ANALYSIS OF ECONOMIC STRUCTURE IN WATER BUFFALO BREEDING BY GEOGRAPHICAL REGIONS IN TURKEY

Bahri Karli[1], Mevlüt Gül[1,*], Metin Göksel Akpinar[2], Yavuz Tascioğlu[2], Yalçın Bozkurt[3] and Bekir Sıtkı Şirikçi[1]

ABSTRACT

In this study, the status of water buffalo breeding in each geographical region in Turkey was examined, and the activities of enterprises were analysed from technical and economic perspectives. Four regions and the cities in these regions where buffalo breeding was concentrated in Turkey were chosen by Purposive Sampling Method, considering the number of water buffaloes, milk production and their share in the buffalo population and buffalo milk production in Turkey. A total of 462 sample enterprises were chosen from these cities by Stratified Random Sampling Method. The research data were collected through the questionnaires administered in face-to-face interviews with the producers. The data collected reflect the buffalo production in Turkey in 2014. The study examined socio-economic structures of the enterprises, revealing their capital structures and annual economic activities. The Marmara region ranked first in the time spent in buffalo breeding (26.62 years). Gross profit income was positive in four regions. Absolute profit and relative profit indicators were negative for farms in the Black Sea region and favourable for farms in other regions. For the development and promotion of buffalo breeding, the breeders should be further educated about better breeding practices; small enterprises should be modernized and expand their operations; efforts for the betterment of breeding practices should be intensified; existing wetlands should be protected and enhanced; the production costs (feed cost etc.) should be reduced; state subsidies should be granted to real producers; the public should be educated about the high nutritional value of water buffalo meat and milk through promotional campaigns, and buffalo producers should be better organized in producer unions.

Keywords: *Bubalus bubalis*, buffaloes, water buffalo, business, region, capital structure, profitability, Turkey

INTRODUCTION

Animal products are the most important nutritional sources in a healthy and balanced diet. The availability and sustainability of animal products in sufficient quantities depend on the development and expansion of animal husbandry. In addition to the food supply, animal husbandry also plays a vital role in the development of rural

[1]Department of Agricultural Economics, Faculty of Agriculture, Isparta University of Applied Sciences, Isparta, Turkey, *E-mail: mevlutgul@isparta.edu.tr

[2]Department of Agricultural Economics, Faculty of Agriculture, Akdeniz University, Antalya, Turkey

[3]Department of Animal Science, Faculty of Agriculture, Isparta University of Applied Sciences, Isparta, Turkey

areas and in increasing the general standard of living for the people in these regions. In this regard, many developed nations have designed and implemented various policies for the development of animal husbandry. In water buffalo breeding, which is a sub-branch of cattle breeding, a number of incentive programs have been put into practice to promote buffalo breeding, increase the demand for buffalo products and improve the buffalo meat and milk yield per buffalo.

In Turkey, the buffalo population suffered a dramatic fall (66.78%) from 255,000 head in 1995 to 84,726 head in 2010. In the same period (1995 to 2010), milk production declined by 69.02% (TUIK, 2017). This shows that the interest in buffalo breeding has been decreasing and the producers have been abandoning buffalo breeding. In order to overcome this problem in buffalo breeding and to support the breeding of buffalo, the government introduced a campaign called "Anatolian Water Buffalo Breeding Project". Within the scope of this project, eight cities were selected as pilot regions, and the breeders were given incentives of TRY500 per broodstock. Since 2012, both the number of cities participating in the project and the amount of government support given per animal have been increased. These incentives have increased both the number of buffalo and the production of buffalo milk in Turkey. The number of buffalo, which was 84,726 head in 2010, increased by 67.68% to 142,073 in 2016, and buffalo milk production increased by 77.56%, from 35,487 to 63,085 tons (TUIK, 2017).

In Turkey, the supply of red meat is inadequate, and the deficit in meat is currently compensated by imports. Without a doubt, the expansion of buffalo farming and the increase of the buffalo population will provide a significant contribution to the supply of red meat in Turkey. However, as in general animal breeding, the most prominent problem in buffalo breeding is the high input costs. In the case of production costs, the feed costs constitute the most significant cost element. From this perspective, the protection of grasslands and the cultivation of feed crops should be promoted and supported by the government.

Turkey has massive potential for buffalo breeding. Effective and efficient use of resources in businesses requires the capital to be as significant as the success of the business owners. This study, therefore, aims to analyse water buffalo breeding enterprises in Turkey on a regional basis, determining their social and economic structures and making relevant suggestions for the development of buffalo breeding.

MATERIALS AND METHODS

Materials

The primary research data consist of the information collected from the buffalo producers in the sample cities through questionnaires. These data reflected the production activities in 2014.

