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Production Function Analysis of Buffalo Fattening Enterprises in Afyonkarahisar Region of Turkey

[1]Hasan Cicek, [2]Aytekin Gunlu and [1]Murat Tandogan
[1]Department of Animal Health Economics and Management, Faculty of Veterinary Medicine, Afyon Kocatepe University, Afyonkarahisar, Turkey
[2]Department of Animal Husbandry, Faculty of Veterinary Medicine, Selcuk University, Konya, Turkey

Abstract: General characteristics of buffalo fattening in Afyonkarahisar Region of Turkey and resource usage efficiency level were determined by using Cobb-Douglas type production geometric means of 2005-2006. A total of 31 enterprises selected randomly were used. The expenditure distributions of buffalo fattening enterprises were calculated for the buffalo bull, feed, labour, veterinary medicine and drug cost and miscellaneous as 42.19, 27.26, 21.57, 2.63 and 6.36%, respectively. Average daily rough feed consumption (kg daily^{-1}), average daily concentrated feed consumption (kg daily^{-1}), total feed consumption (kg daily^{-1}), feed conversation ratio, fattening period (day), average buffalo number and capacity usage percentage (%) were determined as 4.31, 8.08, 12.39, 10.99, 178.2, 10.45 and 39.92, respectively. The marginal value productivity of input factors for buffalo bulls, feed, labour, veterinary medicine and drug cost and miscellaneous cost were 1.403, 1.364, 0.015, 4.403 and -3.112, respectively. Return to scale in buffalo fattening enterprises in the research area was 1.02. The Cobb-Douglas production model results revealed a high possibility to increase factor-productivity and total economic of buffalo fattening enterprises. For this aim, effective technical and economical reorganization and education are needed.

Key words: Buffalo fattening, economic and technical analysis, production function, AVP, MVP, Afyonkarahisar

INTRODUCTION

Livestock has been an integral component of traditional agriculture for centuries on record. In Asia, buffalo played a pivotal role in overall social development through contributions of milk and meat and also hides and draft power for agricultural operation (Nanda and Nakao, 2003). Water buffalo has been raised since ancient times in Turkey as a resource of meat, milk and draft power. Water buffaloes are very popular especially for their pull power in the forestry areas and for also their milk fat cream traditionally suits for famous Turkish dessert (Soysal *et al*., 2005).

Turkish water buffaloes, also called as Anatolian water buffaloes are practically classified as a river water buffalo of Mediterranean water buffaloes group. The chromosome number of Anatolian water buffalo is (25 pair 2n:50) the same as river buffaloes. Native Anatolian water buffalo breed was originated from Mediterranean water buffaloes by the results of natural selection (Soysal *et al*., 2005).

In Turkey, the numbers of buffalo decreased significantly during the last 30 years. Main reasons for the decrease are rather political and the lack of guidelines for animal husbandry in the agricultural economy of Turkey. Nevertheless, buffalo husbandry is still important in small family units as resources of various products. In Turkey, the main regions where buffaloes are raised are the coastal and inside areas of North Anatolia region, having the most suitable environmental conditions for buffalo farming as well as in Mus, Diyarbakir, Afyonkarahisar and Sivas Province buffaloes are raised. In the country, buffaloes are raised for their milk in small family units. In the units, male calves are sold for fattening or drought. Females are slaughtered at the end of their productive life. In buffalo fattening, main problem is marketing. In Turkey buffalo meat is only used in meat products like sausage. People do not accustom to eat fresh buffalo meat in their meals. Therefore, at the end of the fattening period, buffaloes are marketed to sausage factories. This situation prevents competition as regards to meat price, although the price of concentrate mixture is getting higher (Sekerden, 1998).

Corresponding Author: Hasan Cicek, Department of Animal Health Economics and Management, Faculty of Veterinary Medicine, Afyon Kocatepe University, 03200, Afyonkarahisar, Turkey

The Food and Agricultural Organization (FAO) has rightly termed buffalo has an important, but an undervalued assets. Buffalo has been and will remain as an integral part of socioeconomic source, especially of small holder farmers in several agro based developing countries in Asia. The role of buffalo is a sustainable agriculture in under developed and developing countries will remain (Nanda and Nakao, 2003). Turkey has 12,48000 head water buffaloes in 1967 and this number dropped to 13,8000 in 2001 (TSI, 2001). This shows that the number of buffaloes has been decreasing continuously. Therefore, it is necessary to sustain buffalo breeding in Turkey.

