Economic analysis of buffalo breeding in Turkey

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Mevlüt Gül
PhD in Agriculture Economics
Institution: Isparta University of Applied Sciences
Address: Faculty of Agricultural Sciences and Technology, Department of Agricultural Economics, Isparta University of Applied Sciences, 32260, Isparta, Turkey.
E-mail: **mevlutgul@isparta.edu.tr**

Metin Göksel Akpinar
PhD in Agriculture Economics
Institution: Akdeniz University
Address: Faculty of Agriculture, Department of Agricultural Economics, Akdeniz University, Antalya, Turkey.
E-mail: **mgoksel@akdeniz.edu.tr**

Yavuz Tascioğlu
PhD in Agriculture Economics
Institution: Akdeniz University
Address: Faculty of Agriculture, Department of Agricultural Economics, Akdeniz University, Antalya, Turkey.
E-mail: **ytascioglu@akdeniz.edu.tr**

Bahri Karli
PhD in Agriculture Economics
Institution: Isparta University of Applied Sciences
Address: Faculty of Agricultural Sciences and Technology, Department of Agricultural Economics, Isparta University of Applied Sciences, 32260, Isparta, Turkey.
E-mail: **bahrikarli@isparta.edu.tr**

Yalçın Bozkurt
PhD in Animal Science
Institution: Isparta University of Applied Sciences
Address: Faculty of Agricultural Sciences and Technology, Department of Animal Science, Isparta University of Applied Sciences, 32260, Isparta, Turkey.
E-mail: **yalcinbozkurt@isparta.edu.tr**

Abstract

In this study, we analysed the economic dynamics of buffalo farming regions in Turkey. Samsun, Istanbul, Diyarbakir, Muş, Tokat, Afyonkarahisar and Bitlis – which contain more than half of all buffalo in the country and produce more than 50% of all the milk - were included in the scope of the study. The 462 farmers selected for interview were chosen by the stratified random sampling method. The data collection method was face-to-face interviews with the farmers using a questionnaire during the 2014 production season. The characteristics of the buffalo farmer, the capital structure, production costs of the buffalo activity, gross

production value, gross profit, absolute profit, relative profit and some financial ratios were calculated in the analyses. Buffalo farming is a profitable production activity, but profitability differs depending on the operating scale. Buffalo breeding generally involves an extensive production system. Buffalo breeding can be improved by further work towards the betterment of the native buffalo breed, new market opportunities, effective cooperation with producer organisations and enhancing the farmer's financial knowledge. However, it can be suggested that the activity will continue in regions close to the city centres that have the appropriate ecosystems.

Keywords: Buffalo, Profit, Cost, Turkey

1. Introduction

Buffalo farming is common in about 34 countries around the world. Buffalo numbers, which were 97.3 million in the period 1961-1970, doubled in 2014 to reach 195.1 million. In 2014, India was the largest buffalo-breeding nation (56.38%), followed by Pakistan (17.73%) and China (12.19%). Historically, buffalo farming has increased significantly in the world especially in the countries where breeding has been intensified. On the other hand, buffalo numbers in Turkey decreased by about 90% in the 1980s and were down to 121,826 by 2014. In that year, buffalo numbers in Turkey constituted 0.06% of world buffalo breeding.

When the changes in the numbers of Turkish buffalo were evaluated, it was observed that the average number of buffalo decreased by 25,425 per year in the 31-year period covered. As a result, buffalo numbers that were about 1.3 million at the beginning decreased to 121,800 by the end of the period. In the period 1980-1990, buffalo numbers decreased by 64%. Between 1990 and 2010, although the decrease in the numbers of buffalo continued, the decline slowed compared to the earlier period with buffalo numbers decreasing by 77%.

Turkish buffalos are descended from the Mediterranean Buffalo, a subgroup of river buffalo, and are known as Anatolian buffalo (Soysal et al., 2005).

In Turkey, buffalo breeding is intensive in Samsun, Istanbul, Diyarbakır, Tokat, Afyonkarahisar, Muş and Bitlis. As of 2015, the most prominent breeding province was Samsun with a rate of 12.7%. Istanbul and Diyarbakir followed this with 8.6%, Tokat with 6.6%, Bitlis with 5.7%, Mus with 4.6% and Afyonkarahisar with 3.9%.

Turkish buffalo milk production decreased by 8034 tons per year on average in the period 1980-2011. The production of buffalo milk, which was approximately 274000 tons at the beginning of the period, decreased to 51900 tons by the end. The amount of buffalo milk

produced has been steadily decreasing since 1980 as a result of the decrease in buffalo numbers. If the trend continues, milk production in Turkey will come to an end in a few years.

In Turkey, the value of agricultural production had reached TRY 248.4 billion by 2015. Approximately 52% of total agricultural production value consists of animal production. Agricultural policies pursued by Turkey before 2000 aimed to raise crop production and improve quality. Also, some incentive and development measures such as the production of feed crops and milk incentives for livestock were also introduced. After this period, it can be said that support was reduced to more practical measures. Also, support for the livestock sector has become more and more concentrated on the lower branches of animal husbandry.

In the last thirty years, there have been significant technical and structural changes in animal breeding in Turkey. In particular, domestic breeds, feeding, aquaculture systems and producer consciousness have changed drastically.

Livestock husbandry includes cattle, buffalo and camels. Turkey differs from the rest of the world regarding the production value of buffalo, which has decreased in recent years.

The economic studies related to the subject are insufficient in Turkey. As a result, we aimed to reveal the economic structure of buffalo farming, which has decreased considerably over the years.

Buffalo breeding in Turkey has accelerated in the opposite direction to the rest of the world. The sector showed substantial reductions in Turkey, especially in the 1980s. However, in recent years these developments have been recognised, and efforts have been made to improve the sector. In Turkey, the existence of buffalo in the provinces of Samsun, Istanbul, Diyarbakir, Tokat, Afyonkarahisar, Muş and Bitlis declined significantly from 1991 to 2008.

There is limited work in the literature looking into the economic aspects of the buffalo farmers in Turkey. One of such previous research, the study by Yilmaz et al. (2012) identified the reasons for the recent decline in buffalo population in Turkey.

However, there is no significant research on the assets and structure of the buffalo farming and its contribution to the farmer's status in the study area. Therefore, this study is of high importance in that it is the first research to examine the economic and financial structure of the farms engaged in buffalo breeding.

2. Literature Review

The primary objective of animal production is to increase production per unit, decrease production costs, to obtain quality products and to ensure competitiveness in the market. Agricultural farms need to be examined from an economic standpoint, providing useful data regarding business owners and stakeholders. Therefore, it is essential to examine the economic structures of buffalo farms both regarding farmers and regarding the sector and accordingly to reveal capital structures.

Studies on the economic analysis of buffaloes have been done mostly in Asian countries because the number of buffaloes is more in this continent. From these studies; Saha and Gupta (2000) determined the economics of milk production of a crossbred cow, local cow and buffalo farms in Murshidabad district of West Bengal. Kumar and Pandian (2003) and Hemalatha et al. (2003) studied the milk production from Tamil Nadu and Maharashtra state, respectively. Inderpreet et al. (2011) determined the economic analysis of milk production in the buffalo and cow farms of Punjab in India.

Basavarajappa and Chinnappa (2013) calculated the milk production cost, in case of local cows, crossbred cows and buffaloes in Karnataka state in India. Aujla and Hussain (2015) compared the production costs and returns of farms from significant dairy buffalo breeds (Nili-Ravi and Kundhi) in Pakistan. Devakate (2016) analysed the farms' economics structure of local cows, crossbred cows and buffaloes in Kankavali, Kudal and Vaibhavadi talukas of Sindhudurg district in India. Jadav et al. (2016) analysed the economics of cow and buffalo milk production in Junagadh district of Gujarat in India. They determined the production cost, return and input-output ratio for indigenous buffalo, Jafarabadi buffalo, indigenous cow and Gir cow.

Hasan et al. (2016) analysed the socio-economic structure of water buffalo farms at Bhola district in Bangladesh. They found that small-scale dairy buffaloes were highly profitable at coastal belt areas in Bhola district. Islam et al. (2017) determined the socio-economic profile and calculated the income and cost of buffalo farm in Bangladesh. Studies involving the economic analysis of water buffalo breeding in Turkey is limited. For example; Günlü et al. (2010) examined the cost and capital structure of buffalo breeding in the Afyonkarahisar province. They determined the financial and economic profitability of farms be negative. Işık and Gül (2016) calculated the cost and profitability of buffalo farming in Mus Province. They found that the relative profit was higher than one.

