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A Comparison of Scale on Profitability of Dairy Cattle Farms in Eastern Part of Turkey

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Abstract: The main objective of this study, was to determine the profitability of dairy operations in the province of Van (A province in eastern part of Turkey). A total of 117 dairy farmers were interview and data were collected about their operations. Dairy operations were divided into 3 groups based on their size, namely small, mid and large. All of data belongs to year 2007. The average cow per farm was 6.59. The daily milk yield per cow was 5.79 kg, overall, the average lactation period was 281.85 days for farms and yearly milk production per cow was 1630.9 kg. Total assets per farm were $ 16789, gross production value per farm was $ 8824 and per cow was $ 1339. Overall, gross profit per farm was $ 1863.1 and net profit per farm was $ 393 for farms. Overall, profitability rate was 2.2% for farms and increased in proportion to dairy cattle farm size. The total production elasticities of inputs were 0.851 indicating that there were decreasing return to scale for dairy cattle farms.

Key words: Profitability rates, costs, dairy cattle, structural situation

INTRODUCTION

Climate of regions differ and thus, the structure of farms in these regions differ in Turkey. This situation brings different socio-economical structures. Even though importance of agriculture proportionally decreases in Turkish economy, it is still vital due to population involved in agriculture. Eastern Anatolia region, in which animal production is the major source of income is very important for Turkish agriculture due to high potential of existing animal number and high population increase rate (Sahin, 2007). Dairy sector plays an important role in exploiting some part of this labor thus helps, the labor remain in rural areas alleviating the migration to urban areas (Yildirim and Sahin, 2006). Development of dairy farms depends on the increases in net income of dairy operations. Due to the lack of cooperation among dairy operations, dairy farmers faces many problems at obtaining farm supplies and marketing farm products. Thus, this lack of cooperation increases farm inputs and decreases value of farm products, resulting in low profitability rate.

Milk is very important nutrient for nourishment of increasing population. It is important to breed high producing dairy cow breeds to meet increasing milk demand. One of the solutions, towards this target is to increase the number of dairy cattle breeds with high milk yield in the herd (Erkus *et al*., 1996). It is also, very important to improve feeding quality of these animals because it is well-known that concentrate feed used in dairy cattle has great impact on milk production (Schaik *et al*., 1996).

Size of enterprises is an important determinate of profitability of enterprises. Scale of dairy operation was reported to influence profitability of dairy farms of England (Wadsworth *et al*., 1992), of Adana, Izmir, Turkey (Sahin, 1993; Saner, 1993), of Norway (Loyland and Ringsrad, 2000) and of Michigan and Wisconsin, USA (Headley *et al*., 2002).

The main objective of this study, was to determine the effects of dairy operation size on profitability by evaluating gross, net profits and profitability rates and also production costs and elasticities in Easter Anatolia region of Turkey.

MATERIALS AND METHODS

The research material included 117 out of 1647 dairy farms in Van (A province in eastern part of Turkey). The sample size was determined by using the following strafed random sampling method (Yamane, 1967; Erkan *et al*., 1991).

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

where:

N = Total number of farms
S^2_h = Variance of h the 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 the strata

The sample size was 117 farms within 10% acceptable error limit. The dairy farms were classified into 3 groups. The small-scale group (1-5 cattle), the med-scale group (6-10 cattle) and large-scale group (>11 cattle), which consisted of 52, 42 and 23 farms, respectively. The data were obtained in 2007 production period obtained from the dairy farm operators with face to face questionnaires.

Data were analyzed by using absolute, proportional distribution and chi-square (χ^2) analysis. Relationship among inputs were evaluated by chi-square (χ^2) analysis. Relationship between milk yield and inputs were determined by means of Coob-Douglas production function (Sahin, 1993; Miran, 2003; Yildirim, 2006).

RESULTS

Farms in the province consisted of small-scale (44.4%), mid-scale (35.9%) and large-scale (19.7%) farms. In these farms, the average population per farm was 6.87 people. The average age of farm managers was 48.9 year old and their average education period was 6.5 years. The average experience of farm managers in dairy cattle activities was 26.7 years.

The average land size was 6.28 ha. Approximately, 60.7% of the total land is irrigated and the remaining 39.3% is dry land. In 2007, an average of 2.53 ha land was planted with forages, which were mainly alfalfa (1.76 ha), sanfoin (0.65 ha) and silage corn (0.12 ha).

The average numbers of cows per farm was 6.59. The average daily milk yield per cows was 5.79 kg and increased in parallel with farm size, being the lowest with 4.9 kg for small-scale and the highest with 7.3 kg for large-scale dairy cattle farms. Overall, the average lactation period was 281.85 days for farms. Yearly milk production per cows was 1630.9 kg (Table 1).