The literature review included resources from the provincial and district directorates of the Turkish Ministry of Food, Agriculture and Livestock, Turkish Statistical Institute (TUIK), as well as previous research on the subject.

Methods

The study included the cities Afyonkarahisar, Bitlis, Diyarbakir, Istanbul, Muş, Samsun and Tokat. The Purposive Sampling Method was used in choosing what cities in Turkey should be included in the study. The designated cities represent 50.67% of the total water buffalo population and 54.16% of the milk production in

Turkey.

Using the data obtained from the records of provincial and district directorates of the Ministry of Food, Agriculture and Livestock, buffalo breeding enterprises were chosen by stratified random sampling method (Çiçek and Erkan, 1996). A total of 462 enterprises were included in the study (Table 1).

Group I enterprises were in the Marmara region (Istanbul) and the number of enterprises was 69; Group II enterprises were in the Aegean region (Afyonkarahisar), and the number of enterprises was 63; Group III enterprises were in the East Anatolia, and south-eastern Anatolia region (Diyarbakır, Muş and Bitlis) and their number was 164; Group IV enterprises were in the Black Sea region (Samsun and Tokat), and the number of enterprises was 166. Face-to-face interviews were conducted with a total of 462 enterprise managers and the primary research data were obtained (Table 1).

The data was collected from sample enterprises through surveys. Within the scope of the research, we determined the general characteristics and capital structures of the enterprises, calculating their production costs in buffalo breeding, gross production value, gross profit, absolute profit and relative profit. In an agricultural enterprise, production costs comprise all the inputs used for the production activity and the expenditures made for the services utilised.

In the economic analysis of the enterprises,

- The family labour costs were calculated based on the daily wages given to male and female workers in the research areas.

- 3% of total variable costs were considered as general administrative expenses.

- The interest in working capital is a variable cost and reflects the opportunity cost of the capital invested in the production activity. Interest for working capital was calculated by applying half of the current interest rate applied by Ziraat Bank on crop production loans to variable costs.

The success indicators for the enterprises were their gross, net and relative profits. In the calculation of these indicators (Açıl and Demirci, 1984), we used the following formulae:

Gross profit = Gross production value - Variable costs

Net profit = Gross production value - Production costs

Relative profit = Gross production value / Production costs

RESULTS

Population structure by region

The region with the highest population per enterprise unit was the East-South-Eastern Anatolia region (11.60 persons), and the lowest population was in the Marmara region (4.34 persons). The population per business was 6.71 in the Black Sea region and 6.33 persons in the Aegean region (Table 2). The population of persons aged 0 to 6 years accounted for 16.50% of the total population in the East-Southeast Anatolia region, which had the youngest household. The region with the highest rate of population aged 7 to 14 years was the East-Southeast Anatolia region. In the enterprises located in the Black Sea region, the share of the population over 50 years old was higher than that of other regions (21.74%).

In general, the education level of the households engaged in water buffalo breeding was at the primary school level. The rate of illiterate population was the highest in the East-Southeast Anatolia region with a mean of 1.18 people per enterprise. The families in the Marmara region had the highest education level, with more persons

having a high school or college degree. The level of education in the East-Southeast Anatolia region was lower than in other regions. The education level of the women was also much lower in the East-Southeast Anatolia region. While the highest literate female population was seen in the East-Southeast Anatolia region with a mean of 0.39 persons, the region with the highest rate of female illiteracy was again in the East-Southeast Anatolia region with 0.88 people per enterprise. A similar situation also applies to the level of education in the male population. The mean level of education was much lower in the East-Southeast Anatolia region. While the mean number of illiterate men was 0.30 in the East-Southeast Anatolia region, the literacy rate was calculated as 0.36 persons per enterprise in the East-Southeast Anatolia region.

Characteristics of Enterprises by region

In the enterprises surveyed, the mean age of the farmers was determined as 45.40 years in East-Southeast Anatolia, 45.83 in Marmara. Education level was 5.63 years in East-Southeast Anatolia, 6.84 in the Aegean region. The region with the lowest education level was the East-Southeast Anatolia region, and the farmers with the highest education level were in the Aegean region. The mean buffalo breeding experience of farmers in the East-Southeast Anatolia region was lower than those in other regions. The farmers in the Marmara region had the highest rate of experience in buffalo breeding (Table 3).

Most of the farmers stated that animal husbandry activities were on the rise in all region. Animal husbandry activities were observed to increase in the Black Sea, East-Southeast Anatolia and Aegean regions. Considering the business groups, more than half of the producers reported that the buffalo breeding activities showed a significant increase. The rate of this increase was 57.97% in the enterprises in the Marmara region, 71.42% in the Aegean region, 78.05% in the East-Southeast Anatolia region and 72.90% in the Black Sea region.