3. Material and Methods

The provinces of Samsun, Istanbul, Diyarbakir, Muş, Tokat, Afyonkarahisar and Bitlis were included in the scope of the study. These regions represent more than half of Turkey's buffalo numbers (50.67%) and milk production (54.16%).

The number of farmers chosen to be interviewed was calculated as 462 by the stratified random sampling method (Cicek and Erkan, 1996). A five percent deviation rate and a 95% confidence interval were used in the calculation of the sample size.

Table 1: Distribution of interviewed farmers by buffalo numbers

Buffaloe's number (head)	Groups of buffalo farmers	N	%
1-5	I	79	17.10
6-15	II	126	27.27
16-35	III	100	21.65
36-+	IV	157	33.98
	Total	462	100.00

Using the specially designed questionnaires, the researchers personally interviewed with 106 farmers in Samsun (in the villages of Doğanca, Sarıköy, Yakintaş, Taşköprü, Habilli, Gökçeboğaz, Doyran and Gölyazı in Bafra, Alaçam and Terme); 69 farmers in Istanbul province (in the villages of Baklalı, Nakkas, Tayakadın, Yeniköy, Gümüşpınar, Orcunlu, Ağaçlı, Akpınar, Işıklar, Pirinçi, Çiftalan in Arnavutköy, Çatalca, Eyüp); 56 farmers in Diyarbakır (in the villages of Yenişehir, Güzelköy and Tanışık); 54 farmers in Muş (in the districts of Hasköy, Merkez, Korkut and Sazlıkbaşı); 60 farmers in Tokat (in the villages of Tatlıcak, Satroba, Çiftlik, Gürçeşme, Çevresu, Tosunlar in Turhal, Pazar, Niksar and Erbaa); 63 farmers in Afyonkarahisar (in the villages of Küçükçobanlı, Akçın, Kadıköy, Eber, Çayıryazı); 54 farmers in Bitlis (in the villages of Değirmenköy, Gölbaşı, Güzelli, Özkavak in Güroymak). The research data were obtained from face-to-face interviews with the farmers through the use of a questionnaire asking questions about the 2014 production season. The characteristics of the farmer, assets structure, production costs of the buffalo activity, gross production value (GPV), gross profit, absolute profit and relative profit indicators were calculated. The calculation of the family labour wage rate was based on daily remuneration given to male and female workers in the research region. About 3% of total variable costs were considered as general administrative expenses. The interest on the revolving fund was a

variable expense and reflects the opportunity cost of the capital invested in the production activity. Interest on the revolving fund was calculated by applying half the interest rate Ziraat Bank charged on agricultural loans.

Whatever the area of the economy, capital refers to the sum of the monetary values of the assets allocated to the business to generate earnings (Isikli et al., 1994). In agriculture, capital can be divided into two separate groups. The first group (farmland capital) being capital that comes to the entity completely or fundamentally without human influence. The second group (working capital) is created with the influence of physical and mental human activity (Acil, 1980).

The land capital consists of the sum of the assets of the owned land, rented land and shared land (Acil and Demirci, 1984). Building capital provides housing for the people and products of farms and live and inanimate fixtures. The sum of the values of all kinds of buildings, the farm courtyards and the roads constitute the building capital (Acil, 1980). The equilibrium of machinery and equipment capital in the agricultural sector leads to the acceleration of work, savings in the labour force, increased productivity and cost-reductions (Inan, 2006). Machine tools removed from the inventory are those that have been used for more than a year and are therefore subject to depreciation (Aras, 1988). Animal capital covers all live animals in agricultural holdings. Animal stock (live inventory) is generally required for the economic activities of the farm. The existence of live inventory gives a specific characteristic to the farms (Acil, 1980). In the calculation of the capital elements, the numbers provided by the farmers and the market values were used.

The GPV included the income from the sale of dairy products and crops, productive value increases, the government supports and the cost of fertilisers (Erkus et al., 1995). Productive value increases were calculated by subtracting the opening balance from the closing balance (Kiral et al., 1999; Rehber and Tipi, 2016).

The gross production income included GPV and out-of-farm agricultural income (Erkus et al., 1995).

The capital turnover ratio was calculated by dividing the gross production income into the total assets (Cetin, 2008). The current ratio was found by dividing the current assets by current liabilities. This ratio shows us the farm's ability to meet or cover its current liabilities using its current assets (Cetin, 2008; Rehber and Tipi, 2016). The total debt-to-assets ratio was calculated by dividing the total liabilities into the total assets. The debt-to-equity ratio was total liabilities divided into equity (Cetin, 2008; Rehber and Tipi, 2016).

We used rate of return on assets and rate of return on equity to measure the profitability of farms. The rate of return on assets was calculated by dividing the farm's operating profit into whole farm's assets (Cetin, 2008). The rate of return on equity was estimated by dividing farm's net income into whole farm's equity (Cetin, 2008).

Gross profit is an important criterion that determines the competitiveness of the production activities and indicates the success of the business (Erkus et al., 1995). Gross profit was calculated by subtracting variable costs from the GPV. Gross profit was an asset that was comparable to the various production branches of the operator. Since fixed costs were not taken into consideration in gross profit calculation, more precise and consistent results can be achieved (Karagolge, 1996).

Relative profit was based on the ratio of GPV to production costs. The absolute profit was obtained by subtracting the total production costs from the GPV obtained as a result of animal production. This value allows the farms to determine their success themselves (Acil and Demirci, 1984; Kiral et al., 1999). Profit was the difference between income and expense. The primary purpose of the business is to make a profit and to seek ways to generate the highest profit. The difference between GPV and production cost is called absolute profit (Kiral et al., 1999).

The farmers were divided into four groups according to their number of buffalo. These were the first group of farms (1-5 head), the second group (6-15 head), the third group (16-35 head) and the fourth group (36 head and over). A total of 462 farmers were interviewed (Table 1), including 79 farmers from the first group, 126 from the second, 100 from the third and 157 farmers from the fourth group.

4. Findings

4.1. Various socio-demographic characteristics related to the businesses and farmers

The population, which is an indispensable element of socio-economic life, is used not only as a source of labour in all sectors but also in terms of the consumption of goods and services produced by the various sectors (Erkus et al., 1995).

The determination of the average population by age group and the distribution of income per business are essential in terms of distribution among the individuals who are in business. This indicator was also used to determine the working population and family labour force (Kiziloglu, 1994).

The age of the farmers, experience with breeding, level of education, and exposure to various mass media was important regarding business management. They were also important factors in the use of new techniques. Within this framework, variables related to such socio-demographic characteristics of farmers and farms were given in Table 2. In the first group of farms, the average age of the operators was 48.14 years. This criterion was 46.43 years in the second group, 45.34 years in the third and 45.63 years in the fourth group. This value was calculated as 46.21 years on average across the farms. Although there was no statistical difference between the farm groups and the ages of the managers, the operators in the third group were younger.

When examining the level of education of buffalo farmers, it was 6.14 years in the first group, 6.39 years in the second, 6.24 years in the third and 6.25 years in the fourth. The highest level of education was in the second group. The average education level of the farmers was 6.27 years.

When experience in the farming activity was examined, farmers in the first group were found to be more experienced with 30.22 years. Regarding experience in animal husbandry, the operators in the first group were more experienced than the other groups with 29.63 years.

The duration of experience in buffalo breeding was 24.61 years on average. The farmers in the third group were found to be more experienced than the others with 25.52 years (Table 2).

About 40.51% of the operators in the first group indicated that animal husbandry activities had increased, 36.71% said they had decreased and 22.78% said that they had remained the same over the past five years. 54.76% of the farms in the second group had increased their activities over the past five years, had 72% of those in the third group and 65.61% of the farms in the fourth group. 72.29% of those interviewed stated that buffalo production activity had increased, 10.82% said it had decreased and 16.88% said that it had remained the same over the past five years. There was a higher tendency to reduce buffalo breeding activity in small-scale farm groups.

In the agricultural sector, the participation of operators in training activities related to their activities was generally low, as this study reflects. In the farmers surveyed, 12.99% farmers declared their participation in educational activity related to animal breeding. 8.86% of the operators in the first group, 10.32% of those in the second group, 14% in the third group and 16.56% of the operators in the fourth group had participated in livestock training activities.

