaid labour and increasing prestige of workers, who are involved in high-technology operations on the farm.

Table 3. The machine types used in livestock enterprises, number of machine, number of machines per enterprise in Turkey

| Machine Type | The number of machines (number) | The number of machines per enterprise (machine/enterprise) |
|---|---|---|
| Tractor | 1,273,531 | 0.5931 |
| Hay rake | 1,151.69 | 0.0536 |
| Farmyard Manure Spreaders | 4,382 | 0.0020 |
| Reaper | 5,723.4 | 0.0267 |
| Reaper-Binder | 9,305 | 0.0043 |
| Baler | 2,152.0 | 0.0100 |
| Mower | 8,450.0 | 0.0395 |
| Hay Silage Machine | 5,227 | 0.0024 |
| Corn Silage Machine | 2,634.7 | 0.0123 |
| Feed Processing Machine | 2,897.9 | 0.0135 |
| Hatching Machine | 1,285 | 0.0006 |
| Brooder | 1,005 | 0.0005 |
| Milking Plant | 10,057 | 0.0047 |
| Mobile Milking Machine | 30,179.5 | 0.1406 |
| Agricultural Trailers | 11,377.09 | 0.5299 |
| Tractor Drawn Water Tanker | 2,106.97 | 0.0981 |
| Straw Machine | 1,797.8 | 0.0084 |
| Straw conveyor and unloader | 1,562.1 | 0.0073 |
| Feed spreading trailer | 3,356 | 0.0016 |
| Loader used on farm | 5,030.4 | 0.0234 |
| Leveling Blade | 1,887.3 | 0.0088 |
| Cream separator | 17,726.8 | 0.0826 |
| Churner | 2,492.97 | 0.1161 |

Source: TUIK, 2017. [13].

## CONCLUSIONS

Mechanization is the use of mechanical and electronic equipment to reduce the need for human labor. It has been used for carrying out various farm operations like feed preparation, feeding, milking, barn cleaning, animal cooling, environmentally controlled housing etc in the livestock farms and grazing lands. Positive points of mechanization save time, requires less labor, improves product quality,

increases production, efficiency, accuracy and safety. Negative points include high installation and repair costs; hence it is more suitable for commercial and institutional farms.

In the result of this study, it was seen that that average size of livestock enterprise was very small in Turkey. The fact that the livestock enterprises were very small resulted in low productivity and prevents establishment of mechanization and automation in production and causes costly production and low marketability.

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