We also investigated whether the farmers had received training on buffalo production activities and found that the rate of training history was extremely low, with significant differences between regions. The rate of farmers receiving formal training on animal husbandry was 7.25% in the Marmara region, 1.59% in the Aegean, 8.54% in the East-Southeast Anatolia and 24.10% in the Black Sea region. The rate of farmers with training in the Black Sea region was higher than that of the other regions. The places where the farmers received education on animal husbandry mainly included the provincial and district directorates of the Ministry of Food, Agriculture and Livestock. However, the farmers in the Marmara, East-Southeast Anatolia, and Black Sea regions received training at universities within the scope of education programs carried out in these regions. The farmers in the Marmara region and the Black Sea region also participated in educational activities on livestock farming organised by public and private institutions.

About 11.59% of the farmers were found to generate income from non-agricultural business activities in the Marmara region. 11.11% of the farmers in the Aegean region, 25.61% of the farmers in the East-South-eastern Anatolia region and 17.47% of the farmers in the Black Sea region reported doing non-agricultural business. We found those also engaged in non-agricultural business activities were predominantly small business owners and retired people.

Certain assets owned by the enterprises engaged in buffalo breeding were also included in

the scope of the research. 53.62% of the businesses in the Marmara region had computers, and 50.72% had internet access. Mobile phone ownership rate was the highest in the Aegean region with 98.41%. The enterprises in the Black Sea region had a higher rate of automobile ownership (80.12%) and credit card possession (47.59%) (Table 3).

The social security status of enterprises was high. It was determined that 85.51% of the farmers in the Marmara region, 92.06% in the Aegean region, 73.78% in the East-Southeast Anatolia region and 87.35% in the Black Sea region have social security.

We found that in general the breeders were moderately satisfied, while the farmers in the Black Sea and East-Southeast Anatolia regions were more satisfied than others.

The farmer's level of interest in buffalo breeding was high in all regions surveyed, but those in the Black Sea and Aegean regions were more interested than others (Table 3).

Overall analysis showed that the breeders in all regions were highly satisfied with their breeding activities. The farmers in the Black Sea and East-Southeast Anatolia regions had a significantly higher level of satisfaction than other regions. The knowledge level of farmers on buffalo breeding was found to be high in all regions. The farmers in the Marmara and Aegean regions were found to be more informed than those operating in other regions (Table 3).

Capital structures

In every area of the economy, the capital represented the sum of the monetary values of the assets used in production and allocated to the business to generate earnings (Işıklı *et al*., 1994). In agriculture, capital can be examined in two groups in terms of character.

Active capital refers to all capital elements invested in the business. In the enterprises surveyed, the worth of the active capital was $631,295.04 in the Marmara region, $616,196.66 in the Black Sea region, $511,303.17 in the East-Southeast Anatolia region, and $484,757.42 in the Aegean region. The share of farm capital in the active capital was 85.97% in East-Southeast Anatolia, 76.84% in the Black Sea, 70.10% in the Aegean, 67.56% in the Marmara region (Table 4). The previous studies on animal husbandry found that the share of farm capital in active capital was as follows: 81.96% Saner (1993), 75.85% Bayramoğlu (2003), and 57.77% Gözener (2013). Our results appeared to be consistent with relevant previous research findings.

Land capital consists of the sum of the assets of the property owned by the enterprise or used through sharecropping and tenancy (Açıl and Demirci, 1984). The share of land capital in the active capital was 76.13% in East-Southeast Anatolia, 61.48% in the Black Sea, 49.81% in Aegean, 37.73% in the Marmara region (Table 4). In similar studies related to the subject, the share of land capital in total active capital was found as 66.28% by Saner (1993), 31.85% by Dağıstan (2002), 47.04% by Bayramoğlu (2003), 59.05% by Yılmaz (2010) and 21.99% by Gözener (2013).

Animal capital includes all livestock held in agricultural holdings of animal husbandry. The share of animal capital in the active capital was determined as 22.64% in the Marmara Region, 16.44% in the Aegean Region, 12.98% in the Black Sea Region, 9.92% in the East-Southeast Anatolia Region (Table 4).

Saner (1993) reported that the share of animal capital in total active capital was 10.09%, Dağıstan (2002) 26.65%, Bayramoğlu (2003) 12.88%, Yılmaz (2010) 10.15% and Gözener (2013) 32.28%. In the enterprises surveyed, the share of

animal capital in the active capital in the Marmara region was closer to that of other animal husbandry activities, while the share in other regions was low, which could be attributed to the low unit value of buffalo.