While 15.19% of the farmers in the first group were engaged in non-agricultural employment, 19.05% of those in the second group, 23% in the third group and 17.20% of the fourth group were also working in any non-agricultural sector. The average value was 18.61%. Some of the farmers interviewed also had non-agricultural activities.

26.75% of the farmers interviewed were retired, 11.62% were civil servants, 39.54% were artisans, 15.11% were workers, and 6.98% were in animal trading.

Changes in the job search conditions of non-agricultural workers among the farmers interviewed were also examined. 45.02% of the farmers stated that their job search had increased in the non-agricultural area, 50.00% said that it had not changed and 4.98% said their job search activities had decreased.

It was clear that the use of mass media (such as newspapers, television, radio and magazines) had a significant role in the transformation of rural communities, their modernisation and their becoming outward-looking societies (Sayili and Ekinci, 2012). As mass media reach almost all of society, innovation presented is heard by the vast majority of individuals. In this respect, there is a time-saving issue in the dissemination of information (Esengun and Sivaslıgil, 1993) as it is possible to deliver information to large numbers in less time, more efficiently and at less cost (Almus, 1999).

In the agricultural sector where the literacy rate is low compared to the city, and most people are primary school graduates, mass media such as the Internet, newspapers, magazines, brochures and newsletters can be widely utilised in the delivery of agricultural innovations to producers (Sayili and Ekinci, 2012). With this in mind, the exposure to mass media and use levels of the farms in the research area were examined. When the computer ownership status of the operators in the research area was analysed, the average was 30.74%. It was determined that computers were used in 18.99% of the first group of farms, 24.60% of the second group, 26.00% of the third group and 44.59% of the fourth group (Table 2).

The average level of internet use in the farms surveyed was 26.41%. Internet was available in 16.46% of the first group of buffalo breeding farms, 19.84% of the second group, 21% of the third group and 40.13% of the fourth group (Table 2).

Among operators engaged in buffalo breeding, 94.81% of managers have mobile phones. This rate was 91.14% in the first group, 97.62% in the second, 93% in the third and 95.54% in the fourth group (Table 2).

About 63.20% of the operators own a car. This ratio was found to be lowest in the first group of farms (46.84%) and highest in the fourth group (75.16%) (Table 2).

38.10% of the operators stated that they had a credit card. There were credit cards among 29.11% of the operators in the first group, 41.27% in the second group, 36% in the third group and 41.40% in the fourth group (Table 2).

The indebtedness of the farmers who have been engaged in buffalo farming for the past five years was also examined. 45.45% of the farmers stated that their debts had increased (Table 2), 47.84% had seen no change, and 6.71% stated that their debts had decreased.

The social security situation of the farmers engaged in buffalo farming was examined. 79.75% of the operators in the first group, 84.92% in the second group, 83% in the third group and 82.80% in the fourth group had social security. On average, this value was 82.90% (Table 2).

According to the research, 51.30% of the farmers were satisfied with their farming activity, 16.02% were very satisfied, 23.16% were found to be moderately satisfied, 8.66% less than satisfied and 0.87% satisfied at a minimal level.

The research showed that 0.65% of the farmers had very little knowledge of buffalo breeding, 3.68% had a low level, 19.91% had a medium level, 54.76% had a high level, and 21% had a very high level of knowledge.

It was found that 41.56% of farmers had a high level of knowledge regarding the marketing of buffalo products and 10.17% had a very high level. It was determined that 35.71% of buffalo farmers have a moderate level of knowledge of marketed products, 11.26% had little knowledge, and 1.30% had very little knowledge.

2.16% of the surveyed buffalo farmers were not planning to continue buffalo farming while between 5.84% and 6.71% were undecided. 45.24% of operators will definitely continue, and 40.04% will continue to breed buffalo. As a general trend, the farms intended to continue buffalo breeding (4.20 to 5 Likert scales) (Table 2).

Table 2: Some characteristics of farmer and farms

Indicators	Buffalo farmers groups				**Total**
	I	**II**	**III**	**IV**	
Farmers' age (years)	48.14	46.43	45.34	45.63	46.21
Education level of farmers (years)	6.14	6.39	6.24	6.25	6.27
Experience in farming activity (years)	30.22	29.74	29.74	28.54	29.41
Experience in animal husbandry (years)	29.63	29.24	29.11	26.93	28.49
Experience in buffaloes activity (years)	24.14	24.63	25.52	24.25	24.61
Education on animal husbandry (%)	8.86	10.32	14.00	16.56	12.99
Owners of computers (%)	18.99	24.60	26.00	44.59	30.74
Internet owner (%)	16.46	19.84	21.00	40.13	26.41

Mobile phone owner (%)	91.14	97.62	93.00	95.54	94.81
Car owner (%)	46.84	61.11	60.00	75.16	63.20
Credit card holder (%)	29.11	41.27	36.00	41.40	38.10
Debt increased in the last five years (%)	39.24	46.83	38.00	52.23	45.45
Having social security (%)	79.75	84.92	83.00	82.80	82.90
Total land (hectares)	8.53	12.96	8.72	19.55	13.53
Owned land (%)	73.52	63.88	56.40	62.77	63.33
Rent land (%)	20.84	32.97	34.49	30.60	30.71
Sharecropping land (%)	5.64	3.15	9.11	6.63	5.96
Irrigated land (%)	59.30	60.77	58.09	55.97	57.88
Satisfaction with livestock activity *	3.28	3.39	3.32	3.39	3.35
Level of interest in buffalo farming *	3.80	3.82	3.83	4.01	3.88
Satisfaction with buffalo activity *	3.72	3.72	3.69	3.76	3.73
Knowledge of buffalo breeding *	3.82	3.83	3.99	3.99	3.92
Level of knowledge in marketing buffalo products *	3.38	3.34	3.49	3.64	3.48
Tendency to continue buffalo farming **	4.18	4.22	4.11	4.26	4.20

* 1 Very little 2 Little 3 Medium 4 High 5 Very high
** 1 Absolutely no 2 No 3 Undecided 4 Yes 5 Definitely yes

On average, the interviewed farmers had 13.53 hectares of land in total. The first group had 8.53 hectares, the second group 12.96 hectares, the third group 8.72 hectares and the fourth 19.55 hectares. 63.33% of the land was owned, 30.71% was rented, and 5.96% was sharecropped. The owned land ratio was the highest in the first group of farms. The ratios of rented land and sharecropped land were higher in the third group of farms (Table 2). The farmland was used for forage crops, as fields and for fruit and vegetable growing. 13.2% of the interviewed buffalo growers did not produce crops.

4.2. Population structure in the farms

The average household size was 8.04 persons in the examined farms. When the population structure of buffalo farms was examined, the female population between 0-6 years was the highest in the second group with 7.42% and the male population was the largest in the first group. The female and male populations aged 7-14 years were 11.16% and 11.30%, respectively in the third group of farms. The female population aged 15-49 was 27.02% in the fourth group, and the male population was 26.88% in the second group. When the female and male populations over 50 years of age were examined, the female population was 8.93%, and the male population was 9.73%. The total female population was higher in the fourth group with 50.30%, while the total male population was the largest in the third group with 52.54% (Table 3).

Table 3: Population structure of enterprises

Age groups by gender	Buffalo farmers groups				Total
	I	II	III	IV	
	Percentage (%)				
0-6	12.0	13.3	11.0	13.5	12.7
7-14	19.8	18.4	22.5	19.5	19.7
15-49	49.6	52.1	50.0	52.4	51.5
50 years and over	18.6	16.2	16.5	14.6	16.2
Female	47.5	49.6	47.5	50.3	49.1
Male	52.5	50.4	52.5	49.7	50.9
Households size (person)	7.94	8.44	7.08	8.37	8.04

Education in the agricultural sector was lower than in other sectors. In this study, it was found that those in the farms had a predominantly primary education (47.99%). The women were less educated than the men. More women were illiterate than men. The number of non-illiterate women was found to be higher in the first group of farms.

According to the results of the research, some of the farmers also earned income from agricultural activities outside the buffalo operation. This income in the first group of farms was US$502.75, while non-agricultural income was US$2,541.48. Agricultural income outside buffalo operations in the second group was US$183.64, in the third group US$177.00 and in the fourth group it was US$237.03. Non-agricultural income was US$1511.91 for the second group, US$2004.33 for the third group and US$2572.56 for the fourth group. On average, agricultural income outside buffalo operations was calculated as US$254.91 and non-agricultural income as US$2154.98 per year.