The differences in average milk yield per cow were not significant between dairy cattle farms groups ($p>0.01$). Cow number and total milk production per farm were significantly different among groups ($p<0.05$).

The average daily labor demand per cow for dairy farms was 1.14 h and decreased in proportion to farm size, differing from 1.80 h in small-scale and 0.98 h in large-scale group. The average amount of feed supplied per cow was 21.35 kg in dairy farms (Table 1). Health expenses consisted of veterinarian and medicine costs. Veterinarian expenses were mainly due to the needs for pre and post partum controls of cows. Average health cost per cow was $147.3.

All assets were owned assets. Total assets per farm were $ 16789 and increased in parallel with farm size, ranging from $ 7956 for small-scale to $ 39328 for large-scale dairy cattle farms.

Gross production value per cow was $ 1339 and increased according to farm size, which changed between $1246.6 and $1489.6. The gross production value consisted of milk value (49.7% of total gross production value), productive inventory value (48.9%) and manure value (1.4%). Gross production value per farm was $ 8824 and increased according to farm size, ranging from $ 2512.2 for small-scale to $ 23639.3 for large-scale dairy cattle farms. The 66.4% of milk produced in dairy cattle

Table 1: The number of cow, milk production and some inputs used per cow and farm

	Small-scale	Mid-scale	Large-scale	Overall
Number of cow per farm	2.02	7.17	15.87	6.59
Daily milk yield per cow (kg)	4.90	6.05	7.30	5.79
Milk production per farm (kg)	9.90	43.34	115.92	38.13
Lactation period (days)	278.88	282.14	288.04	281.85
Milk yield per cow per lactation (kg)	1367.61	1706.29	2103.97	1630.90
Milk production per farm (kg)	2761.51	12228.43	33389.09	10747.23
Daily feed intake per cow (kg)	21.43	22.09	20.71	21.35
Daily labor demand per cow (h)	1.80	1.11	0.98	1.14

Table 2: Production costs, variables costs, gross and net profits per cow and farms

	Small-scale	Mid-scale	Large-scale	Overall
Production cost per farm ($)	4527.60	22895.90	67635.60	21584.20
Production cost per cow ($)*	2242.30	3194.80	4262.00	3275.40
Variable cost per farm ($)	2978.70	13960.90	37997.50	13371.60
Variable cost per cow ($)*	1475.20	1948.00	2394.40	2029.10
Feed cost per farm ($)	2127.60	8725.60	22351.50	8735.20
Feed cost per cow ($)**	1053.70	1217.50	1408.50	1325.60
Health cost per farm ($)	228.80	980.40	2629.60	970.70
Health cost per cow ($)*	113.30	136.80	165.70	147.30
Cost of 1 kg milk ($)	0.46	0.43	0.40	0.44
Gross profit per farm ($)	125.90	1452.90	6539.60	1863.10
Gross profit per cow ($)*	62.40	202.70	412.10	282.70
Net profit per farm ($)*	22.50	337.90	1816.60	393.00
Net profit per cow ($)*	11.10	47.10	114.50	59.60
Economical profitability rate (%)	0.60	2.40	5.30	2.20

*p<0.01; **p<0.05

farms was sold to markets, while the remaining (33.6%) was consumed at home for household needs.

Production costs per farm were $ 21584.2 and increased in parallel with farm size, varying from $ 4527.6 for small scale to $ 67635.6 for large scale dairy cattle farms. Production costs, variable costs, feed costs and health costs per cow were $ 3275.4, $ 2029.1, $ 1325.6 and $ 147.3, respectively and increased in proportion to farm size. Cost of 1 kg milk was $ 0.44 and decreased in proportion to farm size. Cost of 1 kg milk was $ 0.46, $ 0.43 and $ 0.40 for small scale, medium scale and large scale dairy cattle farms, respectively (Table 2).

Production costs, variable costs and health costs per cow differed statistically between dairy cattle farm operations ($p<0.01$).

The variable costs accounted for 61.95% of total production costs. Feed costs made up 65.32% and health cost made up 7.26% of total variable costs. Feed costs ratio decreased with increasing farm size, ranging from 71.42% for small scale to 58.82% for large scale dairy cattle farms.

Overall gross profit per cow was $ 282.7 for farms and increased in parallel with farm size, ranging from $ 62.4 for small scale to $ 412.1 for large scale dairy cattle farms. Overall gross profit per farm was $ 1863.1 for farms and increased in parallel with farm size, varying from $ 125.9 for small scale to $ 6539.6 for large scale dairy cattle farms. Overall net profit per cow was $ 59.6 for farms and increased as farm size increased, which were between $ 11.1 for small scale and $ 114.5 for large scale dairy cattle farms. Overall net profit per farm was $ 393 for farms and increased with increasing farm size, ranging from $ 22.5 for small scale to $ 1816.6 for large scale dairy cattle farms. Overall profitability rate was 2.2% for farms and increased in proportion to dairy cattle farm size. The profitability rate of small-scale farms was 0.6, mid-scale and large scale farm were 2.4 and 5.3%, respectively (Table 2).

