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A Comparison of Profitability and Economic Efficiencies Between Native and Culture-Breed Cattle Fattening Farms in Eastern Part of Turkey

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Abstract: In this study the comparison of profitability and economic efficiency of native- breed and culture-breed fattening farms was aimed. The data belong to 1999 production period and was collected from 35 native-breed and 18 culture-breed-fattening farms in Center town of Van province, Turkey using strafed random sampling method. The average number of cattle, fattening period, live weight gain per cattle per fattening period and daily weight gain per cattle was 33.11, 168 days, 118.37 kg and 710.60 g, respectively for native-breed cattle fattening farms. The same figures were considerably higher for culture-breed fattening farms with 43.67, 186.67 days, 184.70 kg and 993.57 g, respectively. The economical and financial profitability rates were 31.25 and 31.53% and 35.73 and 36.18% for native-breed and culture-breed fattening farms, respectively. The cost of 1 kg of live weight gain was calculated as $ 4.96 for native-breed compared to $ 3.73 for culture-breed fattening farms. The total production elasticity of inputs was 0.7988 and 1.606, respectively for native-breed and culture-breed cattle fattening farms, which means there exist decreasing return to scale for native-breed and increasing return to scale for culture- breed cattle fattening farms.

Key words: Profitability rates, costs, cattle fattening farms, Turkey

INTRODUCTION

Taking into consideration the high rate of population, moderate increases in income and considerable high-income elasticity, it is clear that the demand for meat will stay strong in Turkey. Recent foreign trade statistics indicate that Turkey has begun importing considerable quantities of red meat. To offset the growing gap between the domestic supply of and demand for read meat, programs directed at enhancing productivity and profitability should be established (Yurdakul *et al*., 1999).

A sustainable profitability rate is essential for the feasibility of cattle fattening activities. Such a level of profitability will contribute to continuity of the enterprise and thus reduce the gap between the supply of and demand for beef meat in Turkey. Increasing the number of culture-breed cattles in the herd is considered as an important step to achieve such a target (Meyn, 2005; Sturaro *et al*., 2005; Erkuo *et al*., 1987). Daily weight gain per cattle, the purchased feed expenses and the production efficiency are the major factors, which affect the profitability (Julien *et al*., 2002; Coldow *et al*., 2005; Wolfova *et al*., 2004). Profitability is also influenced from sale prices (Inan, 1986), resource management (Sturaro *et al*., 2005; Bortolussi *et al*., 2005; Pihamaa and Pietola, 2002), economics of scale (Riddell, 2005; Headley *et al*., 2002) and government supports (Lopez *et al*., 2005; Yurdakul *et al*., 1999).

The contribution of cattle fattening farms is substantial to farm income in Turkey and the continuity and growth of feed manufacturing and veterinary services depend in great extent on profitability levels of the sector. The sector has also great contribution regarding the exploiting family labor potential, which is abundant in the region, mitigating the migration from rural to urban areas (Yildirim and Sahin, 2006) and providing a regular cash flow for the enterprise all the year (Oktay, 1988). Regarding the maintenance of the stability and growth of livestock sector, Turkish government policies included import restrictions of meat products, animal disease control, subsidized culture-breed heifer, aid for artificial insemination, input price subsidies, export subsidies and agricultural credit.

In this study the comparison of the profitability and economic efficiency of native and culture-breed cattle fattening farms was aimed. The hypothesis was that the culture-breed cattle-fattening farms would have higher 1 kg live weight gain per cattle, less production costs per 1 kg live weight gain and thus higher economical and financial profitability rates compared to that of native breed fattening farms. Another hypothesis was that the scale is effective on profitability and consequently the profitability would rise as scale increased.