4.3. Borrowing habits in the farms

47.84% of operators in the buffalo farm groups had not used loans in the past five years. More than half had used loans and also said that their loans had increased. About 5.06% of the operators in the first group, 3.17% in the second group, 2.00% in the third group and 2.55% in the fourth group were less likely to use loans. On the other hand, 24.05% of the operators in the first group, 19.05% in the second group, 28% in the third group and 39.49% in the fourth group had increased their use of loans. Public lenders were the dominant providers of loans, but the use of loans in buffalo breeding was low.

4.4. Capital Structure of Total Farms

Active capital or total farm assets refers to all capital elements invested in the business. On average, the total farm assets of the groups were calculated as US$563293.16. Farm assets were US$386710.14 in the first group of farms, US$465176.37 in the second, US$387489.91 in the third and US$842867.03 in the fourth group (Table 4). The share represented by farmland capital in total farm assets was calculated as 77.44% or US$436,210.70 (Table 4).

The total land capital of the farms was calculated as US$342,795.44 representing 60.86% (Table 4).

Building capital was calculated as US$45323.17 in the first group, US$50438.59 in the second, US$56708.82 in the third and US$110088.34 in the fourth group. When the share of building capital in total farm assets was examined, it was 11.72% in the first group, 10.84% in the second, 14.63% in the third and 13.06% in the fourth group (Table 4). The operating (working) capital was a very important capital element to activate the farmland capital (Cetin, 2008). It consists of the sum of the animal capital, machinery and equipment capital, stock capital, and cash. Operating capital was calculated as US$47921.61 in the first group, US$64704.76 in the second, US$104074.34 in the third and US$231630.93 in the fourth group. Total operating capital amounted to US$127082.46. The share of operating capital in total farm assets was determined as 12.39% in the first group, 13.91% in the second, 26.86% in the third and 27.48% in the fourth group (Table 4).

The whole machinery and equipment capital in the farms amounted to US$26,886.12. This amount was calculated as US$14573.47 in the first group of farms, US$15662.43 in the second group, US$25113.80 in the third group and US$43,218.06 in the fourth group. The ratio of machinery and equipment capital to total farm assets was found to be 3.77% in the first group, 3.37% in the second, 6.48% in the third and 5.13% in the fourth group (Table 4). The average value of animal capital was calculated as US$78948.93, and its share in total farm assets was 14.02%. In the first group farms, the animal capital amounted to US$20294.40, the second group farms were calculated as US$36476.99, the third group farms were US$60106.10, and the fourth group farms were calculated as US$154550.55. The share of this capital element in the total assets was 5.25%, 7.84%, 15.51% and 18.34% in the groups, respectively (Table 4). Stock capital includes the value of seeds, fertilisers, feed, and products to be produced in the farm as well as chemical fertilisers, feed, fuel and medicines

purchased from outside the operation (Saner, 1993). The total stock capital was calculated as US$15624.67, and the average share in the total farm assets was 2.77% in the groups (Table 4). Variable amounts of cash and equivalents asset were needed depending on the size of the farms, the nature of the activity and the structure of the farm to enable it to operate and succeed in these activities (Bulbul, 1973). The cash and equivalents asset, which was included in the farm assets capital account of the money-holding farms and was present in the bank's assets, consists of time and demand deposit accounts, receivables, participation shares, insurance policies and bonuses in the bank (Acil and Demirci, 1984). The total cash and equivalents asset in the research area amounted to US$5622.75. The share of cash and equivalents asset in total farm asset was 1.00% (Table 4).

Total liabilities (foreign capital) in the research area was calculated as US$106345.73, and the equity was US$456947.43. The share of total liabilities in total farm assets amounted to 18.88% while the share of own capital was 81.12% (Table 4).

Table 4: Capital in the farms

Capital elements	Buffalo farmers groups				Total
	I	II	III	IV	
	Amount (US$ per farm)				
Land capital	284687.06	336325.12	196788.98	470225.17	342795.44
Building capital	45323.17	50438.59	56708.82	110088.34	71191.65
Land reclamation capital	1217.40	5567.14	16654.78	10091.87	8760.90
Plant capital	7560.91	8140.75	13262.99	20830.73	13462.70
Farmland capital (A)	*338788.53*	*400471.61*	*283415.57*	*611236.10*	*436210.70*
Breeding livestock capital	20294.40	36476.99	60106.10	154550.55	78948.93
Machinery and equipment capital	14573.47	15662.43	25113.80	43218.06	26886.12
Stock capital	10154.08	8922.27	15326.86	23946.07	15624.67
Cash and equivalents asset	2899.66	3643.08	3527.57	9916.25	5622.75
Operating (working) capital (B)	*47921.61*	*64704.76*	*104074.34*	*231630.93*	*127082.46*
Total farm assets(Active capital) (A + B)	**386710.14**	**465176.37**	**387489.91**	**842867.03**	**563293.16**
Farm liabilities (C)	62608.01	106410.53	76907.60	147052.29	106345.73
Equity (D) *	324102.13	358765.85	310582.31	695814.75	456947.43
Total Farm liabilities and **Equity (C + D)***	**386710.14**	**465176.37**	**387489.91**	**842867.03**	**563293.16**
			Ratio (%)		
Land capital	73.62	72.30	50.79	55.79	60.86
Building capital	11.72	10.84	14.63	13.06	12.64
Land reclamation capital	0.31	1.20	4.30	1.20	1.56
Plant capital	1.96	1.75	3.42	2.47	2.39
Farmland capital (A)	*87.61*	*86.09*	*73.14*	*72.52*	*77.44*
Breeding livestock capital	5.25	7.84	15.51	18.34	14.02
Machinery and equipment capital	3.77	3.37	6.48	5.13	4.77
Stock capital	2.63	1.92	3.96	2.84	2.77
Cash and equivalents asset	0.75	0.78	0.91	1.18	1.00
Operating (working) capital (B)	*12.39*	*13.91*	*26.86*	*27.48*	*22.56*
Total farm assets(Active capital) (A + B)	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**
Farm liabilities (C)	16.19	22.88	19.85	17.45	18.88
Equity (D) *	83.81	77.12	80.15	82.55	81.12
Total Farm liabilities and **Equity (C + D)***	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**

The capital turnover ratio was calculated as 0.16 on average. In the first group of farms, the capital turnover ratio was 0.11, while it was 0.13 in the second group, 0.17 in the third group and 0.19 in the fourth group.

The debt-to-assets ratio was found to be 0.19 on average. This ratio was calculated as 0.16 in the first group, 0.23 in the second group, 0.20 in the third group and 0.17 in the fourth group.

The mean debt-to-equity ratio was calculated as 0.23. This ratio was 0.19 in the first group, 0.30 in the second group, 0.25 in the third group and 0.21 in the fourth group.

The current ratio was calculated as 1.17 on average. For the first group, it was found to be 1.19, 0.84 in the second group, 1.16 in the third group and 1.33 in the fourth group.

The rate of return on assets was 4.56% on average. For the first group, it was 0.94%, 2.01% in the second group, 2.29% in the third group and 7.19% in the fourth group.

The mean rate of return on equity was calculated as 3.62% for all farms. For the first group, it was found to be -0.60%, 0.25% in the second group, 1.92% in the third group and 6.49% in the fourth group.

4.5. Distribution of GPV by production activity

The sum of the values of plant and animal products produced by the farms in a production period and the productive increase in the value of the products that occur during the year constitute the total GPV of the farm (Erkus et al., 1995).

The GPV, one of the economic consequences of agricultural activity, can be defined as gross profit created by one of the operations or business activities (Inan, 2006).

The total GPV obtained in the farms surveyed was calculated as US$89593.18. The most important part of the GPV was buffalo production with 46.12%. This was followed by the GPV obtained from plant production with 38.30%. In the first group of farms, the share of GPV obtained from buffalo farming was 16.18%, while it was 23.85% in the second group, 39.11% in the third group and 58.74% in the fourth group (Table 5).

