Economic analysis of different dairy farm sizes in Burdur province in Turkey

V. Demircan[1], T. Binici[2], H. Koknaroglu[3], A.R. Aktas[1]

[1]Department of Agricultural Economics, Faculty of Agriculture, Süleyman Demirel University, Isparta, Turkey
[2]Department of Agricultural Economics, Faculty of Agriculture, Harran University, Şanlıurfa, Turkey
[3]Department of Animal Science, Faculty of Agriculture, Süleyman Demirel University, Isparta, Turkey

ABSTRACT: The purpose of this study was to analyze the economic structure of different dairy farm sizes in Burdur province in Turkey. Data were acquired by conducting a survey on 132 dairy farms selected by the stratified random sampling method. Dairy farms were divided into three groups according to their sizes and were analyzed accordingly. It was found that production cost decreased and profit increased as animal unit per farm increased. Production costs per animal unit for the first, second, and third group were 2 634.09, 2 252.01 and 1 930.52 YTL, respectively (1 USD = 1.42 YTL), whereas the net profit was –267.36, 25.95 and 405.99 YTL, respectively. When the average profit of all farms was considered, it was found that the profit was not high enough to sustain a farm household's living. In the study area the retail sale price of 1 kg of milk was 0.468 YTL and production cost of 1 kg milk was 0.455 YTL. Hence it could be said that the profit margin (0.013 YTL/kg), defined as the difference between these two prices, was small. It was found that besides milk production, the cattle value appreciation increased farm income.

Keywords: dairy production; production cost; profit

Dairy cattle production is an important industry of the animal production sector and has an important position in Turkish economy with its employment rate and values of products. However, a decrease in total cattle population, number of cows, and milk production has been observed in recent years. During the period 1990–2003, cattle stocks in Turkey decreased from 12 173 000 to 10 400 000, which was a decrease by 14.57%. During the same period, the number of cows also decreased from 5 892 550 to 4 200 000. In spite of a 25.17% increase in milk production per cow, milk production decreased from 9 614 415 to 8 160 000 t/year due to the decrease in the total number of cows (FAO, 2003).

Even though milk production per cow has increased in the last ten years, milk production per cow is still rather low compared to that of European Union (EU) countries. Milk production per cow is a quarter of the EU countries (Anonymous, 2001). The relatively low milk yield and the decrease in cattle stocks coupled with an increase in per capita income and population resulted in supply shortage in Turkey. This situation becomes more critical with Turkey's accession to EU because it seems that the Turkish dairy production sector is not in a position to compete with European counterparts. Taking all these factors into account structural, technical and financial support and incentives should be given to the dairy production sector to become competitive.

The calculation of production cost is an important requirement for farm analyses, preparation of

Supported by the Research Fund of Suleyman Demirel University (Project No. 0906-M-04).

budget planning and profit analyses. Along with those benefits mentioned above, production cost analyses at the macro-level provide useful information for price policy and other agricultural policies such as agricultural input subsidy, etc. (Erkus et al., 1995).

Dairy production is an important industry of agriculture in Burdur. Based on data for the year 2003, milk production in Burdur was 243 423 t while cow milk accounted for 98 percent of this production. Total stocks of cattle in Burdur were 104 255 head and 98% of this population were European breeds, mainly Holstein (Anonymous, 2003). In Burdur, along with private milk processing units, small creameries also exist. Burdur has a potential to expand its milk production capacity and investments related to dairy production through farmer's organizations and co-ops because of its closeness to the largest market region, Mediterranean and Aegean regions, in Turkey (Anonymous, 1996).

The purpose of this study was to analyze the economic structure of different dairy farm sizes in Burdur province, which takes a highly important place for milk production in Turkey. In the study costs of production, gross profit, net profit, and relative return were determined for different farm sizes. Determination of the most profitable farms with respect to size was also done and suggestions for profitable farming were given.

MATERIAL AND METHODS

Data were collected by face-to face-interviews with dairy farmers who live in villages that belong to three districts Bucak, Yesilova and Central Burdur Province. Besides the data acquired via questionnaire, similar studies conducted by other institutions and researchers were also utilized. Data were collected in 2004, but the gathered information covered the production period that started in 2003 and lasted till 2004.

