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GROSS AND NET PROFIT OF DAIRY CATTLE FARMS - A CASE STUDY IN EASTERN ANATOLIA REGION OF TURKEY

Faik GENÇDAL[1], İbrahim YILDIRIM[2]

[1] Directorate Food, Agriculture and Livestock, Diyarbakır, Turkey
[2] University of Van Yuzuncu Yil, Faculty of Agriculture, Department of Agricultural Economics, 65080, Van Turkey, Phone;+90432 225 1701 Email: veyselibrahimab@gmail.com

Corresponding author: veyselibrahimab@gmail.com

Abstract

The major aim of this study was to compare the gross and net profit of culture, cross and native-breed dairy cattle farms in Gevaş district of Van Province, Turkey. The required data belonged to 2009 production period and was collected from 44 farms by means of questionnaires interviewing the managers directly. Stratified random sampling method was used in determining the sample size. The number of cows per farm, daily milk yield per cow and lactation period were 3.15 head, 11.54 kg and 210 days for culture-breed farms; 4.0 head, 6.43 kg, and 210 days for cross-breed farms and 3.06 head, 4.21 kg and 215 days for native-breed farms, respectively. Daily feed intake per cow was 13.47 (9.88 kg roughage and 3.59 kg concentrated feeds) for culture-breed farms, 11.00 kg (9.66 kg roughage and 1.134 concentrated feeds) for cross-breed farms and 11.19 kg (9.29 kg roughage and 1.9 concentrated feeds), for native-breed farms, respectively. Feed costs consisted of 90.34, 89.11 and 84.59 % of total variable costs for culture, cross and native-breed farms, respectively. The cost of one kg milk was $0.49, $0.76 and $ 1.11 for culture, cross and native-breed farms, respectively. Gross profit per farm and per cow were $2,665 and $846 for culture-breed farms, $1,220 and $305 for cross-breed farms; $55 and $17.8 for native-breed farms, respectively. Economical profitability rate of culture-breed farms in terms of gross profit were nearly two times higher with 19.27% compared to that of 10.01 % for cross-breed farms. The economical profitability rate for native-breed farms was only at 0.53% levels. Production elasticity of inputs (Σbi) was 1.66, which means increasing return to scale. In case of duplicating the inputs used, milk quantity is expected to increase by 1.66 times.

Key words**:** *dairy cattle farms, Gross Profit, Turkey*

INTRODUCTION

Dairy cattle farms need sufficient and continuous profit to sustain their activities. In order to meet the milk need of people in Turkey where a rapid population increase is experienced, the annual milk supply should be in accordance with yearly demand [37; 36].
Many research findings revealed that gross profit of dairy cattle farms is effected by a lot of factors, namely, cow breed, lactation period and length of cow productive life [30; 14], feed costs and the efficiency of inputs used [8; 32; 13; 19], milk output per cow [17; 14]; the sale prices of milk and the prices of inputs used [30; 21; 2; 35; 3], farm size [11; 20], support given by public institutions [29; 18; 22; 13], management [30], and organization of cooperation [31; 23; 1; 15].
Taking into consideration 1996-2017 periods, milk production obtained from dairy cattle rose from 9.4 million to 18.8 million tons in Turkey [33]. This means that yearly average annual increase was 496.6 thousand tons. On the other hand, milk output per cow during a lactation period at the same period rose from 1,586 kg to 3,143 kg. This indicates 98% yearly increase representing 89.2 kg yearly addition to milk production [33].
The main hypothesis of this study was that the culture-breed farms would have higher profitability rates given higher gross profit per cow stemming from relatively higher milk yield per cow and calf incomes, which means higher gross production value.