Table 5: GPV in enterprises

Production activities	Buffalo farmers groups				Total
	I	II	III	IV	
	Amount (US$ per farm)				
Other animal husbandry	7956.31	11464.18	16145.70	17610.47	13966.34
Buffaloes	6268.49	14309.50	25602.53	90636.16	41316.75
Crops	24512.88	34216.59	23722.54	46058.61	34310.09
Total gross production value	*38737.69*	*59990.26*	*65470.76*	*154305.24*	*89593.18*
	Ratio (%)				
Other animal husbandry	20.54	19.11	24.66	11.41	15.59
Buffaloes	16.18	23.85	39.11	58.74	46.12
Crops	63.28	57.04	36.23	29.85	38.30
Total gross production value	*100.00*	*100.00*	*100.00*	*100.00*	*100.00*

4.6. Cost elements for buffalo farming

In order to be able to create a production in whatever sector, various inputs and services need to be used. All of the expenditures made on them constitute production costs. Production costs include (i) establishing resource requirements for production activities, (ii) determining resource utilisation effectiveness, (iii) calculating unit product cost, (iv) establishing business-zone-country planning and (v) providing valuable information to policymakers. At this point, it was essential to determine the costs of production accurately. However, the calculation of production costs becomes very complicated, mainly since the agricultural farms were engaged in multi-production activities. It was, therefore, essential to elaborate on the production processes and to determine the quantities of fixed and variable input elements used in these processes. Production costs were categorised as fixed and variable cost elements in the period briefly described in the economic literature. In the long term, all elements were of a variable cost nature.

While the fixed costs of the buffalo production activities amounted to US$10850.22, the variable costs were calculated as US$13329.91. Production costs were US$24180.13. When the farm groups were examined, it was found that the important cost items in first and second group farms were ranked as fixed costs and variable costs, while in the third and fourth groups they were variable and fixed costs.

The calculations were made taking into account the different cost elements in the activities of the buffalo farms such as feed, veterinary-drug, salt-litter, lighting, water-cleaning, tool-machine rent, instrument-machine repair-maintenance, fuel, temporary workers, marketing and other expenses.

The other components of the production cost elements were the fixed costs. Fixed costs are unchanged costs, regardless of production volume. Fixed costs in buffalo farming: General administrative expenses, permanent worker-family labour, depreciation, interest payments on fixed capital elements and building repair and maintenance costs.

When the group average of the farms was taken into consideration, it was calculated that the feed costs were US$10,148.74, permanent worker-family labour was US$4,389.20, the fixed capital interest was US$2,934.14, and the depreciation was US$2,813.38. The cost elements increase in parallel with the size of the farms.

The proportional distribution of the production cost elements in the buffalo activity in the farms was given in Table 6. On average, the share of variable costs in production costs was 55.13% and of the fixed costs 44.87%. These ratios differ among the farm groups. In the first group farms, the share of fixed costs was 57.81% while the share of variable costs was 42.19%. In the second group of farms, 50.14% was fixed, and 49.86% was variable. The share of variable costs in the third and fourth group farms was 55.58% and 57.60%, respectively.

On average, the most important cost factor of farms was feed costs whose share in production costs was calculated as 41.97%. Another significant cost factor in production costs was permanent worker-family labour. The share of this cost in production costs amounted to 18.15%. The third important cost was fixed capital interest rate of 12.13%, and the fourth was depreciation with 11.64%. 14.67% concentrated feed, 11.75% roughage, 10.13% green fodder and 5.43% grain forage were the components of total feed costs.

In the first group of farms, the cost of permanent worker-family labour was the essential cost item of buffalo farming with 36.32% of the total production costs. Feed costs at 28.05% followed this. Other important cost elements were fixed capital rate (9.82%) and depreciation (8.26%). In the second group of farms, feed costs were the most important cost item and 35.10% of total production costs. Permanent worker-family labour followed this with a rate of 28.48%. Other important cost elements were fixed capital interest (9.35%) and depreciation (8.46%).

The share of feed costs in total production costs in the third group amounted to 41.70% and was the most important cost factor. Other significant cost elements were permanent worker-family labour (20.16%), fixed capital interest (10.70%) and depreciation (10.32%).

In the fourth group of farms, feed costs were the most important factor in total production costs. The share of feed costs in total production costs was calculated as 45.14%.

The second most important cost element was the fixed capital rate. The share of this factor in total production costs amounted to 13.46%. Permanent worker-family labour constituted 13.21% of total production costs in third place. Depreciation was in the fourth place with 13.13% (Table 6).

Table 6: Proportional distribution of production costs in buffalo's production activity in enterprises

Cost elements	Buffalo farmers groups				Total
	I	II	III	IV	
	Ratio (%)				
Concentrated feed	3.43	6.46	10.14	19.11	14.67
Roughage	10.12	12.48	10.27	12.14	11.75
Green fodder	7.59	12.27	12.38	9.22	10.13
Grain forage	6.91	3.89	8.91	4.67	5.43
Total feed	*28.05*	*35.10*	*41.70*	*45.14*	*41.97*
Veterinary and medicine	3.75	4.09	4.82	3.72	3.97
Salt, water and cleaning	2.07	1.76	1.30	0.94	1.20
Lighting	1.69	2.04	1.61	1.37	1.53
Pasture rent	0.06	0.03	0.00	0.00	0.01
Marketing	0.46	0.39	0.52	0.43	0.44
Machinery rental-fuel-repair maintenance	4.47	3.66	3.91	3.83	3.86
Temporary shepherd	1.23	2.42	1.51	1.25	1.47
Other cost	0.41	0.38	0.20	0.92	0.68
Variable cost	***42.19***	***49.86***	***55.58***	***57.60***	***55.13***
General administrative expenses	1.27	1.50	1.67	1.73	1.65
Permanent worker-family labour	36.32	28.48	20.16	13.21	18.15
Depreciation (Building-buffalo-equipment)	8.26	8.46	10.32	13.13	11.64
Fixed capital interest (buffaloes-building-machinery-debt)	9.82	9.35	10.70	13.46	12.13
Building repair	2.14	2.35	1.58	0.87	1.30
Fixed cost	***57.81***	***50.14***	***44.42***	***42.40***	***44.87***
Total production cost	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**

When the production costs per head of the farms were examined, the average feed cost was calculated as US$349.80 while veterinary services and medication amounted to US$33.09. Total variable costs were determined as US$459.45, fixed costs were calculated as US$373.98, and production costs were US$833.43. The fixed cost items consist of US$151.28 of permanent worker-family labour, US$101.13 of fixed capital rate and US$96.97 of depreciation (Table 7).

GPV obtained from buffalo production activity

Table 7: Production costs per buffaloes in enterprises

Cost elements	Buffalo farmers groups				Total
	I	II	III	IV	
	Amount (US$ per buffaloes)				
Concentrated feed	73.10	82.86	94.94	135.14	122.29
Roughage	215.70	160.00	96.12	85.87	97.89
Green fodder	161.68	157.30	115.88	65.16	84.40
Grain forage	147.29	49.92	83.45	33.04	45.21
Total feed	597.78	450.06	390.39	319.21	349.80
Veterinary and medicine	79.86	52.47	45.11	26.32	33.09
Salt, water and cleaning	44.21	22.60	12.20	6.63	9.97
Lighting	36.00	26.12	15.03	9.67	12.75
Pasture rent	1.34	0.36	0.00	0.00	0.07
Marketing	9.84	4.99	4.90	3.01	3.66
Machinery rental-fuel-repair maintenance	95.24	46.87	36.61	27.11	32.17
Temporary shepherd	26.13	31.02	14.11	8.80	12.23
Other cost	8.75	4.92	1.92	6.52	5.71
Variable cost	***899.14***	***639.40***	***520.27***	***407.29***	***459.45***
General administrative expenses	26.97	19.18	15.61	12.22	13.78
Permanent worker -family workforce	774.00	365.24	188.68	93.39	151.28
Depreciation (Building-buffalo-equipment)	175.97	108.43	96.61	92.86	96.97
Fixed capital interest (buffaloes-building-machinery-debt)	209.32	119.90	100.14	95.18	101.13
Building repair	45.61	30.15	14.79	6.16	10.81
Fixed cost	***1231.86***	***642.90***	***415.82***	***299.81***	***373.98***
Total production cost	**2131.01**	**1282.30**	**936.09**	**707.10**	**833.43**

4.7. Economic indicators for buffalo farming

The GPV obtained from the buffalo production activity in the farms was given in Table 8. The farm average was calculated as US$41,316.75. 80.36% of the GPV of the farms came from the sale of buffalo products, 10.40% were subsidies, 8.34% was a productive increase of the inventory and 0.90% was fertiliser income.

