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A Comparison of Profitability Between Culture and Native-breed Dairy Farms (Case Study of Eastern Part of Turkey)

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Abstract: The comparison of the profitability of culture and native-breed dairy farms was aimed in this study. The hypothesis that culture-breed dairy farms are more profitable as well as more cost-efficient in producing one unit of milk and that the profitability increases in proportion to farm size was tested. The material was collected from 40 culture and 16 native-breed dairy farms in Center town of Van province, Turkey. The data belong to 1999 production period. The number of cow per farm, daily milk per cow, lactation period, milk production per cow per lactation and total milk production per farm was 8.3, 7.63 kg, 225.5 days, 1720.6 and 14.289.7 kg, respectively for culture-breed dairy farms. The same figures were relatively lower for native-breed dairy farms with 4.4, 3.24 kg, 208.13 days, 674.3 and 2.967 kg, respectively. Economical profitability was positive with 3.27% for culture-breed farms while this figure was negative for native-breed farms with -1.14%. Both economical and financial profitability increased in parallel to farm size. The cost of 1 kg of milk was calculated as $ 0.47, which is 60% higher than that of culture-breed dairy farms. This figure decreased in proportion to farm size. The total production elasticity of inputs found by coob-douglas production function for culture-breed dairy farms was 2.97, which means there is an increasing return to the scale. We can suggest that the scale is effective on the profitability and expanding the culture-breed dairy enterprise could increase the profitability due to economies of scale.

Key words: Profitability rates, costs, dairy farms, Turkey

Introduction

In order to meet the milk needs of an increasing population, a sustainable profitability level should be maintained for dairy farms. One of the solutions towards this target is to increase the number of culture-breed dairy cattle with high milk yield in the herd (Erkuş *et al*., 1996). Milk yield per cow is one of the major factors affecting the profitability (Gloy *et al*., 2002). The profitability is also influenced by more efficient uses of resources (İnan 1986), the amount of the concentrates consumed (Schaik *et al*.,1996); availability and the quality of pasture (Abdalla *et al*.,1999); the prices of milk and inputs (Yurdakul 1978); farm size and farm location (Wadsworth *et al*., 1992); organizational and personnel management (Howard *et al*.,1999) and the economies of scale (Headley *et al*., 2002).

In regard of exploiting the family labor potential, which is abundant in the region and promoting the production of feed plants, the dairy farms have great contributions. Dairy cattle enterprises also

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provide a regular cash flow for the enterprise all the year (Oktay, 1988). Furthermore, it can mitigate the migration from rural areas and promote establishing and improving the dairy factories in the region thus contribute to employment.

In this study the comparison of the profitability of culture and native-breed farms was aimed. The hypothesis was that the culture-breed dairy farms would have higher economical and financial profitability and lower costs of 1 kg of milk compared to that of native breed farms. Another hypothesis was that the scale is effective on profitability and the profitability would increase in proportion to farm size. To this end, the major yearly results of the dairy farms were analyzed.