MATERIALS AND METHODS

The research material of this study constituted 254 dairy cattle producers located at Gemini, Yemişlik, Dilmetaş and Kayalar villages in Gevaş town of Van Province, Turkey. The data, which belong to 2009 production period, was collected through a questionnaire

interviewing the managers directly. Optimum sample size was determined as 44 farms using the following stratified random sampling method with 10% error amount permitted from the average and 90% reliability range [6].

$$n = \frac{N.\Sigma N_h.S_h^2}{N^2.D^2 + \Sigma N_h.S_h^2}$$

where:
n= Sampling size
N= Total dairy cattle farms
N_h= Farms available in h th strata
S2h=the variance at h th strata
$D^2=d^2/Z^2$ value
d= Error amount permitted from the population average
Z= Z value in standard normal distribution according to error amount
Taking into consideration the relative distribution of cattle numbers, the farms were classified into three groups. Accordingly, 13, 14 and 17 farms constituted the culture, cross and native-breed farms, respectively.
The data were controlled for extreme values using outlier tests before the analysis were made. In comparison of means of some physical variables of culture, cross and native breed farms, variance analysis was used. The functional relationship of milk quantity per farm and the major inputs used was determined by means of Cobb-Douglas Production Function, which shows the production elasticities of inputs directly.

RESULTS AND DISCUSSIONS

General Demographic Information on Farms: The average population per farm was 8.59 person. The managers' age, experience and education years were 45.32, 18.8, and 4.11 years, respectively. The average family labour potential was 1,449 man-days, however, nearly two-third of this potential (69.58%) was not used.
Cow Number, Lactation Period and Milk Yields: The average cow numbers for culture, cross and native-breed farms were 3.15, 4.0 and 3.06 head, respectively. Daily milk yield per cow was 11.54, 6.43 and 4.21 kg, for culture, cross and native-breed farms, respectively (Table 1). It seems that daily milk yield per cow of culture-breed farms is 1.79 and 2.74 times more than that of cross-breed and native-breed farms, respectively. The period of lactation for culture-breed and cross-breed farms were 210 days, while this period was slightly longer with 215 days for native-breed farms (Table 1). The average milk yield per cow per lactation were 2,423 kg, 1,350 kg and 905 kg for culture, cross and native breed farms, respectively (Table 1). This amounts to 1.79 and 2.67 times higher milk production per cow during a lactation period for culture-breed farms in comparison to that of cross-breed and native-breed farms, respectively. The result stems from a higher milk yield per cow of culture-breed farms. Milk production per farm was 7,633 kg, 5,400 kg, and 2,769 kg for culture-breed, cross-breed and native-breed farms, respectively (Table 1). Milk production per farm was nearly 1.41 and 2.75 times higher for culture-breed farms when compared to that of culture-breed and native-breed farms, respectively.
The farm types (culture, cross and native-breed farms) didn't differ statistically in terms of cow numbers (p=0.245) and lactation period (p=0.535). However, they differed in terms of average means of daily milk per farm (p=0.000), daily milk per cow per lactation (p=0.000) and daily milk per cow (p=0.000).
Milk yield per cow in different parts of Turkey was reported as 7.63, 7.9, 15.1, 18.73 27.45 kg in Van Province [36], in Kırklareli Province [37], in Hatay Province [29], and in Konya Province [23], respectively. The reported milk production per cow per lactation period in Thrace region of Turkey was 5.8 tonnes [16].
[14;17;26;25], revealed that milk yield per lactation and economic efficiency per cow were two main profitability factors for dairy cattle farms in South-Hungary, Czech Republic, Romania and Romania, respectively.
[18] reported that there existed positive relationship between herd size and milk yield per cow and total efficiency in Czech Republic. On the other hand, inverse

relationship were reported between milk yield and herd sizes in Haryana State region of India [19].

Labor Demand. The daily labour demand per cow ranged between 1.35 for culture-breed cattle farms and 1.0 hours for cross-breed farms (Table 1). In terms of daily labour demand per cow, the farm types didn't differ statistically (p=0.252).

Feed Intake and its Compositions. The main roughages were straw, dry weed (clover) and silage while major concentrated feeds constituted milk meal, bran, wheat and barley break. Feed intake per cow ranged from 13.47 to 9.62 kg being the highest with 13.47 kg for culture-breed and the lowest with 9.62 kg for native-breed farms (Table 1). The share of roughage in the total feed intake for culture cross and native-breed farms were 73.34, 87.81 and 87.73%, respectively. Concentrated feed per cow was more than twice for culture-breed farms (3.59 kg) compared to that of cross-breed farms (1.34 kg) and native-breed farms (1.18 kg). In terms of average means of daily forage feed intake per cow (p=0.020) and daily concentrated feed intake per cow (p=0.000), the farm types differed statistically.