Table 8: GPV obtained from the operation of buffalo production in enterprises

Revenues	Buffalo farmers groups				Total
	I	II	III	IV	
	Amount (US$ per farm)				
Product revenue	4730.04	11109.60	20165.39	73562.78	33202.12
Amount of support	806.17	1843.70	3139.12	8755.72	4295.57
Productive inventory increase	651.01	1181.92	2043.60	7562.42	3445.92
Fertilizer income	81.27	174.27	254.43	755.24	373.15
Total	6268.49	14309.50	25602.53	90636.16	41316.75
	Ratio (%)				
Product revenue	75.46	77.64	78.76	81.16	80.36
Amount of support	12.86	12.88	12.26	9.66	10.40
Productive inventory increase	10.39	8.26	7.98	8.34	8.34
Fertilizer income	1.30	1.22	0.99	0.83	0.90
Total	100.00	100.00	100.00	100.00	100.00

In the first group, the rate of buffalo products was 75.46%. It was 77.64% in the second group, 78.76% in the third group and 81.16% in the fourth group. Support has a significant share in the added value created. This value ranged between 9.66% and 12.88% in the farm groups (Table 8).

The gross profit in the farms was determined as US$27,986.24, the absolute profit was US$17,136.61, and the relative profit was 1.71 (Table 9). According to this result, the farms earned US$171 income per US$100 spent on their buffalo breeding activities.

There was a direct relationship between the size of the buffalo herd and profitability in the farms. In small-scale farms, it was found that the profitability of buffalo farming was low and that most small farmers even lost money.

Table 9: Profitability indicators in buffalo production activity in enterprises

	Buffalo farmers groups				Total
	I	II	III	IV	
	Amount (USD $ per farm)				
Gross profit	2603.63	7585.65	14864.08	65490.65	27986.84
Absolute profit	-2417.39	825.04	6281.63	46980.72	17136.61
Relative profit	0.72	1.06	1.33	2.08	1.71

5. Discussion

The average age of farmers was 46.21 years. Although there was no statistical difference between the farm groups and the ages of managers, the third group owners were younger.

The average education level of the operators was 6.27 years, and the highest level of education was in the second group. The average experience of farmers in buffalo breeding was 24.61 years. Those in the third group were found to be more experienced than the others with 25.52 years. There was a greater tendency to reduce buffalo breeding activity in the small-scale groups.

In buffalo breeding, the participation of operators in training activities related to the industry was generally low (12.99%). As a general trend, farms intended to continue buffalo farming.

The average household size was 8.04 persons. The total female population was higher in the fourth group of farms with 50.30%, while the total male population was more significant in the third group with 52.54%.

Education levels in the agricultural sector are lower than in other sectors. It was also found that the households had a predominantly primary education (47.99%). Women were less educated compared to men.

The use of loans in buffalo breeding was low.

The most buffalo breeders inherited their businesses (75.54%). 113 farmers (24.46%) started buffalo farming activities by purchasing buffalo. 36.71% of the first group of farms, 32.54% of the second group, 16% of the third group and 17.20% of the fourth group began production activities by purchasing buffalo. More large-scale farms were inherited.

The 13.2% of the buffalo farmers interviewed had no land. About 6.3% were only generating income from buffalo farming, and 25.1% of them had no other livestock activity. Buffalo breeding is carried out in river beds, lakes, ponds, reeds or in areas close to these.

The share of farmland capital in total farm assets was calculated as 77.44%. The share of this capital element in total farm assets was higher than that of other animal husbandry activities. According to other studies of animal husbandry, the ratio of farm capital to total farm assets was calculated as follows: Saner (1993) 81.96%, Fidan (1996) 66.93%, Armagan (1999) 70.75%, Bayramoglu (2003) 75.85%, Nizam (2006) 80.31%, Tokmak (2009) 39.33%, Gozener (2013) 57.77% and Gurbuz (2015) 60.15%.

The total land capital rate was calculated as 60.86%. In similar studies related to the subject, the share of land capital in total farm assets was Saner (1993) 66.28%, Fidan (1996) 39.18%, Armagan (1999) 53.67%, Dagistan (2002) 31.85%, Bayramoglu (2003) 47.04%, Nizam (2006) 63.67%, Tokmak (2009) 6.68%, Yilmaz (2010) 59.05%, Gozener (2013) 21.99% and Gurbuz (2015) 46.54%. The share of building capital in total farm assets was Saner (1993) 11.10%, Fidan (1996) 21.40%, Armagan (1999) 13.14%, Dagistan (2002) 12.88%, Bayramoglu (2003) 25.72%, Nizam (2006) 10.50%, Tokmak (2009) 32.65%, Yilmaz (2010) 23.27%, Gozener (2013) 32.84% and Gurbuz (2015) 12.14%.

In various studies on animal husbandry, the share of machinery and equipment capital in total farm assets was Saner (1993) 7.36%, Fidan (1996) 12.60%, Armagan (1999) 7.34%, Sahin et al. (2001) 2.38%, Dagistan (2002) 9.44%, Bayramoglu (2003) 10.34%, Nizam (2006) 6.36%, Tokmak (2009) 16.86%, Yilmaz (2010) 5.85%, Gozener (2013) 5.02% and Gurbuz (2015) 5.51%. In this study, the share of machinery and equipment capital in total farm assets was determined as 4.77%, which was lower than the studies related to other livestock activities.

The share of animal capital in total farm assets was calculated as 14.02%. It was lower than other animal husbandry activities, which can be attributed to the low value of the buffalo unit. The share of animal capital in total farm assets of Saner (1993) was 10.09%, Fidan (1996) was 14.92%, Armagan (1999) was 20.79%, Sahin et al. (2001) was 51.05%, Dagistan (2002) was 26.65%, Bayramoglu (2003) was 12.88%, Nizam (2006) was 12.79%, Tokmak (2009) was 49.04%, Yilmaz (2010) was 10.15%, Gozener (2013) was 32.28% and Gurbuz (2015) was 30.37%.

The share of own capital was found to be 81.12%. In a study conducted by Gul (1998), the share of equity capital in total farm assets was found to be 94.2%. This ratio was determined as 85.56% in the study conducted by Sayili (2001) in the province of Amasya. The share of own capital in total farm assets was found as Saner (1993) 88.30%, Fidan (1996) 88.05%, Sahin et al. (2001) 98.21%, Dagistan (2002) 95.18%, Bayramoglu (2003) 87.32%, Nizam (2006) 77.34%, Tokmak (2009) 93.74%, Yilmaz (2010) 83.89%, Gozener (2013) 90.31% and Gurbuz (2015) 84.21%. Similar to the research on other animal husbandry activities, in this study, it was determined that the farms were working with more equity.

The mean total asset turnover ratio was calculated as 0.16. This ratio indicated that farms assets turnover was low. The total asset turnover ratio showed how much production value the farms generated from each dollar of the total farm assets. This ratio was higher in the farms breeding buffaloes only. Yilmaz et al. (2003) found that capital increase in dairy farming would lead to increased milk production.

The current ratio was calculated as 1.17 on farms average. Only in the second group of farms, this ratio was below 1, which indicated that this group had no sufficient current assets for the current liabilities.

The mean debt-to-assets ratio was calculated as 0.19, which was slightly low. This ratio showed that 18.88% of the farm's assets were financed with loans (both short-term and long-term). The assets of the farms were funded 5-to-1 by creditors. This means that the investors owned 81.12 cents of every dollar of farm's assets while creditors only own 18.88 cents of each dollar. This ratio was 22.88% in the second group, and this group was considered to be at more risk than were other groups.

The rate of return on assets was found as 4.56%. This means that, on average, every dollar that farms invested in the total assets during the 2014 year generated 4.56 cents in profit. This ratio was increasing compared to farm scale, and the rate of return on assets was 7.19% in the high scale of farms group. In the first group, this ratio was 0.94%.

The rate of return on equity measures a farmers' profitability by revealing how much profit a farm generates with the money farmers has invested. The farmers' rate of return on equity was calculated as 3.62%. This means that every 100 dollars of farmer's equity earned about $3.62 in the 2014 year. In other words, farmers got a 3.62 percent return on their investment. Farmer's ratio was most likely considered low compared to other industries. The rate of return on equity was increasing compared to farm scale. The rate of return on equity was 6.49% in the fourth group of farms. In the first group, this ratio was -0.60%. The fourth group of farmers got an 8.74 percent return on their investment while the first group of farmers received a -0.60 percent return. Dagistan (2002) found that the rate of return on equity was 4.81% and the rate of return on assets was 7.27% in sheep farms. In the study on dairy cattle in Adana carried out by Gul (1998), the profitability of the farms was found to be quite high. The rate of return on equity and rate of return on assets in these farms was 18.89% and 17.62% respectively.