In the Marmara region, the share of farm capital in the active capital was 67.56%, the share of working capital was 32.44%, the share of foreign capital was 23.52%, and the share of owner's equity was 76.48% (Table 4).

In the Aegean Region, the share of the farm capital in the active capital was 70.10%, the share of working capital 29.90%, the share of foreign capital 20.22% and the share of owner's equity was 79.78%. In the enterprises in the East-Southeast Anatolia region, the share of farm capital in the active capital was 85.97%, the share of working capital 14.03%, the share of foreign capital 12.56% and the share of owner's equity was 87.44%. In the Black Sea region, the share of farm capital in the active capital was 76.84%, the share of working capital 23.16%, the share of foreign capital 21.69% and the share of owner's equity was 78.31% (Table 4). In the Marmara region, the share of animal capital was higher than in other regions. This indicates that the enterprises in the Marmara region are in the vicinity of main consumption centers and that there are no problems in the marketing of buffalo products, which makes this region more advantageous as compared to other regions. The presence of animal capital in a farming operation and its high share in the active capital reduces the risk in that business, providing a balanced income and stable cash flow in each period of operation.

Saner (1993) found the share of owner's equity in passive capital as 88.30%, Dağıstan (2002) 95.18%, Bayramoğlu (2003) 87.32%, Yılmaz (2010) 83.19% and Gözener (2013) 90.31%, and Gürbüz (2015) 84.21%. In agreement with previous research in the literature, we found that businesses usually work on owner's equity.

Distribution of gross production value (GPV) by production activities

The Gross Production Value (GPV), one of the economic outcomes of agricultural activity, can be defined as gross income from all or one of the operations of a business (İnan, 2016).

In the enterprises examined in our study, the share of the GPV obtained from the buffalo breeding in the total GPV was 75.55% in the Marmara Region. This rate was 41.36% in Aegean, 42.49% in East-Southeast Anatolia and 28.13% in the Black Sea region. The fact that the share of GPV from buffalo farming in the total GPV in the Black Sea region was low indicates that plant production in this region was the main priority (Table 5). The relationship between the regional groups and the GPV was statistically significant.

Production costs in the buffalo breeding activity by regions

Operating expenses are categorised into two groups: fixed and variable costs. Fixed costs are those remaining unchanged, not affected by the increase and decrease in activity volume within a particular time and volume of activity (Bursal and Ercan, 2000). Fixed cost elements are inversely proportional to the amount of production. The amount of fixed cost per unit of production is reduced, and as the amount of production is reduced, the amount of fixed cost per unit increases. This cost element consists of the expenses occurring in the enterprises whether or not they are engaged in production activities. Variable costs are the expenses increasing or decreasing depending on the volume of activity of the business. These are the cost elements directly proportional to the

amount of production.

While the share of variable costs in total production costs in the Marmara region was 57.83%, the share of fixed costs was 42.17%. The share of total feed costs in total production costs was 49.76%, which constitutes the most significant cost factor. Feed costs were followed by fixed capital interest (15.38%), amortisation (12.46%), permanent labour costs (12.00%) (Table 6).

In the buffalo enterprises operating in the Aegean region, 48.76% of the total production costs were variable costs and 51.24% was fixed costs. Total feed costs were the most critical cost factor in this region (38.18%). The second major cost factor was permanent labour costs. Permanent labour force accounted for 21.10% of total production costs. The third and fourth significant expenditure items were amortisation (15.50%) and fixed capital interest (13.17%) (Table 6).

In the East-Southeast Anatolia region, 52.11% of the total production costs were fixed costs and 47.89% was variable costs. As in other regions, the most critical cost factor in total production costs in this region was feed costs (31.43%). The feed costs were followed by permanent labour costs at 28.36%. The expense item of fixed capital interest was in third place with 10.24%. Amortisation had a share of 9.81% in total production costs and was the fourth most crucial cost factor (Table 6).

In the Black Sea region, the share of variable costs was 59.45%, and the share of fixed costs was 40.55% in all production costs. In total production costs, feed costs had the highest share at 43.22%, which was followed by permanent labour costs of 15.91%. Other significant expense items included amortisation (10.99%) and fixed capital interest (10.21%) (Table 6).

Feed costs in all regions had a significant place in total production costs. Therefore, it is necessary to reduce feed costs in animal husbandry production activity. For this reason, it is vital for farmers to give priority to the planting of feed plants in the enterprises and to meet their feed needs from their enterprises. In that way, the amount and share of feed costs can be reduced within production costs, and unit production cost will decrease. Decreased cost of unit production will increase the market competitiveness of the animal products produced in those enterprises and businesses will be able to earn more income.