[4; 13; 30] cited feed quantity given daily per cow, efficiency of feeds and its management as the major factors effective on the profit.

The Composition of the Assets. Operating assets made up 62.77% of total assets ($ 11,971) while remaining was building assets (37.23%). The greater part of operating capital was animal capital ($5,597). This figure was the highest for culture-breed farms with $7,428 and the lowest with $3,109 for native-breed farms. Animal capital made up 79.49 and 46.76% of operating and total assets, respectively. The animal assets rate in the total assets was the lowest with 29.97% for native-breed and the highest with 56.78% for the cross-breed farms. Out of total assets 98.73% consisted of self-capital (equity) for culture-breed farms while all the capital belonged to farm managers in native-breed farms, which means they didn't perform with debt.

Table 1. Some Physical Aggregates Related to Output and Inputs

	Culture-Breed	Cross-Breed	Native-Breed	Total
Cow Number (Head)	3.15	4.00	3.06	3.39
Daily Milk Yield Per Cow (kg)**	11.54	6.43	4.21	7.08
Period of Lactation (Day)	210	210	215	212
Milk Production Per Cow Per Lactation (kg)**	2,423	1,350	905	1,501
Milk Yield per Farm (Kg) ***	7,633	5,400	2,769	5,088
Daily labour demand per cow (h)	1.35	1.00	1.02	1.10
Daily feed intake per cow (kg)*	13.47	11.00	9.62	11.19
Forage feed intake per Cow (kg)**	9.88	9.66	8.44	9.29
Concentrates feed intake per Cow (kg)	3.59	1.34	1.18	1.9

Source: Calculated by authors from preliminary data collected from producers

*** P<0, 01* * P<0, 05*

Gross Production Value. Gross production value was $5,815, $4,473 and $2,080 for culture, cross and native-breed farms, respectively. More than half of gross production value consisted of milk production values with 66.07, 60.78 and 67.11% followed by calf selling values with 31.07, 36.44 and 29.70% for culture, cross and native-breed farms, respectively

Production Costs Production costs per farm and per cow were $5,712 and $1,813 for culture-breed farms; $5,957 and $1.489 for cross-breed farms and $3,953 and $1,292 for native-breed farms, respectively (Table 2). Feed costs made up 49.83, 48, 64 and 43.32% of production costs for culture, cross and native-breed farms, respectively. Feed costs amounted to 90.36, 89.20 and 84.54% of variable costs for culture-breed, cross-breed and native-breed farms, respectively. The costs of one kg of milk was $0.49 for culture-breed farms, which shows it is nearly ¼ less than that of cross-breed ($0.76) and amounts to only 44.45% that of native-breed farms ($ 1.11) (Table 2).

The reported feed costs in total production costs for different parts of Turkey were 52.99 % in Van province [36]; 47.31 % in Ankara province [28]; and 42.17% in Kırklareli province [37]. The feed cost constituted 84.33 and 86% of the variable costs in Konya

Province [23] and Thrace regions of Turkey [16], respectively.

[5; 7; 12; 19] Reported the feed costs in total production costs as 55.4%, 53%, 73% and 68% in Tunisia, in the regions of Minnesota, Wisconsin, Iowa, and South Dakota of U.S, in Pennsylvania counties of U.S, and in the regions of Karnal, India, respectively [10; 24], drew attention to feed costs effects on the profit in Semarang regency, India and Tamil Nadu, India, respectively.

Gross Profit, Net Profit and Profitability Rates: Gross profit per farm and per cow were $2,665 and $846 for culture-breed farms, $1,220 and $305 for cross-breed farms; $55 and $17.8 for native-breed farms, respectively (Table 2). Economical profitability rate of culture-breed farms in terms of gross profit were nearly two times higher with 19.27% compared to that of 10.01% for cross-breed farms. The economical profitability rate for native-breed farms was only at 0.53% levels.

Net profit per farm and cow was negative for cross-breed with $-372 and $-612 and $-1873 and $-612 for native-breed farms, while these figures were positive with $103 and $33 for culture-breed farms, respectively.

The reported profitability rates in different parts of Turkey were 3. 27% in Van Province [36], 6.3% in Kırklareli Province [37] 2.04% in Konya Province, [23], and 7.62% in Hatay Province [29].