The previous studies in Turkey showed that feed costs were the single most important cost item. The rate of feed costs in operating costs was 51.1, 55.60, 51.60 and 50.26%, respectively in Izmir (Aras and İzmirli, 1976); Adana (Yurdakul, 1978); Çorum (Fidan, 1992) and İzmir and Manisa provinces (Talim *et al*., 1998). The feed costs consisted of 72.88 and 83.98% of total variable costs, respectively for 40 (Bal and Yıldırım, 1999) and 38 dairy cattle farms (Dedeoğlu and Yıldırım, 2005) in Van province. A great deal of studies indicated that the profitability was higher for culture-breed dairy farms compared to native-breed dairy farms. Erkuş *et al*. (1996) found the milk yield per cow per lactation as 5.729 and 4.269 kg, respectively for 27 imported culture-breed and 46 half-bred dairy farms in Tekirdag, Turkey and reported that the gross production value was 27.47% higher for imported culture-breed dairy farms. Gul (1998) reported that gross and net profit per farm was respectively 2.50 and 3.36 times higher for dairy farms involved with a project controlled by Agriculture Director of Adana, Turkey compared to the farms that not involved. Saner (1993) stated that the successful dairy farms had a higher productivity and they used less labor per cow compared to unsuccessful farms. Shawkat *et al*. (1995) found that the imported first-calf heifers had significantly more days open, longer lactation length, higher number of services per conception, higher repeat breeder and culling rates and produced more milk in their first lactation compared with the Jordanian Friesian first-calf heifers. Hanson *et al*. (1998) stated that net income per cow was higher for dairy farms that employed moderate intensive grazing than for dairy farms that employed extensive grazing in Pennsylvania and New York. Dart *et al*. (1999) reported that 35 Michigan dairy farms implementing management-intensive grazing had more economic profit than 18 conventionally managed dairies and that they captured this profit by being more efficient in asset use, operating practices and labor use. Tauer (2001) stated that the costs of 1 kg milk for 50-cow farms and 500-cow farms were respectively $ 0.299 and $ 0.287 in New York dairy farms and that efficient small dairy farms could be competitive with larger dairy farms in producing milk at comparable costs per unit. The major factors that affect the profitability in dairy farms in Adana, Turkey were enumerated as input prices, milk sale prices and the efficient uses of resources (Yurdakul, 1978). Inan (1986) found that gross margin of optimum business plans were between 57.4 and 107.8% higher than that of existing plans for dairy farms in Tekirdag, Turkey. Erkuş *et al*. (1987) stated that high feed costs was the major factor restraining the dairy cattle activities in Eskişehir and Burdur, Turkey. Howard *et al*. (1990) reported that management factors were related to both milk output and herd reproduction efficiency for 87 farms in Tulare County, California and that greater attention to organizational and personnel management could improve the productivity of workers, which will translate to economic outcomes. Wadsworth *et al*. (1992) stated that 80% of 124 New England dairy farms were in good financial position in 1984 and that production per cow, farm operating expenses per cow, milk price, non-milk sources of farm income, farm size, farm location and land purchases in the last 5-years period were statistically significant determinants of financial performance. Schaik *et al*. (1996) reported that milk production and calving interval were the main indicators describing the performance of the 18

smallholder dairy farms investigated in Murang district of Kenya and that both milk production and calving interval were influenced by the amount of concentrates-fed suggesting that feeding concentrates is an important indicator of high farm performance. Abdalla *et al*. (1999) stated that milk production was being limited by pasture availability, the quality of pasture and the lack of supplementation in most Brazilian dairy herds. Schmit *et al*. (2001) investigating the financial risks of a group of New York producers from 1988 through 1997 reported that the major contributors to variability in returns to New York dairy farms were variability in purchased feed quantities and milk production. Solanoa *et al*. (2001) studying farmers' objectives and the factors affecting them for 91 dairy farms in Costa Rica reported that age, educational level, the distance of the farm to population centers, the level of dedication and pasture area were the characteristics that had the largest impact on the arrangement of objectives. Headley *et al*. (2002) investigating 20 dairy farms in Michigan and Wisconsin, US that had one-time herd size increases of at least 20% between 1988 and 1998, reported that herd size increased from 296 to 569 cows and that the most commonly cited reason for expansion was increased profits. Gloy *et al*. (2002) using data from 237 nongrazing and 57 grazing farms participating in the New York farm business summary program reported that herd size, rate of milk production per cow and prices received from milk have a strong positive impact on profitability .

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 dairy cattle activities were determined. The research population consisted of 468 dairy cattle farms from 11 districts, in Center town of Van province, which 72% raised culture-breed dairy cattle. Sample farm 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 56 farms within 10% acceptable error limit. Of total 56 farms, 40 were selected randomly from culture-breed and the remaining 16 from native-breed dairy farms taking into account the percentage distribution of population. The culture-breed farms were classified into three groups. The first group (1-5 cattle), the second group (6-10 cattle) and the third group (more than 10 cattle) consisted of 21, 11 and 8 farms, respectively. Data were collected by interviewing with farm managers by means of questionnaires. The data belong to 1999 production period.

Family labor potential was expressed in terms of man-days using generally accepted coefficients (Oktay, 1988). 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 (Inan, 1999; Oktay, 1988). The economic profitability was calculated by dividing the gross return to total assets (Kıral, 1993). The cost of 1 kg milk was calculated by subtracting the income of calf and manure from the production costs and dividing the remaining result to milk quantity produced (Kıral *et al*., 1999).

In order to determine the relationship between milk quantity and the inputs used Coob-Douglas production function was used. Step-wise regression method was applied to find the best model explaining the change in dependent variable (Weisberg, 1985). Culture-breed farms were classified into success groups according to milk yield per cow per lactation. The Fisher and Kruskal Wallis' one-way variance analysis methods were used to compare the success groups (Oktay and Özkaya, 1994).