Buffalo meat is lean, tasty and often undistinguishable from beef. Buffalo meat contains lower saturated fat than beef, which is a good dietary value. Buffalo meat contains 40% less cholesterol, 55% less calories, 11% more protein and 10% more mineral in comparison to bovine meat so it is, healthier (Nanda and Nakao, 2003). Considering its composition, it may be advisable over the cattle beef for the cholesterol sensitive people (Bilal *et al*., 2006).

Buffalo grow faster than cattle on poor quality roughage because of their better digestive capacity. The cost of fattening per kg bodyweight is therefore, much lower for buffalo than cattle (Nanda and Nakao, 2003).

With respect to the bovine, there is restricted study on the buffalo. Body weight of buffalo reported for 12 months age was 162.4 kg and live weights of male and female Anatolian Buffalo calves were superior than black pied calves in 0-12 months age period (Sekerden, 2001). Likewise body weight of buffalo was reported as 411 kg for 36 months age by Uslu (1970).

Marques *et al*. (2006) has been reported body weight, daily weight gain and feed conversation ratio for buffalo, which is average 350 kg weight and 16 months of age kept in the feedlot for 84 days and feeding with on sugar cane silage +1% of urea and soybean, corn meal and salt minerals as 444 kg, 1.2 and 9.7 kg, respectively. Average daily weight gain has been reported for buffalo feeding with control (no fat in diet), soybean oil and whole soybean as 990, 1.090 and 1.280 g day^{-1}, respectively and soybean oil diet increased performance and reduced cost. It has been also suggested that soybean oil diet could be used to improve meat production in water buffalo (Olivera *et al*., 2007). In a 28 weeks fattening period, buffalo groups 135.7, 133.2 and 133.2 kg body weight and 8 months of age buffalo was feed with contain 10.1, 12.8 and 15.1% protein and slaughtered weight, average daily weight gain, daily feed consumption has been reported as 311.7, 307.3 and 317.0 kg and 896, 887, 936 g and 7.412, 7.487 and 7.131, respectively. Since no significant differences in the study, it is advised that young male buffalo is of fattening with the ration contain 10.1% protein level for the profitable buffalo fattening (Aksoy and Alpan, 1991).

An investigation to carried out for determine the cost of production buffalo, the cost factor of production percentage has been reported as 72% of feed, 18% on labour, 5% on veterinary care and certificates and the remainder on other costs (Giudice, 2004).

As in the case of any other farming activity, the profitability of buffalo fattening is dependent on critical mass, successful fattening program and whether costs factor (or expenditures) can be properly controlled. It is also important efficiently resource usage in production process.

In this study, it was aimed to analyze buffalo beef production process using Cobb-Douglas type production function and also determine, which precaution is necessary for efficiently production process in buffalo meat production.

MATERIALS AND METHODS

The survey data were collected from the 31 enterprises in the production season of 2005 and 2006 to analyze the resource usage efficiency. Enterprises were examined in terms of cost and income factors according to national accounting system (Akdogan, 2009). Cost factors were determined as the current market prices of buffalo material, feed cost, labour cost (including family cost, hired labour cost and herdsmen), veterinary services, drug and miscellaneous cost, which are depreciation cost, energy, repair, interest cost and management cost. Income factors for buffalo fattening were determined as buffalo sales value, calf and manure incomes.

Efficiency of resource usage in buffalo fattening was evaluated by Cobb-Douglas production function;

$$Y = f(X_1^{b_1}, X_2^{b_2}, X_3^{b_3}, X_4^{b_4}, \ldots\ldots\ldots\ldots X_n^{b_n})$$

$$\text{Log}Y_i = \text{Log}\,a + b_1 \times \text{Log}X_1 + b_2 \times \text{Log}X_2 + b_3 \times \text{Log}X_3 + \ldots\ldots\ldots + b_n \times \text{Log}X_n$$

Where:

Y = Total income (output)-Turkish Lira (TL)
X_1 = Fattening material (TL)
X_2 = Feed cost (TL)
X_3 = Labour cost (TL)
X_4 = Veterinary services and drug cost (TL)
X_5 = Miscellaneous cost (TL)

Regression analysis was applied on the data by conducting SPSS statistical program. Marginal Value

Productivity (MVP) was calculated according to multiply regression analysis, obtained by econometric model (Heady and Dillion, 1961).

RESULTS AND DISCUSSION

Cobb-Douglas type production function test was employed to investigate the buffalo fattening. The results of the MVP for input factors and regression analysis results were shown in Table 1 and 2.