[17] Reported that milk yield per cow had positive effect on the profitability of dairy cattle farms in 12 regions in the Czech Republic. Milk yield per lactation and the length of cow productive life were also reported as the major factors which increase the profitability in Michigan, U.S dairy cattle farms [14]

[36] indicated that the farm size was a major factor for the profitability of dairy cattle farms in Van Province, Turkey being negative with -1.93 % for small-scale farms (farms with 1-5 dairy cattle) and positive with 5.92% for large-scale farms (farms with more than 10 dairy cattle). The reported differences between economical profitability of small-scale farms with < 10 tonnes milk production (-7.2 %) and large-scale farms with >40 tonnes milk production (24.7%) were dramatic in Kırklareli Province, Turkey [37]. More research conducted on dairy cattle farms demonstrated that the farm size was a major component contributing to profitability positively [11; 20; 18; 35; 9; 27]. However, [8] reported that the smaller dairy cattle farms achieved more net profit compared to larger ones in Haryana State and Hisar and Karnal, regions of India. [21]Suggested that effective cost management and improved livestock breeds would improve the dairy farms' profit in Sargodha, Pakistan. [26] Cited the major factors effective on the profit as cost of inputs, milk output and milk market prices in Southern Romania. Researches made on Michigan and Wisconsin dairy farmers indicated that volatility in milk and feed prices had potentials to affect dairy farm profitability [34, 35].

Table 2. Production Costs and Profits per Farm and per Cow

	Culture -Breed	Cross-Breed	Native-Breed	Total
Gross Production Value per Farm ($)	5,815	4,473	2,080	3,967
Production Costs per Farm ($)	5,712	5,957	3,953	5,143
Production Costs per Cow ($)	1,813	1,489	1,292	1,517
Variable Costs per Farm($)	3,150	3,253	2,025	2,749
Fixed Costs per Farm ($)	2,562	2,707	1,928	2,394
Feed Costs per Farm ($)	2,846	2,899	1,713	2,425
Feed Costs per Cow ($)	903	725	560	715
Costs of 1 Kg Milk ($)	0.49	0.76	1.11	0.72
Gross Profit per Farm ($)	2,665	1,220	55	1,218
Gross Profit per Cow ($)	846	305	17.8	360
Net Profit per Farm ($)	103	-1,484	-1,873	-1,176
Net Profit per Cow ($)	33	-371	-612	-347
Economical Profitability rate in terms of gross profit (%)	19.27	10.01	0.53	10.18

Source: Calculated by authors from preliminary data collected from producers

Cobb-Douglas Production Function. Cobb-Douglas production function was as follows.

$Y= -3.867\ X_1\ -0.153\ X_2\ 0.540\ X_3\ 0.355\ X_4\ 0.529\ X_5\ 0.398\ X_6\ -0.009$

Determination coefficient (R^2) was 0.606, which means 60.60% of variances in milk production quantity is explained by inputs

used in the model. The production elasticities of X_1 (number of dairy cattle), X_2 (lactation period), X_3 (concentrated feed intake), were statistically significant at 10% probability level ($P<0.01$).

Production elasticity of inputs in total (Σbi) was 1.66, which means increasing return to scale. In case of duplicating the inputs used, milk production quantity is expected to increase by 1.66 times. On the other hand, milk production quantity is expected to increase by 54.0, 35.50, 23.70, 52.90 and 39.80 %, respectively in cases of doubling the inputs of X_2 (lactation period), X_3 (concentrated feed intake), X_4 (roughage feed intake), and X_5 (barn capacity) individually; while the other inputs remained unchanged.

CONCLUSIONS

Given nearly two times higher profitability rate of culture-breed farms (19.27%) compared to that of 10.01% for cross-breed farms and that of extreme low level of native-breed farms (0.53%), we suggest culture-breed dairy cattle for milk production. The higher profitability rates of culture-breed farms stems from daily milk yield per cow of culture-breed farms, which is 1.79 and 2.74 times more than that of cross-breed and native-breed farms, respectively. On the other hand, daily feed amount given per cow of culture-breed farms was only 0.22 and 0.40% higher than that of cross-breed and native-breed farms, respectively. These findings show that feed efficiency is higher for culture-breed farms in terms of transformation the feed costs to gross profit.

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