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Comparative Analysis of Dairy Cattle-Breeding Farms on Member and Non-Member of Breeders' Association

[1]F. Füsun Tatlidil and [2]Duygu Aktürk
[1]Department of Agricultural Economics, Faculty of Agriculture,
University of Ankara, 06110, Ankara, Turkey
[2]Department of Agricultural Economics, Faculty of Agriculture,
University of Çanakkale Onsekiz Mart, Çanakkale, Turkey

Abstract: Economic structure of 47 dairy cattle-breeding farms that are members and 43 farms that are non-members of Breeders' Association is put forward and comparative analysis is done through determination of elements of milk production cost and unit milk cost. The average number of milk cows is found as 8.11 on member farms and 7.65 on non-member farms. The cost of one kilogram of milk is calculated as 0.19 $ on member and as 0.21 $ on non-member farms.

Key words: Dairy cattle, milk cost, production costs, gross value of production

INTRODUCTION

With respect to the number of livestock population Turkey ranked in the first 25 countries of the world but livestock production is insufficient in terms of quantity and quality because of low yield level of the local livestock breeds, care and feed conditions. The number livestock population should be improved in terms of quality for increment of livestock production and therefore, provision of the lacking animal originated protein need of the country.

The records should be kept related to the genetic potential of the animals, infrastructure of management and environmental conditions should be prepared and information lack should be eliminated for successful services aiming for raising genetic attributes of the cattle population. The record keeping serves significant functions both for determination of operational efficiency and profit and for improvement services conducted on the livestock production activities.

At the beginning record, keeping activities are barely conducted on state farms and these type of activities are commenced by private livestock farms since, 1990. These types of activities are first conducted by ministry of agriculture and since their establishment in 1995, responsibility in this field is transferred to cattle breeders' association. The spread of cattle breeders' association in country-wide level which has been playing an important role in development of livestock production will provide a database and thus, healthy plans and policies will be formulated related to livestock production.

In this research, comparative analyses of dairy cattle breeding farms are done on member and non-member of Breeders' Association in Çanakkale province. The economic structures of the farms are studied and milk production cost is calculated in the analysis.

MATERIALS AND METHODS

Central, Biga, Çan and Gelibolu districts of Çanakkale Province are chosen as the research area. The data is collected through interviews by filling questionnaires with farmers. The interviews are held with sample farmers chosen by simple sampling method from 279 farmers whom are members of the dairy cattle Breeders' Association and from 1244 farmers whom are not members and owned five and more milking cows at their farms during the data collection period (Yamane, 1967).

Capitals related to the dairy cattle breeding activities are determined with their year-end values.

The cost of one kilogram of milk is calculated by reducing by-product revenue from total production costs and remainder value is divided by total milk production.

The functional analysis of milk production between member and non-member farm enterprises of Milk-Cow Breeders' Association is done and below variables are taken for relation between milk cost and used inputs in this functional analysis.

Corresponding Author: F. Füsun Tatlidil, Department of Agricultural Economics, Faculty of Agriculture, University of Ankara, 06110, Ankara, Turkey

Y = Milk cost ($\$ kg^{-1}$).
X_1 = Milk production (kg).
X_2 = Feed cost ($).
X_3 = Labor cost ($).
X_4 = Artificial insemination cost ($).
X_5 = Veterinary and medicine cost ($).
X_6 = Water, cleaning and electricity cost ($).

Cobb-Douglas production function is applied with above noted data. Several researchers stated that Cobb-Douglas type production function equations are appropriated to agricultural activities. The equation of this function is:

$$Y = aX_1b_1.X_2^{b2}.X_3^{b3}.....X_n^{bn}$$

When logarithm of both sides are taken, the equation will be (Heady and Dillon, 1961):

$$\text{Log } Y = \log a + b_1 \log X_1 + b_2 \log X_2 + ... + b_n \log X_n$$

F and t-tests are used in significance test of regression coefficients. Best regression variable selection method is used in determination of important variables. Before completion of regression analysis VIF (Variance Inflation Factor) values are calculated in order to determine if there is a multicollinearity problem between taken variables. For determination of appropriate model Cp-statistics, mean square error and determination coefficient (R^2) are used. The models, which have high R^2 value, Cp-statistics and low mean square error values, are assumed as appropriate models (Draper and Smith, 1998).