Based on personal communication with the personnel of the Directorate of Agriculture in Burdur, 18 villages in Central Burdur, Bucak and Yesilova districts were chosen to conduct the survey because they were intensively involved in dairy farming. Dairy farms in those villages that met research criteria constituted the population size. These three districts constituted 79.7% of the dairy cattle population in Burdur province (Anonymous, 2003). In the second stage stratified random sampling method was applied to select the number of dairy farms from those villages (Korum, 1976).

$$n = \frac{Z^2\sigma^2}{(\bar{x} - \mu)^2} \quad (1)$$

where:

n = sampling size

Z = standard normal distribution value (90% probability; 1.65)

σ = standard deviation of sampling size (5.14)

μ = mean of sampling size (7.78)

$\bar{x}$ = average of sample

It was assumed that the mean of the sample deviated at most 10 percent from the population mean given the population parameters.

$$|\bar{x} - \mu| = \frac{10}{100}\ \mu \Rightarrow |\bar{x} - \mu| = 0.78$$

$$n = \frac{(1.65^2)(5.14)^2}{(0.78)^2} = 118$$

Using Equation 1, the sampling size that would represent the population was found to be 118. However, taking into account that some questionnaires would not be qualified for analyses, 138 dairy farms were randomly chosen to conduct questionnaire interviews. Out of the 138 farms 6 had misinformation and did not qualify for analyses, thus 132 farms were used for the survey. To see whether there was a difference between farms regarding their size, the farms were divided into three groups:

Group I: farms that have 1–5 animals (54 farms)

Group II: farms that have 6–10 animals (43 farms)

Group III: farms that have more than 11 animals (35 farms).

Information acquired from farmers by this survey were analyzed and evaluated by Excel spreadsheets. GLM option in SAS program (SAS, 1999) was also used to determine significance levels of the dependent variables. Some dairy farms also had crop production; however, only dairy production was examined for this survey.

Cattle population on the farm was converted to Animal Units (AU) by means of coefficients (Erkus et al., 1995). Depreciations for buildings, machinery and animals were calculated. Depreciation rates were 2, 4, 1.5, 5, and 10% for concrete buildings, mud brick and wood buildings, stone buildings, capital for machinery and parlours, respectively (Erkus et al., 1995). Depreciation costs for a cow given the productive life of a cow as 6 years were calculated as follows (Kiral et al., 1999).

$$\text{Cow depreciation} = \frac{\text{value as breeding stock} - \text{value if slaughtered}}{\text{productive life}} \quad (2)$$

Equation 3, which was used to calculate total interest rate expenses for capital, consists of machinery, building and cow.

$$\text{Building interest} = \frac{\text{machinery or building worth}}{2} \times \text{interest rate} \quad (3)$$

$$\text{Cow capital interest} = \left[\left(\frac{\text{value as breeding stock} - \text{value if slaughtered}}{2}\right) + \text{value if slaughteed}\right] \times \text{interest rate} \quad (4)$$

Since the values (worth) as to the end of the year were considered for machinery, building and cow capital, real interest rates were used (Kadlec, 1985):

$$i = \frac{(1+r)}{(1+f)} - 1 \quad (5)$$

where:

i = real interest rate

r = nominal interest rate

f = inflation rate (wholesale price index)

In the period during which the survey was conducted, annual nominal interest was 18% and inflation rate was 9.44% and thus the real interest rate was found to be as 7.8%.

Since some farms in the sample have both crop and dairy production, fixed and some variable costs for machinery were common costs for those production industries. The distribution of common costs between crop production and dairy industry was evaluated based on the machinery use ratio between dairy and crop production. Management expense was assumed to be 3% of variable costs. When calculating the equivalence of labour cost for family work, the wage rate for a hired worker was taken as the base. Since milk and eggs are marketed soon after production, the revolving fund interest was neglected for these products.

Milk cost was computed by using the comparative sale price value. By this method, total common expenses were separated into main product and by-product according to their share in total gross revenue. Main product and by-product costs per unit are computed by dividing the total value of these products by the corresponding expenses (Kiral et al., 1999).