Daily live gains, production efficiency and cost reductions are the major factors affecting the profitability. Wolfova *et al.* (2004) stated that when integrating feedlot, only the purebred system with mating female replacement at an early age (about 15 months) and selling breeding bulls showed profitability in Czechlovian beef farms, but at a low level (5%) and that the beef prices and daily gain seemed the most important factors influencing the profitability. Bortolussi *et al.* (2005) who conducted a survey examining 375 farms selected from northern Australian beef producers during 1996 and 1997 reported that increasing turn-off weight and branding rate and decreasing turn-off age were greatest interest of beef producers and that improving pasture management rated highly. Coldow *et al.* (2005) reported that British beef producers needed to function at maximum efficiency if profitability was to be achieved and that cattle practitioners therefore had to demonstrate a sound knowledge of the principal factors that impact on beef cow herd productivity and the ability to translate that knowledge into effective herd investigative strategies and planned intervention programmes. Lopez *et al.* (2005) who investigated eleven typical organic beef farms within framework of the International Farm Comparison Network reported that Germany and Austria produced at the highest costs and the profitability in Germany was relatively low despite high level of direct payments. They concluded that the price differences between domestic and potential export markets would determine the extent of organic beef production thus cost reductions remained a strategy for the producers. Bojnec and Peter (2005) reported that the increased competitive market pressures were very likely to increase efficiency in the beef market in Slovenian food markets and that this needed in the increased competitive market pressures of the enlarged European Union markets. Bitterman *et al.* (1999) reported that the gross profit per cattle for 68 cattle fattening farms in Austria was 5.155 Austria Shilling and that this figure was 6.360 Austria Shilling for farms with 25% higher gross profit and 3.012 Austria Shilling for farms with 25% less gross profit than that of overall farms. Murgas (1997) reported that the beef farms yearly activities in Slovakia resulted in loss excluding the subsidies and that the most important factor affecting the profitability was live weight gain level during the fattening period. Kılıç *et al.* (1994) who investigated 75 cattle fattening farms in Tokat, Turkey found the production elasticies of inputs as 1.321. Karkacıer (1990) reported that the cattle fattening farms in Tokat, Turkey obtained 1.5 kg live weight gains per 100 kg wet residue of sugar beet and that the producer could benefit from contractual cattle fattening.

The reported average daily live weight gain per cattle in Turkey was 659 g (ranging from 464 and 937 g according to farm size) in Elazığ (Kabukçu, 1976); between 508 and 1000 g in Erzurum (Hatunolu, 1976); between 0.845 and 0.965 g in Ankara and Konya (Demirci, 1985); 0.850 g in Çorum (Fidan, 1992), 730 g in Ankara (Kıral, 1993); 897 g and 573.6 g for culture and native-breed fattening farms, respectively in Çubuk, Ankara (Gundomuo, 1993) and 1.051 g in Bayburt (Ozkan and Erkus, 2003).

Regarding the comparison of different types of cattle fattening farms Sturaro *et al.* (2005), reported that genotype, farm type, percentage of unhealthy animals and season of sale significantly affected the average daily gain of 29 cattle farms in Veneto region of Italy and that Charolais and French Crossbred showed the highest values of average daily gains. Gundomuo (1993) who compared the profitability of 9 native-breed and 26 culture and cross-breed farms in Çubuk, Ankara, Turkey reported that economical and financial profitability rates per farm were higher for culture and cross-breed farms (4.4 and 3.58%, respectively) compared to native-breed farms (1.99 and 0.40%, respectively). Ozcelik (1995) compared the open and closed system cattle fattening activities in Ankara, Turkey and reported that although the feed intake per cattle was higher in open system, this system was more advantageous due to the higher 1 kg live weight gain, net profit and economical profitability rates. Ersöz (1991) who compared the profitability of 50 fattening and dairy cattle farms reported that the gross profit per animal was lower for cattle fattening farms (TL 172.163) compared to dairy cattle farms (TL 215.636).

Economical profitability rates per cattle in Turkey were reported as 12.22% in Elazığ (Kabukçu, 1976); 18.39% in Ankara and Konya (Demirci, 1985); 4.4 and 1.99% for culture and native-breed fattening farms, respectively in Çubuk, Ankara (Gundomuo, 1993); 20.63% in Ankara (Kıral, 1993) and 1.05% in Bayburt (Ozkan and Erkus, 2003).