Standardized regression coefficients are calculated for making a comparison of effects of taken variables to milk cost.

RESULTS AND DISCUSSION

The production cost elements of farms, which are members of dairy cattle Breeders' association and non-member farms in milk production activities are present at Table 1.

The total production cost is 11477.33 $ and of this total 85.32% is calculated as variable costs and 14.68% is calculated as fixed costs on member farms. Within production cost fodder and feed concentrates has the highest share with 62.43% and labor cost follows it with 16.43%. Within variable costs; food and feed concentrates has the highest share with 73.14% and labor cost with 19.26%.

The total production cost is calculated as 10264.78 $ on non-member farms. Of the total production costs 86.07% is variable and 13.93% is fixed costs. The share of the fodder and feedstuff is calculated as 61.44% within total production cost and 71.38% within variable costs. The labor cost has the second place and it share is calculated as 17.87% inside total production cost and 20.76% among variable costs. Similar findings are also obtained from another research carried out in Tekirdag province (Turkey), Illinois and California (USA) related to the dairy cattle farming (Erkus *et al*., 1996; Lattz, 2002; Butler, 2002).

Milk, manure and productive stock value increase are taken into account and gross production value is calculated for dairy cattle farms in the research area. Farmers are selling their milk to village development cooperatives whom are members of them or to small milk processing units. Subsidies and incentives are the most employed policy tools by state for meeting support goal of agricultural sector. The dairy cattle farms are also benefited from incentives and subsidies implementation like milk, artificial insemination and forage crops production incentive premiums within the agricultural sector in the research area.

In this context, member farms received 0.014 $\$ kg^{-1}$ and non-member farms 0.007 $\$ kg^{-1}$ as milk incentive premium, member farms also received 5.6 $ and non-member farms received 4.20 $ per animal as artificial insemination premium. Forage crops like alfalfa, vetch, silage maize and beat (as animal feed stuff) are also subsidized and incentives paid for these crops by the state are 16.47, 4.27, 7.14 and 7.92 $\$ da^{-1}$, respectively.

The average milk production per farm is 47, 895.64 kg $year^{-1}$ on member farms and 38 991.86 kg $year^{-1}$ on non-member farms. The composition of the dairy cattle keeping activity revenue are generated from 85.12% milk, 14.24% productive stock value increase and 0.64% from manure on member farms and from 82.87% milk, 16.27% from productive stock value increase and 0.86% from manure on non-member farms (Table 2). While, calculating the share of milk within total production cost, the share of milk within the total revenue is taken into account (Erkus *et al*., 1995; Kiral *et al*., 1999).

While calculating cost of 1 kg of milk, secondary product revenues like manure and milk incentive premium are subtracted from the share of milk from total production cost and remainder value is divided by amount of milk production. The cost of 1 kg of milk is calculated as 0 and 19 $ on member and 0.21 $ on non-member farms. Similar findings are also obtained from a research carried out in India. In this research, the cost of 1 kg milk is calculated 0.15 $ in land owning farms, 0.23 $ in landless farm near urban and 0.25 $ in rural landless farms (Hemme *et al*., 2003). When the price of 1 kg of milk, which is 0.23 $ is taken into account, it is determined that

Table 1: Milk production costs (per Herd)