Rocha (2001) described buffalo breeding as an activity with low production costs and high level of productivity. In this study, the share of feed costs in total production costs was calculated as 41.97%. This rate was much lower than other livestock businesses (dairy cattle, beef cattle) because total production costs in dairy and feeder cattle breeding activities, the share of feed costs are around 70%. In this respect, production costs were low in buffalo breeding as compared to other livestock production activities. In our study, family labour costs were the second most important cost element (18.15%). This rate is lower than that of other livestock businesses since buffalo farming utilises wetlands for the feeding of the animals.

In all regions, fixed costs and variable costs showed significant differences, which could be associated with the systems employed by the enterprises in each region.

In a study carried out in Muş, the feed costs were found to be the most critical cost item among the total production costs (36.81%) (Işık and Gül, 2016). Işık and Gül (2016) calculated that the second highest cost item was permanent family labour (32.54%). Del Giudice (2004) reported that in buffalo breeding in Italy, 72% of total production costs was feed costs, 18% labour, 5% veterinary costs and 5% other costs. Günlü et

al. (2010) found that 42.84% of the total costs was feed costs and 27.48% labour costs in the study on buffalo breeding in Afyonkarahisar. Bardhan *et al*. (2005) estimated that feed costs accounted for 60 to 70% of the costs incurred in dairy buffalo breeding. It was found in this study that the share of feed costs was lower than those reported by Del Giudice (2004); Bardhan *et al*. (2005); Günlü *et al*. (2010).

The production costs per buffalo head varied between $668.13 and $1011.45 among the regions studied. Total production cost per buffalo was highest in the Marmara region with $1011.45 and lowest in the Aegean region with $668.13. The production cost per buffalo head was $780.46 in the Black Sea region and $813.68 in the East-Southeast Anatolia region.

Variable costs per buffalo head ranged from $325.77 to $584.94, with the highest costs in the Marmara region at $584.94 and the lowest in the Aegean region at $325.77. The variable costs per head in the Black Sea region was $463.98, while they accounted for $389.69 in the East-Southeast Anatolia region. The variable costs per buffalo head in the Marmara region was about one and a half times higher than in other regions.

Fixed costs per buffalo head ranged from $316.48 to $426.51, with the lowest fixed cost per head incurring in the Black Sea region and the highest in the Marmara region. In the Aegean region, the fixed costs per head amounted to $342.36. This value increased to $ 423.99 in the East-Southeast Anatolia region. The fixed costs per buffalo head were similar in all regions.

The total feed costs per buffalo head were determined to be the highest in the Marmara region at $503.32 and the lowest in the Aegean region at $255.10. The feed costs in the Black Sea region accounted for $337.33 per head, while it was $255.78 in the East-Southeast Anatolia region. Therefore, the Marmara region had significantly higher feed costs per head, almost twice as high as in other regions.

GPV, gross profit, absolute profit and relative profit in buffalo breeding

The mean gross production value obtained from buffalo production activity was $117233.85 per enterprise in the Marmara region. In the Marmara region, the share of income from buffalo products was 87.60%, 77.27% in the Aegean region, 78.09% in the East-Southeast Anatolia and 69.91% in the Black Sea region. Government support had a significant share of the added value created. This value varied between 5.80% and 18.80% depending on the region. The share of government support in the GPV was the highest in the Black Sea region at 18.80%. This value was 11.15% in the East-Southeast Anatolia region, 10.89% in the Aegean region and 5.80% in the Marmara region (Table 7).

The share of the productive stock increase in the total added value varied between 6.08% and 10.87% among regions. The highest percentage was in the Aegean region (10.87%), while the lowest was seen in the Marmara region (6.08%) (Table 7).

In a study conducted in Muş, Işık (2015) reported that 56.40% of the GPV from the buffalo breeding activity came from milk production, 37.30% from the productive stock increase, 4.03% from state subsidies, and 2.26% fertiliser income.

Gross profit was calculated by subtracting variable costs from the GPV. Relative profit is calculated by comparing the gross production value to production costs. The absolute profit, on the other hand, is obtained by subtracting the total production costs from the gross production

value from husbandry activities. This value allows agricultural enterprises to determine their business success. Profit refers to the difference between income and expenditure. The primary purpose of any business is to make a profit and to seek ways to maximise this profit.

In the Marmara region, the mean annual gross profit was $88029.35, absolute profit was $66734.71, and relative profit ratio was 2.32. Gross profit in the Aegean region was $30778.80, absolute profit $21437.35 and relative profit 2.18. Gross profit in the East-Southeast Anatolia region was $20623.38, absolute profit $12275.50 and relative profit 1.77. Gross profit in the Black Sea region was $9244.55, absolute profit -$309.12 and relative profit 0.99 (Table 8).