Market values of products produced as a result of dairy production plus appreciation in yearly assets constitute the gross product value. By subtracting variable costs and production costs from the gross product value gross profit and net profit were ob-

Table 1. Forage and grain production area (ha)

Forages and grains	Group I	Group II	Group III	Average
Barley	0.771	1.347	2.005	1.286
Oat	0.476	0.784	0.726	0.642
Lucerne	0.079	0.131	0.381	0.176
Maize	0.174	0.188	0.629	0.299
Rye	0.015	0.048	0.029	0.029
Sainfoin	0.037	–	0.240	0.079
Vetch	–	0.030	0.260	0.079
Sudan grass	0.0002	0.012	–	0.005
Total forage and grain production area (ha)	1.554	2.54	4.27	2.595
Total farm area (ha)	3.256	4.743	7.019	4.738
Ratio of forage and grain production area (%)	47.73	53.55	60.83	54.77

tained respectively (Rehber, 1993). Relative return was calculated by dividing the gross product value by total production costs.

RESULTS

As a result of having dairy production, farmers included forage and grain production in their farms. The range for forage and grain production area was 1.554–4.27 ha and the average was 2.595 ha. The proportion of the forage and grain production area in total land size ranged between 47.73 and 60.83% and the average was 54.77%. Table 1 shows that with the increasing farm size there is an increase in the forage and grain production area and in its proportion in total land area. The production area of barley accounted for 49.56% of the forage and grain production area and it was followed by oat (24.74%), maize (11.52%) and lucerne (6.78%).

Daily dry matter intakes (DMI) in farm groups were 16.74, 14.34 and 14.48 kg/d AU for the first, second and third group, respectively and this difference was not significant ($P > 0.05$). Pooled dry matter intake was 15.35 kg/d AU. On average the daily ration consisted of 46.51% roughage, 39.68% concentrate and 13.81% green chopped forage (Table 2). Cotton meal, barley, wheat, maize, oat, wheat bran, mixture of concentrates manufactured by feed manufacturers were sources of concentrates. However, sugar beet pulp, straw, dry grasses, lucerne hay were roughage sources and green chopped lucerne, oat, vetch, sainfoin and silage were sources of green chopped forages. It was found that 54.99% of the feed was bought and 45.01% was provided through cultivation on the farm.

On the farms there were on average 9.8 cattle head consisting of 4.15 cows, 2.08 heifers, 0.97 yearlings, 2.37 calves and 0.23 bulls on average. Cows, heifers, yearlings, calves and bulls accounted for 42.35, 21.22, 24.18, 9.90 and 2.35% of the cattle population, respectively. Cattle stocks in terms of Animal Units (AU) for the first, second and third farm group were 2.51, 5.31 and 14.55, respectively, and 6.62 on average (Table 3). The major part of cattle population on the examined farms consisted

Table 2. Feed consumption

Feed ingredient	Group I		Group II		Group III		Average	
	DMI (kg/AU)	(%)	DMI (kg/AU)	(%)	DMI (kg/AU)	(%)	DMI (kg/AU)	(%)
Concentrate	6.48[a]	38.71	6.10[a]	42.54	5.49[a]	37.91	6.09	39.68
Roughage	8.11[a]	48.45	6.69[a]	46.65	6.20[a]	42.82	7.14	46.51
Green chopped forage	2.15[a]	12.84	1.55[a]	10.81	2.79[a]	19.27	2.12	13.81
Total	16.74[a]	100.00	14.34[a]	100.00	14.48[a]	100.00	15.35	100.00

DMI = daily dry matter intake; AU = Animal Unit

[a]means with the same superscripts on the same row are not different ($P > 0.05$)

Table 3. Cattle stocks on the farms

Cattle distribution	Group I		Group II		Group III		Average	
	number	AU	number	AU	number	AU	number	AU
Cow	1.78	1.78	3.58	3.58	8.51	8.51	4.15	4.15
Heifer	0.61	0.43	1.51	1.06	5.06	3.54	2.08	1.46
Yearling	0.22	0.11	0.51	0.26	2.69	1.34	0.97	0.49
Calf	0.98	0.15	2.05	0.31	4.91	0.74	2.37	0.36
Bull	0.06	0.04	0.14	0.10	0.60	0.42	0.23	0.16
Total	3.65	2.51[a]	7.79	5.31[b]	21.77	14.55[c]	9.80	6.62

[abc]means with different superscripts on the same row are different ($P < 0.05$)

of Holstein breed (95%) and the remaining proportion was taken by Brown Swiss cattle (5%).