The fixed costs were calculated as US$10850.22 and the variable costs as US$13329.91 in buffalo production. The total production costs were determined as US$24180.13. It was found that the most important cost items in first and second group farms were fixed costs, while in the third and fourth groups they were variable costs.

It was calculated that the feed costs were US$10148.74, permanent-family labour was US$4389.20, fixed capital interest was US$2934.14 and depreciation was US$2813.14. The cost elements increase in parallel with the size of the farms.

The share of variable costs in production costs was calculated as 55.13%, and the fixed costs amounted to 44.87%. These ratios differed among the farm's groups. In the first group farms, the share of fixed costs was 57.81% while the share of variable costs was 42.19%. Also, in the second group of farms, fixed costs were higher than variable costs. The share of variable costs in the third and fourth group farms was 55.58% and 57.60%, respectively. Isik and Gul (2016) found that 48.56% of the total production costs in buffalo farming in Mus province were variable costs and 51.44% were fixed costs.

On average, the most important cost factor of the farms was feed costs whose share in production costs was 41.97%. Another significant cost factor in production costs was permanent worker-family labour. The share of this cost in production costs was 18.15%. The third important cost was fixed capital interest rate of 12.13%, and the fourth was depreciation with 11.64%.

Isik and Gul (2016) found that the most critical cost elements in buffalo farming in Mus province were feed, permanent worker-family labour, interest and depreciation. Gunlu et al. (2010) calculated that 42.84% of the total expenditures of buffalo farms in Afyonkarahisar province were feed, 27.48% of them were labour, 2.98% veterinarians and drugs, 9.50% energy, 1.12% foreign capital interest, 3.49% cream pack, 3.24% repair-maintenance and 9.35% depreciation costs.

The variable costs amounted to US$459.45 per head, fixed costs were calculated as US$373.98, and production costs were US$833.43. Both the variable costs and the fixed costs per head decreased in parallel with the number of buffalo. Besides the fact that large farms purchase input elements at a lower price, it can also be said that economies of scale were an effective factor. In Muş province, it was estimated that the total production cost per buffalo was 2382.96 TRY, the variable cost was 1182.85 TRY, and the fixed cost was 1200.11 TRY in 2013 (Isik, 2015).

Buffalo breeding was defined by Rocha (2001) as low cost of production and high level of productivity. In this study, the share of feed costs in total production costs was calculated as 41.97%. Permanent worker-family labour was the second most important cost (18.15%). Especially in the Black Sea where there was more extensive breeding, only roughage was given in the East-South-East Anatolia regions except during cold winter conditions. The use of concentrated feed was very low. The feed costs were the most important cost item in total production costs (36.81%) in the study on buffalo breeding in Mus Province (Isik and Gul, 2016). Isik and Gul (2016) also found that the second most important cost item was a family-permanent worker (32.54%). Del Giudice (2004) reported that in buffalo farming in Italy, 72% of total production costs were for forage, 18% for labour, 5% for veterinary expenses and 5% for other costs. Gunlu et al. (2010) found that 42.84% of the total costs were for feed and 27.48% for labour in the study of buffalo breeding in Afyonkarahisar province. Bardhan et al. (2005) estimated that feed costs account for 60-70% of total costs in milk buffalo breeding. The share of feed cost in this study was found to be lower than in Del Giudice (2004) and Bardhan et al. (2005), close to that of Gunlu et al. (2010) and higher than in Isik and Gul (2016).

GPV in buffalo breeding was calculated as US$41316.75 with 80.36% from buffalo products, 10.40% from subsidies, 8.34% from a productive increase of the inventory and 0.90% from fertiliser income. At this point, it can be stated that the support policies applied to

buffalo farms after 2008 were significant. As a matter of fact, on average 10.40% of the value added created in the farms was provided to the producers by the state.

Isik (2015) reported that 56.40% of the GPV was provided by milk production, 37.30% by a productive increase of stocks, 4.03% by subsidies and 2.26% by fertiliser income.

Essential profitability indicators are absolute profit and relative profit. The absolute profit was determined as US$17136.61, and the relative profit was calculated as 1.71. According to this result, the farms were profitable, but these indicators were average scores. Some of the farmers had a negative profit. Isik and Gul (2016) calculated the relative profit as 1.44 among farmers who raised buffalo in Mus province while Gunlu et al. (2010) found that the relative profit was 0.92 among buffalo breeders in Afyonkarahisar province. Islam et al. (2017) calculated as 1.31 in Bangladesh and Aujla and Hussain (2015) found 1.4 for Nili-Ravi breeds and 1.3 for Kundhi breeds in dairy buffaloes farms in Pakistan.

Farmers lack knowledge of buffalo care and nutrition, buffalo diseases, calf breeding, feeding, efficiency enhancement methods, breeding projects, financial management, support, credit facilities, the working systems and functions of the producer association and marketing. Therefore, non-governmental organisations and public agricultural extension activities should be promoted in these areas.

6. Conclusion

It was concluded that buffalo farming is still considered to be a profitable production activity although the scale of operation varies in different organisations. This is mainly due to a decrease in supply and improvements in prices. Buffalo breeders in the regions have tended to maintain production as a traditional economic activity, often kept in their families for generations. The total asset turnover ratio indicated that farms assets turnover was low. This ratio was increasing compared to farm scale and also this rate was higher in the farms that had only buffaloes. The current ratio was considered critical. Only in the second group of farms, this ratio was below 1. The debt-to-assets ratio showed that creditors funded the farms at a rate of 5 to 1. The rate of return on equity and assets were increased compared to farm scale. Although it differs from area to area, it can be stated that buffalo farming generally involves extensive breeding. Furthermore, the characteristics and type of buffalo are also influential. Buffalo breeding can be improved by further work towards the betterment of the native

buffalo breed, new market opportunities, and effective cooperation with producer organisations. At this point, the current national water buffalo breeding program should be continued. New strategies for marketing buffalo products should be devised. To that end, the buffalo producer organisations should work more effectively. The producer's financial knowledge should be enhanced so that they can make the right decision in their activities related to the buffalo production. It can be concluded that buffalo farming can continue to operate near city centres where there are suitable ecologies.

7. References

ACIL, A. F. *Agricultural economics* (in Turkish). Ankara University Agricultural Faculty Publications: 721, Ankara, 1980.

ACIL, A. F.; DEMIRCI, R. *Agricultural economics courses* (in Turkish). Ankara University Agricultural Faculty Publications: 880, Ankara, 1984.

ALMUS, S. A research on the determination of the factors effecting the farmers adaptation behaviours to land consolidation applied in Güzelbeyli town on Zile county of Tokat province and their inclination to this application (in Turkish). *Thesis* (MSc.). Gaziosmanpaşa University, Tokat, Turkey, 1999.

ARAS, A. *Agricultural accounting* (in Turkish). Ege University Agricultural Faculty Publications, İzmir, 1988.

ARMAGAN, G. A research on structural features and planning of dairy farms: Case study of Nazilli örkoop (in Turkish). *Thesis* (PhD.). Ege University, İzmir, Turkey, 1999.

AUJLA, K.M.; HUSSAIN, A. Economics of milk production of major dairy buffalo breeds by Agro-ecological zones in Pakistan. *Pakistan Journal of Agricultural Research*. v. 28, n. 2, p. 179-191, 2015.

BARDHAN, D.; SRIVASTAVA, R. S. L.; DABAS, Y. P. S. Economics of buffalo milk production in Tarai area of Uttaranchal. *Indian Journal of Dairy Science*. v. 58, p. 129-133, 2005.

BASAVARAJAPPA, D. N.; CHINNAPPA, B. An economic analysis of milk production. *International Research Journal of Agricultural Economics and Statistics*. v. 4, n. 1, p. 38-41, 2013.

BAYRAMOGLU, Z. Analysis of economics of farms considered in dairy cattle projects (100x2) for Konya province (in Turkish). *Thesis* (MSc.). Selçuk University, Konya, Turkey, 2003.

BULBUL, M. *Economic structure, finance and credit problems of agricultural enterprises in Adana* (in Turkish). Ministry of Food, Agriculture and Livestock Occupational Publications Series, Ankara, 1973.

CETIN, B. *Agricultural financing* (in Turkish). Nobel Academic Publishing Publications, Ankara, 2008.