Results

Some General Characteristics of Farms

The number of person per household, the rate of 15-49 age group and the illiterate rate was 9.21, 49.95 and 15.9%, respectively for culture-breed farms. These figures were 9.13, 49.94 and 29.8%, respectively for native-breed dairy farms. The average age, experience period and the illiterate rate of farm managers were 47.7 years, 23.3 years and 5%, respectively for culture-breed farms. The same figures were 47.4 years, 26.4 years and 31.3%, respectively for native-breed dairy farms. Family labor potential, the rate of utilization of family labor potential and family labor in total labor utilization was 1689 man-days, 34.7 and 81.7%, respectively for culture-breed farms. These figures were 1521 man-days, 24.3 and 90%, respectively for native-breed dairy farms. Land per farm, the rate of field land and irrigation rate was 148.1 decare, 96.8 and 29.1% for culture-breed farms. The same figures were 82.3 decare, 98.4 and 21.3%, respectively for native-breed 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 own assets in total assets were $ 28.617, 80.74, 82.19 and 92. 27%, respectively for culture-breed farms. These figures were $ 8.966 73.94, 73.18 and 86.79%, respectively for native-breed farms.

Cow Numbers and Milk Yield

The average cow per farm for culture-breed dairy farms was 8.3 ranging from 3.2 in the first and 22 in the third group. Holstein, Simmental and Montofon accounted for 37.10, 34 and 28.90% of total cows, respectively. The average cow per farm for native-breed dairy farms was 4.4. The daily milk yield per cow, lactation period, total milk production per cow per lactation and total milk production per farm was 7.63 kg, 225.5 days, 1720.6 and 14.271 kg, respectively for culture-breed dairy farms. The same figures for native-breed dairy farms were 3.24 kg, 208.13 days, 674.3 and 2.967 kg, respectively (Table 1).

Labor Demand and Feed Consumption

The average daily labor demand per cow for culture-breed dairy farms was 1.05 h and decreased in proportion to farm size ranging from 2.26 h in the first and 0.56 h in the third group. This figure was 1.02 h for native-breed dairy farms. The rough and concentrates feeds per cow was 8.15 and 3.43 kg for culture-breed and 7.7 and 2.28 kg for native-breed dairy farms, respectively.

Table 1: Cow number, milk yield, lactation period and milk production

	Culture-breed				
	Group I (1-5 cattle)	Group II (6-10 cattle)	Group II (11-+ Cattle)	Overall	Native-breed
Cow number	3.20	8.00	22.00	8.3	4.40
Daily milk yield per cow (Kg)	7.66	8.33	7.04	7.63	3.24
Lactation period (days)	220.95	229.09	232.50	225.50	208.13
Milk yield per cow per lactation (kg)	1692.50	1908.30	1636.80	1720.60	674.30
Milk production per farm (Kg)	5,415.90	15,266.60	36,009.60	14,280.70	2,967.10

Gross Production Value

The gross production value per farm for culture-breed dairy farms was $ 9.741,56 and increased according to farm size ranging from $ 4,312.94 in the first to $ 24,386.43 in the third group. This figure was $2,594.34 for native-breed dairy farms. The rate of milk and milk products in gross production value made up 46.92 and 36.49%, respectively for culture and native-breed dairy farms. The milk marketed in culture and native-breed dairy farms accounted for 76.80 and 58.18%, respectively.

Production Costs

Production costs per farm were $ 9,534.61 and $ 3,202.28, respectively, for culture and native-breed dairy farms. The rate of variable costs accounted for 59.07 and 53.48% of total production costs, respectively for culture and native-breed dairy farms. Feed costs made up 52.49% of production costs and 94.37% of variable costs for culture-breed dairy farms. These figures were 44.60 and 83.38%, respectively for native-breed dairy farms.

Gross Profit, Net Profit, Net Return and profitability Rates

The gross profit per farm and per cow was $ 4,109.20 and $ 495.08, respectively for culture-breed dairy farms. These figures were $ 881.61 and $ 200.37, respectively for native-breed dairy farms. Net profit and net return per farm was $ 206.95 and $ 936.96, respectively for culture-breed dairy farms being positive in all except for the first group. The same figures were negative for native-breed dairy farms with $ -607.93 and $ -382.24, respectively. Economical profitability rate was 3.27% being negative for the first group and increased in proportion to farm size. Financial profitability rate was -1.14 being positive only for the third group farms and increased in parallel to farm size. Economical and financial profitability rates were negative with -4.26 and -13.44, respectively for native-breed dairy farms (Table 2).