Some previous studies indicated that the profitability increased in proportion to farm size. Riddell (2005), who investigated the UK beef industry reported that farmers looking to remain in beef production in the long term needed to cut significant costs from their production systems and that this was most easily achieved through increasing scale of operating, specialization into the part of production that suited their resources best and co-operation with others as demonstrated by members of Borders Quality Beef Cooperative. Studies conducted in different parts of Turkey, namely in Kayseri (Arıkan, 1971); in Erzurum (Zoral, 1973); in Ankara and Konya, Turkey (Demirci, 1985); in Ankara (Kıral, 1993); in

Çubuk, Ankara (Gundomuo, 1993) and in Bayburt (Ozkan and Erkus, 2003) showed that economical profitability rates per farm raised as farm scale increased.

MATERIALS AND METHODS

In collaboration with authorities responsible for animal health in the Directory of Agricultural Organization in Van, Turkey (A province in eastern part of Turkey), the districts that were dominant in cattle fattening activities were determined. The research population consisted of 432 cattle-fattening farms from 12 districts, in Center town of Van province, which 67% raised native-breed cattle. The sample size was determined by using the following strafed random sampling method (Yamane, 1967; Erkan *et al*., 1991).

$$n=\frac{N.\sum N_h.S^2_h}{N^2.D^2+\sum N_h.S^2_h}$$

Where,

N = Total number of farms, S^2h= Variance of h th strata, $D^2 = d^2/Z^2$
d^2 = Error size permitted from population mean
Z^2 = Z value in the standard normal distribution table
N_h = Number of farms in the h th strata

The sample size was found as 53 farms within 10% acceptable error limit. Of total 53 farms, 35 were selected randomly from native-breed and the remaining 18 from cross-breed fattening cattle farms taking into account the percentage distribution of population. The native-breed farms were classified into three groups. The first group (1-15 cattle), the second group (16-30 cattle) and the third group (more than 31 cattle) consisted of 15, 11 and 9 farms, respectively. The data belong to 1999 production period and were collected by means of questionnaires interviewing with farm managers. Family labor potential was expressed in terms of man-days using generally accepted coefficients (Erkuş *et al*., 1995; Rehber and Cetin, 1998). The production costs were classified as variable and fixed costs. Gross and net profit was calculated by subtracting the variable and production costs, respectively from gross production value (İnan, 1999; Oktay, 1988). The economic and financial profitability rates were calculated, by dividing the net return to total assets and the return of owned assets to owned assets, respectively. (Kıral, 1993; Gundomuo, 1993). The cost of 1 kg live weight was calculated by dividing the total costs minus the manure income to live weight at the end of fattening period. The costs of 1 kg live weight gains was calculated by dividing the total costs excluding the purchasing costs of fattening cattle minus the income manure to the live weight gain at the end of fattening period (Kıral, 1993).

In order to determine the relationship between live weight gains of cattle fattening farms and the inputs used Coob-Douglas production function was applied. Stepwise regression method was used to find the best model explaining the change in dependent variable. One-way variance analysis methods were used to compare native and culture-breed cattle fattening farms and the size group of native-breed cattle fattening farms (Miran, 2003).

RESULTS

Some general characteristics of farms: The number of person per household, the rate of 15-49 age group, and the illiterate rate was 10.00, 51.50 and 24.3%, respectively for native-breed fattening cattle farms. These figures were 10.23, 54.84 and 16.4%, respectively for culture-breed fattening farms. The average age, and the illiterate rate of farm managers were 45 years and 22.90%, respectively for native-breed fattening cattle farms. The same figures were 40 years and 11.3%, respectively for culture-breed fattening cattle farms. Family labor potential, the rate of utilization of family labor potential and family labor in total labor utilization was 1.606.1 man-days, 44.1 and 77.8%, respectively for native-breed fattening cattle farms. These figures were 1720.8 man-days, 47.7 and 58.3%, respectively for culture-breed fattening cattle farms. Land per farm, the rate of owned land and irrigation rate was 8.45 ha, 96.75 and 24.0% for native-breed fattening cattle farms. The same figures were 16.65 ha, 89.66 and 37.10%, respectively for culture-breed fattening cattle farms.