Relative profit is a criterion that measures the success of businesses, which is used as a benchmark between businesses, and considered an essential indicator of specialisation. Therefore, by looking at the relative profit criterion, it is possible to calculate the income from the capital invested and determine whether a business operation proves successful.

Relative profit ratio in the examined entities ranged from 0.99 to 2.32, depending on the region (Table 8). When the relative profit criterion was taken into account, the buffalo farmer in Marmara region was found to earn $232 for every $100 spent on the buffalo breeding activity. The farmer in the Aegean region earned $218 for every $100 spent; a farmer in the East-Southeast Anatolia region earned $177 for every $100, while the farmer in the Black Sea region earned $99 for every $100. This indicator shows that the farmers in the Black Sea region were in loss, whereas the enterprises in the other regions were making a profit from their operations. The low relative profitability or even losses was mainly because buffalo breeding still largely depended on wetland breeding and milk productivity was low.

DISCUSSION

The enterprises engaged in buffalo breeding in Turkey exhibit significant differences depending on the conditions of meadow-pasture areas, climate conditions, social structure and economic conditions in the region where they perform breeding activities. Water buffalo breeding is still generally carried out by conventional methods, and the enterprises are composed of small units.

The population per enterprise was found to be 4.34 to 11.60 persons in the regions. Işık and Gül (2016) determined that the population per farm was 6.68 persons in the study conducted in the farms in Muş. Our results are in agreement with the value reported by Işık and Gül (2016). The main reason behind the lower population per farm in cattle breeding enterprises could be the limited area covered by previous studies.

We found that the mean age of farmers engaged in buffalo breeding was 45.40 to 47.22 years, the education level 5.63 to 6.84 years, the experience in farming activity 28.86 to 31.12 years, the experience in animal husbandry 25.03 to 29.99 years, and the experience in buffalo breeding 22.60 to 26.62 years. Işık and Gül (2016) reported that the mean age of the farmers in their study was 55.60 years, the education level 4.11 years, and the experience in buffalo breeding was 26.89 years. These results showed that the farmers engaged in animal husbandry are generally in the 40-60 age group, and their education levels are low as most of them are primary school graduates.

The high level of livestock capital in the

business indicates the presence of a large animal population in that business. A higher number of animals in the business allows better utilisation of surplus crops, efficient use of labour and farm manure, increased plant productivity, the satisfaction of farmer family's needs for animal products and regular and continuous cash inflow into the business (İnan, 2016). In the enterprises studied, about 9.92 to 22.64% of the active capital was animal capital. When previous studies on animal husbandry were examined, Saner (1993) found that the share of animal capital in active capital was 10.09%, Dağıstan (2002) 26.65%, Bayramoğlu (2003) 12.88%, Yilmaz (2010) 10.15%, and Gözener (2013) 32.28%. These results suggest that the share of animal capital in the active capital remains low. This low rate mainly stems from the inability to act together and form a union.

One of the variable costs, the feed costs showed significant differences depending on several factors like the size of the enterprise (number of animals), the life cycle distribution of the animals within the enterprise, the provision of the feed through the enterprise's own means or through purchase from outside and the grazing time of the animals in the pasture. The production costs tend to be much lower when the breeding activities are carried out in modern enterprises working with full capacity, along with the cultivation of forage crops and provision of rough feed from within the farm. In this respect, feed costs constitute a significant cost element in animal husbandry enterprises.

In this study, the share of feed costs in total production costs was changed 31.43 to 49.76%. In other studies on buffalo breeding, the share of feed costs in total production costs was calculated as 36.81% by Işık (2015) and 42.84% by Günlü *et al.* (2010). The results of our research and those reported by previous studies in the literature were similar and in general agreement. Some researchers found that higher shares of feed costs in production costs. Del Giudice (2004), for example, calculated this figure as 72% in water buffalo breeding enterprises in Italy, Bardhan *et al.* (2005) calculated a rate of 60 to 70% in buffalo milk production enterprises. The main reason for this disparity can be explained by the fact that these studies were carried out in different countries and the methods of breeding employed in such countries (pasture breeding and/or breeding in modern enterprises).

All economic activities aim to achieve the highest profit in return for a specific expenditure or to maximise the profit of the business. Profits can be improved in two ways: increasing the gross production value and reducing production costs. Gross production value can be raised by selling products with the same efficiency level at a higher price or by increasing the efficiency at the same price level. When it comes to profitability, specific criteria including gross profit, absolute profit and relative profit, are taken into account. The relative profit, or relative advantage criterion, is the most critical indicator of specialisation.