Cobb-douglas production function for cattle farms was as follows:

$$Y = 3.645\ X_1^{0.421}\ X_2^{-0.022}\ X_3^{0.325}\ X_4^{0.127}$$

where:

- Y = Milk quantity per farm (kg)
- X_1 = The number of dairy cattle
- X_2 = Total man-days labor demand during the production period (h)
- X_3 = Total feed intake of dairy cattle (kg)
- X_4 = Health care expenditures

The total production elasticities of inputs were 0.851 and the determination coefficient (R^2) was 0.724. A 10% increases in farm inputs causes 8.5% production increases in formula.

DISCUSSION

This study was aimed to determine the profitability of dairy operations in the province of Van, especially effects of operation size on profitability. Overall, daily milk yield per cow was 5.79 kg, which is consistent with the corresponding figure of 7.9, 7.6 and 5.19 kg found for dairy farms, respectively in Van, Turkey (Dedeoglu, 2005; Yildirim and Sahin, 2006; Sahin and Yilmaz, 2008). This daily milk yield is very low for milk production. However, the milk yield per cow per lactation was relatively higher in different part of Turkey than the results obtained in this study (1630.9 kg), changing from 3361-6090 kg (Yildirim *et al*., 2008; Erkus *et al*., 1996; Sahin, 1993; Talim *et al*., 1998). The differences in milk yield among regions seemed to be due to mainly 3 reasons; differences in training levels of farmers, differences in animal quality in dairy operations and differences in feeding animals. Overall education level of people in region is the lowest in Turkey, reflecting the lack of training about animal care. Animal used in the region are mainly low producing domestic cattle or cross-bred compared with high producing dairy cattle in the other region. Main forage source in the region is ground-alfalfa. Use of corn silage is very limited in large-scale operation, not exist in other groups. Thus, animals in the region usually unbalanced and under-fed, resulting in considerable low milk yield. One or more reasons mentioned above have additive effects on milk yield of animals in the region. As the scale of operation increase the number of reasons decrease, causing increase in milk yield.

The total production elasticity of inputs were 0.85, indicating that there were decreasing return to scale for dairy cattle farms. This figure was lower than production elasticity of input 1.24 reported for dairy cattle farms of Western part of Turkey (Yildirim *et al*., 2008) and 0.88 reported for dairy cattle farm of Mediterranean sea of Turkey (Sahin, 1993) and higher than 0.82 reported for dairy farms of Black Sea Region of Turkey (Karaaslan, 2000).

The variable costs accounted for 61.95% of total production costs. The rate of feed costs was 61.95, which were lower than the values reported by Yildirim *et al*. (2008; 73.3%) and Dedeoglu (2005; 84%) and Yildirim and Sahin (2006; 94.4%) for dairy cattle farms of Western and Eastern Anatolia Region of Turkey. The relatively lower feed cost obtained in the study may indicate underfeeding of these animals.

Overall, gross profit per farm was $ 1863.1 and net profit per farm was $ 393 for farms. Overall, profitability rate was 2.2% for farms and increased in proportion to dairy cattle farm size. As it is seen, profitability rate was extremely low. This low profitability rate may have

resulted from very low milk yield of animals. In addition to low milk yield, there is a lack of cooperation among farmers. Because of the lack of cooperation among dairy farmers, dairy farmers have many problems from obtaining farm supplies to marketing farm products. Therefore, this lack of cooperation increases farm inputs and decreases value of farm products, resulting in low profitability rate. As scale increase cost of input tended to decrease and value of product increase. Thus, profitability rate increased with increasing scale.

Profitability, rate increased as the number of cow in a dairy operation increased. Thus, transition from small to large-scale dairy operation seemed to be necessary to increase profitability. One of the important factors affecting profitability of dairy operation is daily milk yield of farm. To increase milk yield, better breeding of existing animals and improvement of nutritional status of animals seemed to be the main problems, which should be deal with.

Improving milk industry in the region can stimulate development and enlargement of dairy operation. Transition from extensive to intensive dairy operation system may minimize the effects of external factor on production. Furthermore, subsidizing of milk production and feedstuff production will also have positive effect on dairy farm operations.

CONCLUSION

In conclusion, even though profitability of farmers in the province of Van was very low, increasing operation sale seemed to improve their profitability.

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