Capital and its composition: Total assets per farm, rate of working assets in total assets, the rate of livestock assets in working assets and ratio of owned assets in total assets were $52.860,06, 95.19, 92.12 and 94.42%, respectively for native-breed fattening cattle farms. These figures were $ 116.119.20, 95.11, 86.77 and 94.76%, respectively for culture-breed fattening cattle farms.

Fattening cattle numbers, fattening period and live weight gains: The average fattening cattle number per farm for native-breed fattening cattle farms was 33.11 ranging from 10.13 in the first and 83.78 in the third group. This number was 43.67 for culture-breed fattening farms. The live weight of cattle at the beginning and at the end of fattening period was 197.07 and 315.45 kg, respectively for native-breed fattening cattle farms and these figures increased in parallel to farm size. The same figures were 325.08 and 509.78 kg, respectively for culture-breed

Table 1: The number of fattening cattle, live weight gains and the number of cattle sold

	Native-breed				
	Group I (1-15 cattle)	Group II (16-30 cattle)	Group II (31-+ Cattle)	Overall	Culture-breed
The number of fattening cattle	10.13	23.00	83.78	33.11	43.67
Fattening period (days)	158.00	174.55	176.67	168.00	186.67
Live weight at the beginning of fattening (kg)	158.41**	165.45	300.15**	197.07**	325.08**
Live weight at the end of fattening period (kg)	253.18*	296.31	442.62*	315.45*	509.78*
Live weight gain per cattle per fattening period	94.77	130.85	142.47	118.38*	184.70*
Daily weight gain per cattle (g)	611.99	778.89	791.49	710.60	993.57
The number of cattle sold at the end of fattening period	9.47	21.91	78.89	31.23	43.39

*p<0.05, **p<0.01

fattening cattle farms. The average fattening period, live weight gains per cattle per fattening period and daily live weight gains per cattle were 168 days, 118.38 kg and 710.60 g, respectively for native-breed fattening cattle farms and increased in proportion to farm size. The same figures were 186.67 days, 184.70 kg and 993.57 g, respectively for culture-breed fattening cattle farms. The native and culture-breed fattening cattle farms marketed 31.23 and 43.39 cattle, respectively at the end of fattening period (Table 1). The difference between native-breed and culture breed cattle fattening farms was statistically significant from live weight at the beginning of fattening period ($p<0.01$), live weight gains per cattle per fattening period ($p<0.05$) and daily live weight gains per cattle ($p<0.05$) point of view. With respect to live weight at the beginning of fattening period ($p<0.01$), live weight gains per cattle per fattening period ($p<0.05$) and concentrates feed intake per cattle per fattening period, the first and the third groups of native-breed cattle farms differed significantly.

Labor demand and feed intake: The average daily labor demand per cattle was 0.25 h for native-breed fattening cattle farms and decreased according to farm size being highest with 0.57 h in the first and lowest with 0.16 h in the third group farms. This figure was 0.23 h for culture-breed fattening cattle farms. The forage and concentrates feed intake per cattle per day were 9.04 and 6.72 kg for native-breed fattening farms and 12.35 and 7.19 kg for culture-breed fattening farms, respectively. The forage and concentrates feed intake to obtain 1 kg live weight gain was 12.53 and 9.52 kg and 12.04 and 7.59 kg, respectively for native and culture-breed fattening farms.

Gross production value: The gross production value per farm for native-breed fattening farms was $ 46.579,36 and increased according to farm size ranging from $ 8.511,58 in the first to $ 136.994,21 in the third groups. This figure was $96.162,96 for culture-breed fattening farms. The rate of animal sales in gross production value made up 99.52 and 99.66%, respectively for native and culture-breed fattening farms. Gross production value per cattle per fattening period was $ 1.491,49 for native-breed fattening farms and increased in parallel to farm size being lowest in the first group farms with $ 898,79 and the highest in the third group with $ 1.736, 52. This figure was $ 2.216, 25 for the culture-breed fattening farms.