In the enterprises surveyed, the relative profit ratio was changed depending on the regions. This profit was higher in the Marmara region with 2.32. Farmers in the Marmara region got $232 that every $100 capital invested in buffalo breeding. In other words, they make a profit of $132 in exchange for the capital they invested. However, farmers in the Black Sea region was negative profit. In other studies related to buffalo breeding, the relative profit ratio was calculated as 0.92 by Günlü *et al.* (2010) and 1.44 by Işık (2015).

Table 1. Distribution of interviewed farmers by buffalo numbers in the regions.

Groups of region	Groups	Province/s in the regions	N	%
Marmara	I	İstanbul	69	14.94
Aegean	II	Afyonkarahisar	63	13.64
East-South-Eastern Anatolia	III	Diyarbakır-Muş-Bitlis	164	35.50
Black Sea	IV	Samsun-Tokat	166	35.93
Total	-	-	462	100.00

Table 2. Population structure of farms in the regions.

Age groups by gender	Groups			
	I	II	III	IV
0-6	0.18	0.41	1.91	0.72
7-14	0.48	0.87	2.61	1.30
15-49	2.76	4.30	5.57	3.23
50 years and over	0.92	0.75	1.51	1.46
Households size (person)	4.34	6.33	11.60	6.71
Female (%)	45.39	53.71	48.45	49.63
Male (%)	54.61	46.29	51.55	50.37

Table 3. Some characteristics of farmer and farms in the regions.

Indicators	Groups			
	I	II	III	IV
Farmers' age (years)	45.83	46.13	45.4	47.22
Education level of farmers (years)	6.13	6.84	5.63	6.73
Experience in farming activity (years)	31.12	28.86	28.96	29.36
Experience in animal husbandry (years)	29.99	25.03	28.95	28.73
Experience in buffaloes activity (years)	26.62	25.06	22.6	25.59
Owners of computers (%)	53.62	42.86	17.68	29.52
Internet owner (%)	50.72	31.75	14.63	25.90
Mobile phone owner (%)	91.30	98.41	92.07	97.59
Car owner (%)	66.67	68.25	42.68	80.12
Credit card holder (%)	42.03	30.16	29.88	47.59
Satisfaction with livestock activity *	3.35	2.79	3.44	3.49
Level of interest in buffalo farming *	3.65	3.92	3.83	4.02
Satisfaction with buffalo activity *	3.52	3.41	3.82	3.84
Knowledge of buffalo breeding *	3.94	3.94	3.90	3.92

Table 4. Capital structures in the regions.

Capital elements	Groups			
	I	II	III	IV
	Amount (US$ per farm)			
Land capital	238171.02	241446.56	389244.40	378858.30
Building capital	158689.85	60218.85	46437.34	63442.38
Land reclamation capital	0.00	4052.25	0.00	22844.85
Plant capital	29662.30	34085.14	3886.50	8363.37
Farmland capital (A)	426523.17	339802.80	439568.24	473508.89
Breeding livestock capital	142949.47	79673.73	50715.80	79964.19
Machinery and equipment capital	24639.07	30790.98	11055.01	41978.53
Stock capital	32687.99	30757.66	6290.55	12010.50
Cash and equivalents asset	4495.32	3732.25	3673.56	8734.55
Operating (working) capital (B)	204771.86	144954.62	71734.93	142687.77
Total farm assets (A + B)	631295.04	484757.42	511303.17	616196.66
Farm liabilities (C)	148468.27	98020.42	64196.00	133638.47
Equity (D) *	482826.77	386737.00	447107.16	482558.19
Total farm liabilities and equity (C + D)*	631295.04	484757.42	511303.17	616196.66
	Ratio (%)			
Land capital	37.73	49.81	76.13	61.48
Building capital	25.14	12.42	9.08	10.30
Land reclamation capital	0.00	0.84	0.00	3.71
Plant capital	4.70	7.03	0.76	1.36
Farmland capital (A)	67.56	70.10	85.97	76.84
Breeding livestock capital	22.64	16.44	9.92	12.98
Machinery and equipment capital	3.90	6.35	2.16	6.81
Stock capital	5.18	6.34	1.23	1.95
Cash and equivalents asset	0.71	0.77	0.72	1.42
Operating (working) capital (B)	32.44	29.90	14.03	23.16
Total farm assets (A + B)	100.00	100.00	100.00	100.00
Farm liabilities (C)	23.52	20.22	12.56	21.69
Equity (D) *	76.48	79.78	87.44	78.31
Total farm liabilities and equity (C + D)*	100.00	100.00	100.00	100.00

Table 5. The gross production value in the regions.