It is argued that one of the different approaches to improve productivity is to examine whether the use resource is efficient or not. If the use of resource is found as inefficient, productivity may be increased by making proper adjustment and coordination in the use of factors of production among different categories of enterprises in an optimal direction (Gunlu *et al*., 2002).

The elasticity coefficient associated with (X_1) indicates that, keeping X_2-X_5 constant at their geometric mean levels 1% increase in X_1 will, on an average, increase the output of buffalo fattening production by about 0.656%.

The adjusted coefficient of multiple determinations (R^2) was found to be statistically important (Table 2). According to the regression analysis results on buffalo fattening enterprises results can be explained as 95.00%. The autocorrelation in the residual from the regression analysis was tested by Durbin-Watson statistics. The value of 2.052 for Durbin-Watson statistics sings that there is no autocorrelation in the equation.

Return to scale was determined as 1.02. This means that there was constant return to scale in buffalo fattening enterprises in Turkey. This value is similar with the earlier reviews reported in livestock sector (Cevger, 1997; Raina *et al*., 1993; Sakarya, 1990; Gunlu *et al*., 2002), but higher than reported by Yasankul (1974).

In this study, the least average value product was found in fattening material and the highest ones were in veterinary medicine and drug cost. The MVP of input factors, as important factor for determining resource usage level were calculated for X_1-X_5 as 1.40, 1.36, 0.015, 4.403 and -3.112, respectively. This value showed that marginal 1 TL for fattening material cost had marginal 1.40, income for enterprises in buffalo fattening. According to the marginal value results of fattening material it could be said that the enterprises increased in their scale, this is considered as a beneficial activity for the farmer. For this aim, buffalo breeding enterprises, especially dairy enterprises, might be supported financially by the government. This is very important to save the buffalo number in Turkey, which has been decreasing continuously for two decades.

MVP for feed cost was calculated as 1.36 TL. If this marginal value is evaluated with together technical parameters such as feed conversation ratio, rough and concentrate feed consumption (Table 3), it could be said that management and feeding technique is necessary and have to be taken in account for practice. For this aim enterprise owners have to be educated about the effective buffalo fattening technique. Appropriate fattening technologies would help to reach the above goals and also to ensure the profit for farmers (Le Viet, 2001).

Unbalanced feed and buffalo meat prices are other important factors affecting the buffalo farm profitability and resource usage efficiency. The imperfect competition market condition is the other factor reducing feed efficiency in resource usage. At the end of the buffalo fattening period, buffaloes can be marketed in imperfect competition. This situation prevents competition as regards to meat price, although, the price of concentrate mixture is getting higher (Sekerden, 1998).

MVP for labour cost was calculated as 0.015 TL. Marginal 1 TL had marginal 0.015 TL revenue in buffalo fattening enterprises because of family labour relation in the sector. The high percentage unemployment rate in the rural area is the main factor for using inefficient resource usage in labour. The labour is generally not considered as a scarce resource in the buffalo fattening enterprises. The family owned small scales of buffalo fattening productions use intensive labour force and this is a cause of the inefficient labour usage.

Marginal value product was 0.099 in veterinary medicine costs. It is well known that buffalo has natural resistance for the common bovine diseases. Some limited

Table 1: Estimated buffalo meat production in Afyonkarahisar Region, Average Value Productivity (AVP) and Marginal Value Productivity (MVP) of input factors

Input factors	Elasticities (X±Sx)	Geometric mean	Antilog	AVP	MVP	Adjusted (R^2)
Revenue (Y)	-	4.147±0.261	17032	-	-	0.95
Buffalo (X_1)	0.656±0.188**	3.825±0.225	7708	2.138	1.403	-
Feed (X_2)	0.406±0.122**	3.632±0.249	5099	3.361	1.364	-
Labour (X_3)	0.030±0.174*	3.513±0.080	3322	4.959	0.015	-
Veterinary medicine (X_4)	0.099±0.050**	2.570±0.262	444	44.470	4.403	-
Miscellaneous (X_5)	-0.159±0.076	2.982±0.201	1076	16.460	-3.112	-
Constant	0.065±0.516	-	-	-	-	-
Return to scale	1.02	-	-	-	-	-

n = 31, *p<0.05, **p<0.01, p<0.001

Table 2: The results of variance analysis together with regression model for buffalo fattening in Afyonkarahisar Region

Models	Sum of squares	df	Mean square	F	Sig.	Durbin Watson
Regression	2.042	5	0.408	114.065	0.000	2.052
Residual	0.090	25	0.004	-	-	-
Total	2.132	30	-	-	-	-

Table 3: Enterprises expenditure and their percentage in total

Cost elements	Minimum	Maximum	Mean	SD
Buffalo	28.85	56.25	42.19	6.33
Feed	14.40	38.17	27.26	4.99
Labour	8.40	35.56	21.57	6.78
Veterinary and medicine cost	0.67	6.14	2.63	1.37
Miscellaneous	3.58	15.91	6.36	2.59

n = 31

diseases such as tympani, foot diseases and some digestibility disorders were determined, especially in intensive buffalo fattening enterprises.