CICEK, A.; ERKAN, O. *Agricultural economics research and sampling methods* (in Turkish). Gaziosmanpaşa University Agricultural Faculty Publications No: 12, Tokat, 1996.

DAGISTAN, E. Economic analysis of sheep farming in the Central Southern Anatolian region (in Turkish). *Thesis* (PhD.). Çukurova University, Adana, Turkey, 2002.

DEL GIUDICE, T. An initial estimate of the cost of production of meat from pregnant buffaloes. *Bubalus Bubalis*. v. 10, p. 24-28, 2004.

DEVAKATE, B. K. Economics of production and disposal of milk in Sindhudurg district. *Thesis* (MSc.). Department of Agricultural Economics, College of Agriculture, Dapoli, 2016.

ERKUS, A.; BULBUL, M.; KIRAL, T.; ACIL, A. F.; DEMIRCI, R. *Agricultural economics* (in Turkish). Ankara University Agricultural Faculty Publications, Ankara, 1995.

ESENGUN, K.; SIVASLIGIL, A. C. A research on analysis of effective factors, about accepting and adoption of agricultural innovations, proposed by the extension service in Kozova region of Tokat province of Turkey for the principal agricultural products (in Turkish). *Gaziosmanpaşa University Journal of Agricultural Faculty*. v. 10, n. 1, p. 59-78, 1993.

FIDAN, H. The economic analysis and planning of farms with market oriented dairy cattle enterprises in the central districts of Kütahya province (in Turkish). *Thesis* (PhD.). Ankara University, Ankara, Turkey, 1996.

GOZENER, B. Economic analysis and technical efficiency of cattle breeding farms in the TR 83 region (in Turkish). *Thesis* (PhD.). Gaziosmanpaşa University, Tokat, Turkey, 2013.

GUL, A. *Economical comparison of production activities of projected and without project dairy cattle in Adana province* (in Turkish). Çukurova University Agricultural Faculty Publications: 131, Adana, 1998.

GUNLU, A.; CICEK, H.; TANDOGAN, M. Socio-economic analysis of dairy buffalo enterprises in Afyonkarahisar province in Turkey. *Journal of Food, Agriculture & Environment* v. 8, n. 3&4, p. 689-691, 2010.

GURBUZ, D. *Financial source of dairy farms*: A case of Burdur province. Thesis (MSc.). Suleyman Demirel University, Isparta, Turkey, 2015.

INAN, I. H. *Agricultural economy and management* (in Turkish). Hasad Publishing, Tekirdağ. 2006.

HASAN, T.; AKTER, S.; BISWAS, H.; HALIM, M. A.; ALAM, A.; RAFIQ, K. Economic analysis of small-scale dairy buffalo enterprises in Bhola district of Bangladesh. *Progressive Agriculture*. v. 27, n. 4, p. 502-510, 2016.

HEMALATHA, B.; PRASHANT, V. R. N.; REDDY, Y. V. R. Economics of milk production of different breed of bovines in Ahmednagar district of Maharashtra. *Indian Dairyman*. v. 55, n. 10, p. 41-42, 2003.

INDERPREET, K.; SINGH, V. P.; HARPREET, K.; PRABHJOT, S. Economic analysis of milk production in peri-urban dairy farms of Punjab. *Indian Journal Dairy Science*. v. 64, n. 4, p. 335-340, 2011.

ISIK, M. Economic analysis of water buffalo farming in Mus province, Turkey (in Turkish). *Thesis* (MSc.). Süleyman Demirel University, Isparta, Turkey, 2015.

ISIK, M.; GUL, M. Economic and social structures of water buffalo farming in Muş province of Turkey. *Revista Brasileira de Zootecnia*. v. 45, n. 7, p. 400-408, 2016.

ISIKLI, E.; TURAN, A.; TANRIVERMIS, H. *Capital and problems in Turkish agriculture* (in Turkish). p.231-256. In: Tarımsal Yapı Dönüşüm ve Strateji Arayışları Tarım Haftası 1994 Sempozyumu, Ankara, 1994.

ISLAM, S.; NAHAR, T.N.; BEGUM, J.; DEB, G.K.; KHATUN, M.; MUSTAFA, A. Economic evaluation of buffalo production in selected regions of Bangladesh. *Journal of Stock & Forex Trading*. v. 6, n. 1, p. 3-8, 2017.

JADAV, J. V.; DHANDHALYA, M. G.; SWAMINATHAN, B. An economic analysis of milk production on different farm sizes in Junagadh district of Gujarat. *International Journal of Agriculture Sciences*. v. 8, n. 2, p. 1516-1518, 2016.

KARAGOLGE, C. *Agricultural management* (in Turkish). Atatürk University Publications No: 427, Erzurum, 1996.

KIRAL, T.; KASNAKOGLU, H.; TATLIDIL, F. F.; FIDAN, H.; GÜNDOGMUS, E. *Cost accounting methodology and database guide for agricultural products* (in Turkish). Agricultural Economy Research Institute Publications, Project Report 1999-13, Ankara, 1999.

KIZILOGLU, S. *Econometric analysis of wheat, barley, potato, sunflower, sugar beet and plant production cost and supply functions in Erzurum* (in Turkish). TÜBİTAK Project No TOAG-1035, Erzurum, 1994.

KUMAR, B. G.; PANDIAN, A. S. S. Cost of milk production in the milk shed area of Tamil Nadu. *Indian Journal of Animal Sciences*. v. 73, n. 8, p. 920-923, 2003.

NIZAM, S. Determination of the productivities of dairy farms in Aydın province (in Turkish). *Thesis* (MSc.). Adnan Menderes University, Aydın, Turkey, 2006.

REHBER, E.; TIPI, T. *Agricultural management and planning* (in Turkish). 3rd ed. Ekin Basın Yayın Dağıtım, Bursa, 2016.

ROCHA, L. *Buffalo production systems in Americas*. p.74-86. In: Sixth World Buffalo Congress, Maracaibo, Zulia, Venezuela, 2001.

SAHA, K. P.; GUPTA, J. N. Economics of milk production in Murshidabad district of West Bengal. *Journal Dairying, Foods and Home Science* , v. 19, n. 3-4, p. 196-200, 2000.

SAHIN, K.; GUL, A.; KOC, B.; DAGISTAN, E. Intensive dairy cattle production economics in Adana province (in Turkish). *Yüzüncü Yıl Üniversitesi Ziraat Fakültesi Tarım Bilimleri Dergisi*. v. 11, n. 2, p. 19-28, 2001.

SANER, G. *A study on the economical evaluation of market-oriented dairy farm in İzmir region* (in Turkish). Thesis (PhD.). Ege University, İzmir, Turkey, 1993.

SAYILI, M. Economic analysis of cattle fattening farms in Suluova district of Amasya province (in Turkish). *Thesis* (PhD.). Gaziosmanpaşa University, Tokat, Turkey, 2001.

SAYILI, M.; EKINCI, K. *Determination of farmer behaviours and socio-economic benefits of the project in Samsun province Bafra Plain land consolidation project* (in Turkish). Agricultural Economy Research Institute Publications No 202, 86p, Ankara, 2012.

SOYSAL, M. İ.; TUNA, Y. T.; GURCAN, E.K. An investigation on the water buffalo breeding in Danamandira village of Silivri district of Istanbul province of Turkey (in Turkish). *Journal of Tekirdağ Agricultural Faculty*. v. 2, n. 1, p. 73-78, 2005.

TOKMAK, T. Economic analysis and supply of milk cows marketing in Niğde city (in Turkish). *Thesis* (MSc.). Niğde Ömer Halisdemir University, Niğde, Turkey, 2009.

YILMAZ, H. Economic and social effects of support through cooperatives to dairy farms: Case of Adana province (in Turkish). *Thesis* (PhD.). Çukurova University, Adana, Turkey, 2010.

YILMAZ, İ.; DAGISTAN, E.; KOC, B.; OZEL, R. Analysis of dairy farming activities and factor productivity in projected and non-projected dairy farms in Hatay province (Turkey) (in Turkish). *Akdeniz Üniversitesi Ziraat Fakültesi Dergisi*. v. 16, n. 2, p. 169-178, 2003.

YILMAZ, O.; ERTUGRUL, M.; WILSON, R. T. Domestic livestock resources of Turkey. *Tropical Animal Health and Production*. v. 44, n. 4, p. 707-714, 2012.

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