Production activities	Groups			
	I	II	III	IV
	Amount (US$ per farm)			
Other animal husbandry	13684.50	14798.86	10711.80	16982.87
Buffaloes	117233.85	39667.61	28296.08	23250.51
Crops	24256.78	41451.58	27588.50	42419.17
Total gross production value	155175.12	95918.05	66596.38	82652.54
	Ratio (%)			
Other animal husbandry	8.82	15.43	16.08	20.55
Buffaloes	75.55	41.36	42.49	28.13
Crops	15.63	43.22	41.43	51.32
Total gross production value	100.00	100.00	100.00	100.00

Table 6. Proportional distribution of production costs in buffalo's production activity in the regions.

Cost elements	Groups			
	I	II	III	IV
	Ratio (%)			
Concentrated feed	32.12	3.64	4.38	9.28
Roughage	9.77	9.96	11.97	13.88
Green fodder	1.85	7.12	12.60	16.72
Grain forage	6.03	17.46	2.48	3.34
Total feed	49.76	38.18	31.43	43.22
Veterinary and medicine	2.46	5.02	3.74	5.16
Salt, water and cleaning	0.82	1.67	1.42	1.24
Lighting	1.12	0.76	2.96	1.16
Pasture rent	0.00	0.04	0.02	0.00
Marketing	0.25	0.18	1.18	0.19
Machinery rental-fuel-repair maintenance	2.58	2.04	2.03	6.76
Temporary shepherd	0.44	0.81	4.06	0.83
Other cost	0.38	0.06	1.05	0.89
Variable cost	57.83	48.76	47.89	59.45
General administrative expenses	1.73	1.46	1.44	1.78
Permanent-family labour	12.00	21.10	28.36	15.91
Depreciation (building-buffalo-equipment)	12.46	15.50	9.81	10.99
Fixed capital interest (buffaloes-building-machinery-debt)	15.38	13.17	10.24	10.21
Building repair	0.59	0.00	2.26	1.66
Fixed cost	42.17	51.24	52.11	40.55
Total production cost	100.00	100.00	100.00	100.00

Table 7. Gross production value (GPV) obtained from the operation of buffalo production in the regions.

Revenues	Groups			
	I	II	III	IV
	Amount (US$ per farm)			
Product revenue	102696.20	30651.23	22097.82	16254.65
Amount of support	6802.14	4320.04	3155.29	4370.93
Productive inventory increase	7125.52	4311.95	2826.88	2199.34
Fertilizer income	609.99	384.39	216.10	425.59
Total	117233.85	39667.61	28296.08	23250.51
	Ratio (%)			
Product revenue	87.60	77.27	78.09	69.91
Amount of support	5.80	10.89	11.15	18.80
Productive inventory increase	6.08	10.87	9.99	9.46
Fertilizer income	0.52	0.97	0.76	1.83
Total	100.00	100.00	100.00	100.00

Table 8. Profitability indicators in buffalo production activity in the regions.

Indicators	Groups			
	I	II	III	IV
	Amount (US$ per farm)			
Gross profit	88029.35	30778.80	20623.38	9244.55
Absolute profit	66734.71	21437.35	12275.50	-309.12
Relative profit	2.32	2.18	1.77	0.99

CONCLUSION

Most of the farmers stated that they increased the number of buffalo in their enterprise. The main reason for this increase is the growing government support for buffalo breeding since 2011, which was vital for most of the breeders.

The household size in the enterprises in the East-Southeast Anatolia is more than twice the other regions' average. The lowest level of education is seen in the East-Southeast Anatolia. The most experienced farmers are in the Marmara region, both in buffalo breeding, in livestock production and farm production activities.

Analysis of the capital structure of the enterprises revealed that the share of animal capital in the total active capital is the highest in the Marmara region at 22.64%, followed by 16.44% in the Aegean, 12.98% in the Black Sea region, and 9.92% in Eastern-South-Eastern Anatolia.

The share of the revenue from buffalo breeding in total gross production value is highest in the Marmara region, lowest in the Black Sea. The relative profit ratio is highest in the Marmara region at 2.32, lowest with 0.99 in the Black Sea region. These indicators show that the profitability of the businesses operating in the Black Sea region was low, causing financial losses, while the businesses in the other regions enjoyed profitable business activities.

In the regions where the research is carried out, the buffalo breeding activities play an essential role in the generation of revenue among the producers. In order to expand the buffalo breeding in all regions in Turkey and to maximize the profits, we should enhance the quality of the existing grasslands, provide better education opportunities for the producers, raise awareness about the animal husbandry activities, educate the farmers about the importance of unionization, encourage them to be members of the farmer associations, promote the cultivation of feed crops in the enterprises, increase subsidies for animal feed, focus on establishment of new food processing factories to create higher demand, which will undoubtedly make significant contributions to the development of buffalo breeding in Turkey.

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