Production costs: Production costs per farm were $ 33.726,33 and $ 62.086,94 respectively, for native and culture-breed fattening farms. The rate of variable costs accounted for 96.62 and 96.52% of total production costs, respectively for native and culture-breed fattening farms. The costs of cattle purchases at the beginning of fattening period made up 44.91% of production costs followed by feed costs with 34.56% for native-breed fattening farms. The same ratios were 51.34 and 28.46%, respectively for culture-breed fattening farms. The production costs per cattle per fattening period was $ 1.079,93 and $ 1.430, 90, respectively for native and culture-breed fattening farms.

Net profit and net return: Net profit and net return per farm was $ 12.853,01 and $ 16.518, 62, respectively for native-breed fattening farms and increased in parallel to farm size. The same figures were $34.076,02 and $ 41.489,05 for culture-breed fattening farms, respectively. Net profit and net return per cattle per fattening period was $ 411.56 and $ 528.93 for native-breed fattening farms and increased in proportion to farm size. These figures were $ 785.34 and $ 956.19 for culture-breed fattening farms (Table 2).

Profitibality rates: Economical and financial profitability rates were 31.25 and 31.63%, respectively for native-breed fattening farms and increased according to farm size. The same ratios were 35.73 and 36.18% for culture-breed fattening farms (Table 2).

Cost of 1 kg of live weight gains: The cost of 1 kg of live weight gains was $ 4.96 for native-breed fattening farms

Table 2: Net profit, net return, economical and financial profitability rates and the costs of 1 kg live weight gains

	Culture-breed				
	Group I (1-15 cattle)	Group II (16-30 cattle)	Group II (31-+ cattle)	Overall	Native-breed
Net profit per farm ($)	1.003,80	6.173,64	40.144,05	12.853,01	34.076,02
Net return per farm ($)	1.792,20	8.235,09	5.1116,88	1.6518,62	41.489,05
Net profit per cattle per fattening period ($)	106.00	281.77	508.86	411.56	785.34
Net return per cattle per fattening period ($)	189.25	375.86	647.95	528.93	956.19
Economical profitability (%)	15.42	29.02	33.74	31.25	35.73
Financial profitability rate (%)	14.34	29.24	34.10	31.53	36.18
The cost of 1 kg live weight gain ($)	5.21	3.88	4.51	4.96	3.73

being lowest with $ 3.88 for the second groups and the highest with $ 4.51 for the third groups. This figure was $ 3.73 for culture-breed fattening farms (Table 2).

Cobb-Douglas production function: Cobb-douglas production function for native-breed fattening cattle farms was as follows:

$$Y = 0.0669 X_1^{0.522} X_2^{0.386} X_3^{0.937} X_4^{0.365} X_5^{0.0238} X_6^{-0.010} X_7^{-0.381}$$

Where,

- Y = Total live weight gains per farm per fattening period (kg)
- X_1 = The number of fattening cattle
- X_2 = Live weight of cattle at the beginning of fattening period (kg)
- X_3 = Fattening period (days)
- X_4 = Total forage feed intake of cattle during fattening period (kg)
- X_5 = Total concentrates feed intake of cattle during fattening period (kg)
- X_6 = The capacity of barn (M_2)
- X_7 = Total man-days labor demand during the fattening period (hours)

The total production elasticities of inputs were 0.7988 and the determination coefficient (R^2) was 0.928. The production elasticities of X_2 and X_3 were statistically significant ($p<0.05$). Since the production elasticity of X_6 and X_7 was negative, the economic optimum point could not be found (Erkuş *et al*., 1996).

Equation found using stepwise regression method was as follows:

$$Y = 0.3090 X_2^{0.298} X_3^{0.794}$$

The determination coefficient (R^2) was 0.919 being statistically significant ($p<0.01$). The total production elasticities of inputs were 1.092.