	Member farms (costs)			Non-member farms (costs)		
Cost elements	$	(%)	(%)	$	(%)	(%)
Variable costs						
Feed costs						
a) Feed concentrate	5306.16	46.23	54.15	4427.39	43.13	50.11
b) Fodder	1859.45	16.20	18.99	1879.30	18.31	21.27
Seasonal labour wages	1886.25	16.43	19.26	1834.22	17.87	20.76
Salt (licking stone)	31.00	0.27	0.32	29.37	0.29	0.33
Veterinary and medicine costs	271.04	2.36	2.77	291.46	2.84	3.30
Water cost	66.61	0.58	0.68	79.27	0.77	0.90
Electricity cost	152.18	1.33	1.55	144.49	1.41	1.64
Bedding cost	1.49	0.01	0.02	5.05	0.05	0.04
Cleaning stuff cost	36.97	0.32	0.38	34.59	0.34	0.39
Variable cost for machinery and equipment	20.29	0.18	0.21	5.70	0.06	0.06
Artificial insemination cost	161.41	1.41	1.65	103.79	1.01	1.17
Total variable costs (A)	9792.85		100.00	8834.63		100.00
Fixed costs						
Overheads cost	294.80	2.57	17.50	265.55	2.59	18.57
Building capital depreciation	275.15	2.40	16.33	189.38	1.84	13.24
Building capital interest	271.20	2.36	16.10	188.14	1.83	13.16
Building repair and maintenance cost	11.36	0.10	0.67	16.29	0.16	1.14
Cattle depreciation	406.58	3.54	24.14	427.21	4.16	29.87
Cattle capital interest	300.37	2.62	17.83	277.56	2.70	19.41
Machinery and equipment depreciation	99.87	0.87	5.93	56.43	0.55	3.95
Machinery and equipment capital Interest	25.15	0.22	1.49	9.59	0.09	0.67
Total fixed costs (B)	1684.48		100.00	1430.15		100.00
Total production costs (A+B)	11477.33	100.00		10264.78	100.00	

Table 2: Unit milk cost on the sample farms

Animal products	Gross value of production ($)	(%)	Production cost ($)	Secondary product revenue ($)	Production (Kg)	Unit milk cost ($ kg^{-1})
Member farms						
PSA	1824.27	14.24	1634.40	-		
Manure	81.50	0.64	73.01			
Milk	10904.86	85.12	9769.91	660.78	47895.64	0.19
Toplam	12810.63	100.00	11477.32			
Non-member farms						
PSA	1742.59	16.27	1669.77			
Manure	92.19	0.86	88.34			
Milk	8877.65	82.87	8506.67	359.64	38991.86	0.21
Toplam	10712.43	100.00	10264.78			

member farms obtained 0.04 $ kg^{-1} and non-member farms obtained 0.02 $ kg^{-1} of profit. The rate of profit to the sale price is determined as 17 and 8%, respectively. It is determined that member farms which are keeping cattle having higher genetic potential and being member of Dairy Cattle Breeders' Association obtained 100% more profit compared to non-member farms.

As result of functional analysis, which is done on both type farm enterprises for determination of relation between milk cost and inputs; artificial insemination cost on member and veterinary-medicine cost on non-member farm enterprises left out of the model.

On member farm enterprises: The regression equation is found as:

$$Y = 0.0000 - 1.34\ X_1 + 1.12\ X_2 + 0.245\ X_3 + 0.153\ X_5 + 0.107\ X_6$$

On non-member farm enterprises: The regression equation is found as:

$$Y = 0.0000 - 1.13\ X_1 + 0.960\ X_2 + 0.177\ X_3 + 0.0816\ X_4 + 0.0987\ X_6$$

The determination coefficient is calculated as 92.3 and 91.8% and found as significant on member and non-member farm enterprises by regression analysis respectively. This means, variation of milk cost will be explained by variables included to the model with 92.3% level on member and 91.8% level on non-member farm enterprises.

Due to the Table 3, coefficient of variables milk production amount (X_1), feed cost (X_2), labor cost (X_3) and veterinary and medicine cost (X_5) are significant at 1% and other cost (X_6) are found significant at 5% level. While other variables are constant, when milk production increases one unit, milk cost will decrease 1.34 unit. When

Table 3: Coefficients and significance level of factors related to milk cost on member farm enterprises

	Milk production (kg) (X_1)	Feed cost ($) ($X_2$)	Labour cost ($) ($X_3$)	Veterinary-medicine cost ($) ($X_5$)	Other costs ($) ($X_6$)	R^2
b_i	-1.34	1.12	0.245	0.153	0.107	92.3
Sb_i	0.068	0.070	0.048	0.055	0.053	
tb_i	-19.55**	16.02**	5.07**	2.79**	2.03*	

Table 4: Coefficients and significance level of factors related to milk cost on non-member farm enterprises

	Milk production (kg) (X_1)	Feed cost ($) ($X_2$)	Labour cost ($) ($X_3$)	Artificial insemination cost ($) ($X_4$)	Other costs ($) ($X_6$)	R^2
b_i	-1.13	0.960	0.177	0.0816	0.0987	91.8
Sb_i	0.073	0.064	0.048	0.061	0.059	
tb_i	-15.44**	14.90**	3.69**	1.35	1.65	

*p<0.05; **p<0.01

feed cost increases 1 unit, milk cost will increase 1.12 unit; when labor cost increases 1 unit, milk cost will increase 0.245 unit; when veterinary and medicine cost increase 1 unit, milk cost will increase 0.153 unit and when other cost increases one unit, milk cost will increase 0.107 unit.