Marginal value product was -0.159 in miscellaneous cost. These factors include investment depression cost, interest cost and repair and maintain cost. It seems likely that the important amount investment for buffalo fattening is not an advantage for profitable and effective resource usage for buffalo meat production. Low profitability and high price in feed are problems, which have to be solved by government. High interest rate credit is another problem has to be solved. So, interest policy on buffalo fattening implicated by government has to be reduced according to low profitability of the buffalo fattening sector.

Determining positive marginal product value of input factor, fattening material, feed labour, veterinary medicine and drug cost are similar to the reported an econometric function model results by Karki *et al.* (2006). In contrast to this study result, the positive effect of credit on the buffalo production is being reported by Karki *et al.* (2006). This result could be arisen from the different credit interest and different credit usage percentage. The descriptive statistics of expenditure of the buffalo fattening in research area was shown in the Table 4.

As it can be shown in Table 4, the most important cost factor of the buffalo fattening is the fattening material. The other important factor is the feed expenditure. The important feed expenditure is arising from purchasing concentrate feed. It was determined in the research area that average daily 8.08 kg animal^{-1} concentrate feed is consumed. Vet and medicine cost is nearly 2% of total expenditure. Except of the fattening material cost, the cost factor of buffalo fattening value determined in the study is similar with the reported of Giudice (2004). Some technical parameters in the buffalo fattening process were shown in Table 4.

Table 4: Some technical parameters in buffalo fattening in Afyonkarahisar Region

Parameters	Values
Average daily rough feed consumption (kg daily^{-1})	4.31
Average daily concentrated feed consumption (kg daily^{-1})	8.08
Total feed consumption (kg daily^{-1})	12.39
Feed Conversation Ratio (FCR)	10.99
Fattening period (day)	178.20
Average buffalo number	10.45
Capacity usage percentage	39.92

Buffalo fattening is performed upon the semi-intensive condition and the fattening period is lasted nearly 178 days. Average feed conversation ratio was calculated as 10.99 and total feed consumption of buffalo determined 12.39 kg. This value is greater than the value reported by Aksoy and Alpan (1991), Marques *et al.* (2006) and Olivera *et al.* (2007). This also indicates that there are important technical and managerial problems in buffalo fattening enterprises in the production process. Average capacity usage has been declerated 39.92% by the farmer.

This low capacity is a sign that buffalo fattening have important economic and technical problems. If these problems are solved by the government, the buffalo fattening will be a valuable meat production source. Otherwise, reduction in the number of the buffalo can not be stopped. Because of the low buffalo number and insufficient general livestock policy, necessary precaution is needed for the maintain buffalo in Turkey (Ertugrul *et al.*, 2005).

Buffalo fattening production is being done in small scale enterprises like that the other livestock sector in Turkey (TSI, 2004). In the study, average buffalo number in the enterprises was determined as 10 heads. The small scale enterprises is similar to the value by reported FAO in widely buffalo breeding country like that India, Pakistan, Nepal, Egypt, Iran, Azerbaijan, Bangladesh and Vietnam (Moioli *et al.*, 2000).

These small scale enterprises have important handicaps for both technical and economical buffalo meat production. For the efficient management, breeding techniques such as artificial insemination, progeny testing, evaluation of sire, effectively diseases control program and selecting the better breeding stocks can be included in the buffalo milk production enterprises.

Buffalo fattening material is generally obtained from the excess and discharged buffalo cow, buffalo heifer, buffalo bull from the buffalo milk production enterprises. This is contribution to increase both buffalo milk and buffalo meat production and also contribute to the unemployment in the rural are.

CONCLUSION

It was concluded that buffalo fattening is being performed far away from the optimal economical and technical condition. The farmers should be supported both financial and education to obtain optimal resource allocation. Research clearly showed that balanced feeding and optimal fattening time would reduce the expenditure and increase the profitability of buffalo fattening enterprises.

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