Cost of 1 kg of Milk

The cost of 1 kg of milk was $ 0.47 for culture-breed dairy farms and decreased in parallel with farm size being lowest in the third group with $ 0.41 and highest in the first group with $ 0.70. For native-breed dairy farms this figure was $ 0.76.

Cobb-Douglas Production Function

Cobb-douglas production function for culture-breed dairy farms was as follows:

$$Y = -2.174 X_1^{0.807} X_2^{1.958} X_3^{0.056} X_4^{0.119} X_5^{-0.06} X_6^{0.09}$$

Table 2: Net profits, net return, economical and financial profitability rates (%)

	Culture-breed				
	Group I (1-5 Cattle)	Group II (6-10 Cattle)	Group III (11-+ Cattle)	Overall	Native-breed
Gross profit ($)	2,228.36	3,589.20	9,761.41	4,109.20	881.61
Gross profit Per Cow ($)	696.36	448.65	443.70	495.08	200.37
Net profit ($)	-561.66	73.82	2407.62	206.95	-607.93
Net return ($)	-240.75	802.09	4213.92	936.96	-382.24
Economical profitability rate (%)	-1.93	2.82	5.92	3.27	-4.26
Financial profitability rate (%)	-10.41	-0.63	2.55	-1.14	-13.44

Where,

Y = Milk quantity per cow per lactation.

X_1 = The number of dairy cattle, X_2= the lactation period (days)

X_3 = Total concentrates consumed during production period (kg)

X_4 = Total rough feeds consumed during production period (kg)

X_5 = The capacity of barn (M_2) X_6 = the total man-days labor quantity used during the production period (hours)

The total production elasticities of inputs were 2.97 and the determination coefficient (R^2) was 0.813. The production elasticities of X_1 and X_2 were statistically significant ($p<0.05$). Since the production elasticity of X_5 was negative, the economic optimum point could not be found (Erkuş *et al*., 1996).

Equation found using step-wise regression method was as follows:

$$Y = -4.427X_1^{0.681}X_2^{2.290}X_6^{0.690}$$

The determination coefficient (R^2) was 0.840 being statistically significant ($p<0.01$). The total production elasticities of inputs were 3.661.

Success Groups Relative to Milk Yield Per Cow and Variance Analysis

The farms were classified into three success groups according to milk yield per cow per lactation for culture-breed dairy farms. The farms with more than 25% milk yield than that of average of overall farms were accepted successful, those with less than 25% as unsuccessful and the farms taking between them as medium successful.

Milk production per cow per lactation was 2.855 and 909 kg, respectively for successful and unsuccessful groups. The lactation period, rough and concentrates feed consumption per cow, barn capacity and labor demand were higher for successful and medium successful farms compared to unsuccessful farms (Table 3). With respect to milk production per cow per lactation, successful and unsuccessful as well as medium successful and unsuccessful groups differed statistically ($p<0.01$). Also, in regard of lactation period there was statistically significant difference ($p<0.01$) between successful and unsuccessful groups. On the other hand, successful, medium successful and unsuccessful groups did not differed statistically from cattle number per farm, concentrates and rough feeds consumed and labor demand point of view.

Table 3: Milk yield and some inputs used in success groups of culture-breed farms

	Unsuccessful 17 farms	Medium Successful 11 farms	Successful 12 farms	Overall 40 farms
Cow number	8.18	7.82	8.83	8.28
Milk production per Cow, per lactation) (kg)	909**	1.687**	2.855**	1.707
Concentrates feeds (kg)	1240	1482	1782	1465
Rough feeds (kg)	3194	2458	3400	3053
Barn capacity (M^2)	37.30	13.83	49.01	34.36
Labor demand (h)	3341	3334	3752	3463
Lactation period (days)	210**	223.64**	249.17**	225.5

Milk production **<0.01; Lactation period **<0.01

Discussion

The illiterate rate was 5% for managers of culture-breed in return to 31.3% for native-breed dairy farms. All managers of culture-breed dairy farms associated with Dönerdere Agricultural Development Cooperative and 5.25% of managers of culture-breed dairy farms associated with Emek Agricultural Development Cooperative in Van, Turkey are literate (Acar and Yıldırım, 2000; Dedeoğlu and Yıldırım, 2005). However, the illiterate rates of farm managers of native-breed cattle fattening and sheep farms in Van, Turkey were 22.9 and 23.8%, respectively (Yıldırım, 2000; Şahin and Yıldırım, 2002).