The coefficient variables of milk production amount (X_1), feed cost (X_2) and labor cost (X_3) are found as significant on non-member farm enterprises ($p<0.01$) (Table 4). Artificial insemination (X_4) and other cost (X_6) are statistically found as not significant. Where as other variables are constant, when milk production increases one unit, milk cost will 1.13 unit decrease. When feed cost increases 1 unit, milk cost will increase 0.960 unit; when labour cost increases 1 unit, milk cost will increase 0.177 unit; when artificial insemination cost increases 1 unit, milk cost will increase 0.0816 unit and when other cost increases one unit, milk cost will increase 0.0987 unit.

If one looks at standardized regression coefficients related to milk production (X_1) of farm enterprises both members and non-members of Breeders Association, will see member farm enterprises produce one kilo of milk with a lower cost compared to non-member enterprises (b_1= -1.34, b_1= -1.13). These findings provide support for calculated cost both types of farm enterprises.

When Table 3 and 4 evaluated together, sees that the most effective variable on milk costs of member and non-member farm enterprises is milk production amount (X_1).

On the other hand, however much, feed, labor and other cost of non-member farm enterprises are relatively low than member farm enterprises, member farm enterprises produce one kilo of milk with a lower cost compared to non-members ($p<0.05$). This also gives support earlier findings of this research (Savran, 2003).

CONCLUSION

The findings of this research and the findings of previous studies showed that dairy cattle farms are being facing several problems related to their activities, these problems can be summarized as follows: the percentage of stock breeding material having high genetic potential is not reached to the desired level yet within the cattle population, unproper use or over grazing of pasture because of lacking sufficient pastures, unrealization of quality fodder production, dominance of small-size farms, unprovision of price stability, lack of infrastructural conditions like sheltering, feeding and care which are required for HYLB (High Yielded Livestock Breed) and their cross-breeds, unqualified and low educational level of manpower employed on dairy cattle farms, lacking wide-spread of Breeders' Associations low revenue of milk production because of unprocessed milk marketing etc. (SPO, 2002; Erkus *et al*., 1996; Savran, 2003).

The recommendations developed for solving above noted problems are presented below:

- Besides improvement works for developing cattle population, infrastructural conditions like shelter (barn), keeping (care) and feeding should be developed.
- Dairy cattle farming is generally kept on small size farms in the country and this fact prevents efficient resource use, utilization of modern livestock technologies and improvement of breeding conditions.

While, the average number of dairy cattle per farm is 1-2, the average number of dairy cattle is 8 on leading and farms established purposively with stock breeding in Turkey (5). In fact, average dairy farm size is 19.6 heads in EU countries. Farm size should be increased to economic scale and the number of specialized farms should be increased for boosting competition power of dairy cattle breeding farms in the country.

- For provision price stability of milk price and fodder feed concentrates prices which have the highest

share within the production cost. The proportion of milk/ feed concentrates prices should be kept at 1/1 levels. All stakeholders related to milk production, public institutions, private companies and NGO's should resaerch together to attain this goal and it will be very useful for formulating, dairy farming policies of the country.

For enlarging market share and marketing power of the products, efficient use of existing resources and cheap input supply emphasis should be given to organization and training of dairy farmers. The contribution of successful Breeders' associations to the dairy cattle farming is an undeniable reality in developed countries. The stock cattle Breeders' Associations started to establish in 1995 and their number is getting bigger year by year and have been executing breed records keeping works together with ministry of agriculture in Turkey. Spread of this kinds of research to country-wide level has an important place on improvement services besides formation of technical and economic data base and implementation of efficient agricultural extension work (advisory service) for farmers in the field of dairy cattle farming.

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