The regression model for culture-breed fattening cattle farms was as follows:

$$Y = 0.0669 X_1^{0.08412} X_2^{0.406} X_3^{0.449} X_4^{0.079} X_5^{-0.3144} X_6^{-0.8557} X_7^{0.705}$$

The total production elasticities of inputs were 1.606 and the determination coefficient (R^2) was 0.995. The production elasticities of X_2, X_6 and X_7 were statistically significant ($p<0.05$). Since the production elasticity of X_5 and X_6 was negative, the economic optimum point could not be found (Erkuş *et al*., 1996).

Equation found using stepwise regression method was as follows:

$$Y = 0.0647 X_2^{0.433} X_3^{0.526} X_6^{-0.7210} X_7^{0.623}$$

The determination coefficient (R^2) was 0.995 being statistically significant ($p<0.01$). The total production elasticities of inputs were 1.51.

DISCUSSION

Culture-breed fattening farms had 2.19 times more assets than that of native-breed dairy farms. The borrowing rates were low both for culture and native fattening farms with 5.24 and 5.58%, respectively. This figure was reported as 9.40 and 14.44% for culture and native-breed cattle fattening farms, respectively in Çubuk, Ankara, Turkey (Gundomuo, 1993). The low borrowing rate could be attributed to low profitability rate in return to high credit interest rates, small scale production and fluctuations in sale prices.

The average daily weight gains per cattle were 993.57 g for culture-breed fattening farms against 710.60 g which means nearly 39.82% higher average daily weight gains for native breed fattening farms. The reported figures of daily weight gains for culture and cross breed cattle of 0.850 g in Çorum, Turkey (Fidan, 1992) and 730 g in Ankara, Turkey (Kıral, 1993); were lower while the 1.051 g in Bayburt, Turkey (Ozkan and Erkus, 2003) were higher compared with the results found in this study.

Economical profitability rates per farm for culture-breed farms were 35.73% against 31.25% for native-breed fattening farms. The higher profitability rates could be attributed to higher live weight gains per cattle per fattening period, lower production costs per 1 kg live weight gains and more efficient marketing strategies

because of economics of scale. Economical profitability rates in different part of Turkey were reported as 18.39% in Ankara and Konya (Demirci, 1985); 4.4 and 1.99% for culture and native-breed fattening farms, respectively in Çubuk, Ankara (Gundomuo, 1993); 20.63% in Ankara (Kıral, 1993) and 1.05% in Bayburt, (Ozkan and Erkus, 2003). All these figures were lower than the economical profitability rate of this study. Profitability is influenced in great extent from inputs prices and sale prices, which fluctuate substantially between years in Turkey. So, different rates of profitability should be considered as normal. It should be known that the sale prices of surveyed year were relatively high, which contributed positively to the high profitability rates in the studied farms.

The cost of 1 kg live weight gain was 24.79% higher for native-breed compared with culture-breed fattening farms ($ 4.96 against $ 3.73). Among the major reasons for the lower cost of 1 kg live weight gains, the relatively more advantageous purchasing cattle prices and more efficient feed usage can be cited. The forage and concentrates feeds intake to obtain 1 kg live weight gains were 12.53 and 9.52 kg for native-breed fattening farms and 12.04 and 7.59 kg for culture-breed fattening farms, respectively.

Production elasticities of inputs was 0.7988 and 1.606 for native and culture breed cattle fattening farms, respectively, which means there exists decreasing return to scale for native-breed and increasing return to scale for culture-breed fattening farms.

From the main efficiency and profitability indicators point of view the culture-breed fattening farms were at relatively more advantageous position compared to native-breed cattle fattening farms. The main performance indicators were also in favour of relatively large-scale group of native-breed cattle fattening farms. Consequently, we recommend the increasing number of culture-breed cattle in the herd and expanding the cattle fattening enterprise so that the benefits from economics of scale could be exploited. One of the solutions toward this target may be partnership among the producers.

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