The utilization rate of family labor potential was 28.83% for culture-breed relative to 18.13% for native-breed farms. This was an expected phenomenon because culture-breed farms had more cow per farm, more assets available and they produced and marketed more milk than the native-breed farms. However, it can be said that the utilization rate of family labor is still low and more of it should be exploited by diversification and economies of scale. The previous studies in the region show that a great part of family labor potential in livestock farms is unexploited. The rate of unused family labor ranges between 56.15% for culture-breed cattle fattening farms and 81.87% for native-breed dairy farms (Yıldırım and Çiftçi, 2005).

Culture-breed dairy farms had 3.15 times more assets than that of native-breed dairy farms and the borrowing level was low. Among the reasons for low borrowing rate (7.73 and 13.24% for culture and native-breed dairy farms, respectively), small scale production, low profitability rate in return to high credit interest rates and fluctuation in prices can be cited. The borrowing rates are also low for dairy farms in the region ranging between 5.16 and 27.96% (Yıldırım *et al*., 2005). The rate of net worth assets in total assets were reported as 93.66 and 84.50%, respectively for dairy farms in Tekirdag, Turkey (Erkuş *et al*., 1996) and cattle fattening farms in Ankara, Turkey (Kıral, 1993), which conforms that similar borrowing rates also exist in western part of Turkey.

The number of cow per farm and milk yield per cow was 1.86 and 2.35 times higher, respectively for culture-breed compared with native-breed dairy farms. The higher milk yield was mainly due to high-yielding cow races and longer lactation period. Milk yield per cow (7.64 kg) was consistent with the corresponding figure of 7.9 kg found for dairy farms associated with Emek Agricultural Development Cooperative in Van, Turkey (Dedeoğlu and Yıldırım, 2005). However, the milk yield per cow per lactation period was relatively higher in different part of Turkey with 4.360, 4.036 and 6.090 kg, respectively in Tekirdag (Erkuş *et al*., 1996), Adana, (Şahin, 1993) and Balıkesir, Izmir and Manisa provinces (Talim *et al*., 1998) than the results found in this study (1.720.6 kg).

More than three quarter of milk production (76.80%) was marketed in culture-breed dairy farms while this rate remained at 58.18% in native-breed farms. It can be said that native-breed dairy farms are relatively small-scale enterprises and that a great part of the milk is left for home-consumption.

The rate of feed costs in total variable costs of culture-breed dairy farms (94.37%) is higher than the rates of 83.98 and 72.88% reported for dairy farms of the region (Dedeoğlu and Yıldırım, 2005; Bal and Yıldırım, 1999), as well as 63.75% in Aydın, Turkey (Armağan and Oktay, 1999).

Economical and financial profitability rates of culture-breed farms were higher than that of native-breed farms and increased significantly in proportion to farm size. Economical profitability was 27.47% higher for imported breeding dairy farms compared to culture dairy farms in Tekirdag, Turkey (Erkuş *et al*., 1996). Dart *et al*. (1999) reported that the 35 Michigan dairy farms that implemented management-intensive grazing had more profit that of conventionally managed dairy farms. Dedooglu and Yıldırım (2005), Headley (2002) and Wadsworth *et al*. (1992) indicated that farm size had positive effect on the profitability.

The cost of 1 kg of milk for native-breed dairy farms was 60% higher compared with culture-breed dairy farms. On the other hand, this figure was 67.5% higher in the first group relative to the third group of culture-breed dairy farms. It can be said that the bigger farms use their resources more efficiently mainly due to economies of scale.

Total production elasticities of inputs of culture-breed dairy farms (2.97) show that there is an increasing return to the scale and that if the production factors increased one fold, given the all other conditions unchanged, the production could be raised by 2.97 times.

Milk production per cow per lactation period for successful farms was 3.14 times higher compared to unsuccessful farms. The lactation period was longer for successful farms and they used more inputs such as rough and concentrates feed, labor and barn. Longer lactation period was one of the statistically significant determinants affecting the higher milk production ($p<0.01$). On the other hand, successful, medium successful and unsuccessful groups did not differed statistically ($p>0.05$) from cattle number per farm, concentrates and rough feeds consumed and labor demand point of view.

Conclusions

The main indicators of financial performance were relatively higher for culture-breed compared to native-breed dairy farms. The gross margin per cow, net profit and net return as well as economical and financial profitability were higher for culture-breed dairy farms compared with native-breed dairy farms. Except for gross margin per farm, all these indicators increased while the costs of 1 kg milk decreased in parallel with farm size. Consequently, we can suggest that the scale is effective on the profitability and expanding the culture-breed dairy enterprise could increase the profitability due to economies of scale.

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