Milk yield, milk production, and lactation length for farm groups are given in Table 4. It can be seen from the table that the average number of dairy cows for the first, second and third farm group was 1.78, 3.49 and 8.23, respectively, with an average of 4.05 for all farms. Lactation length is defined as the time between calving and dry period (Toker et al., 1998). With the increasing number of cows on the farm there was an increase in lactation length. Lactation lengths for the first, second and third group were 233.40, 236.40 and 247.80 days, respectively, and the third group was significantly different from the first group ($P < 0.05$). Overall lactation milk yield was 4 506.71 kg/cow and the averages for the first, second and third group were 4 201.42, 4 520.76 and 4 960.46 kg/cow and these groups differed from each other ($P < 0.05$). Average milk production per farm was 19 023.71 kg/year and it increased as the farm size increased ($P < 0.05$). Even though some milk was consumed on the farm, most of it was marketed. The respective ratios of marketed milk were 95.04, 96.78 and 98.60% for the first, second and third group. Almost all milk, 96.21%, was marketed through milk collecting cooperatives.

Production costs related to milk production were analyzed by classifying production costs as variable and fixed costs. Variable costs are costs that occur when production is made and they increase or decrease depending upon the production volume. Fixed costs are costs that do not change with respect to the production volume or costs that occur whether production is made or not (Inan, 1998).

As the farm size increased, the portion of variable costs in total production costs increased whereas the proportion of fixed costs in total costs decreased. The proportion of variable costs in total production costs for the first, second and third group was 63.30, 64.90 and 71.90%, respectively. The proportion of fixed costs in total production costs for the first, second and third group was 36.70, 35.10 and 28.10%, respectively. Feed costs were the main component of total production costs, amounting to 58.20%. The proportion of feed costs in total production costs for the first, second and third group was 53.75, 55.27 and 61.34, respectively. On average, feed costs accounted for 85.20% of variable costs. Thus it can be stated that feed costs were the highest item of variable costs. Other costs constituting variable costs were permanent labour (12.72%), cow depreciation (5.38%), cow capital interest (4.58%), marketing (2.89%), variable costs for machinery (2.61%) and veterinary expenses (2.23%) (Table 5).

Gross product values for farm groups are given in Table 6. Gross product value is the summation of income from milk sale, milk premium, cattle value appreciation, manure sale value, feed bag value. The average gross product value for farms was 15 384.74 YTL (1 USD = 1.42 YTL) and increased as the farm size increased. The gross product value for the first, second and third group was 5 940.49, 12 095.99 and 33 996.33 YTL, respectively. Income from milk sale was the main contributor to the gross product value. The income from milk sale accounted for 57.94% whereas the cattle value appreciation accounted for 35.54% of gross product value and was the second most important contributor. It was found that with the increasing farm size there was an increase in items that formed the gross product value.

Gross profit, net profit and relative return for farm groups and per AU are given in Table 7. Gross

Table 4. Lactation yield and milk production

	Group I	Group II	Group III	Average
Dairy cow (head)	1.78	3.49	8.23	4.05
Milk yield (kg/cow day)	18.00	19.12	20.02	18.90
Average lactation length (days)	233.40^{a}	236.40^{ab}	247.80^{b}	238.20
Lactation milk yield (kg/cow)	4 201.42^{a}	4 520.76^{b}	4 960.46^{c}	4 506.71
Milk yield (kg/farm)	7 478.52	15 777.44	40 824.57	19 023.71
Milk marketed (kg/farm)	7 107.22	15 269.53	40 252.28	18 554.62
Domestic milk consumption (kg/farm)	371.30	507.91	572.29	469.09

^{abc}means with different superscripts on the same row are different ($P < 0.05$)

Table 5. Production costs related to dairy production

Expenses	Group I		Group II		Group III		Average	
	YTL	(%)	YTL	(%)	YTL	(%)	YTL	(%)
Feed	3 553.75	53.75	6 609.65	55.27	17 229.20	61.34	8 175.30	58.20
Concentrate	2 290.61	30.57	4 670.95	33.97	11 184.51	36.27	5 424.25	34.54
Roughage	1 109.39	16.78	1 674.40	14.00	5 066.83	18.04	2 342.77	16.68
Green chopped feed	153.75	2.33	264.30	2.21	977.86	3.48	408.28	2.91
Veterinary medication	144.48	2.19	252.65	2.11	646.35	2.30	312.79	2.23
Artificial insemination	52.20	0.79	112.44	0.94	340.00	1.21	148.13	1.05
Marketing	155.27	2.35	347.59	2.91	865.32	3.08	406.19	2.89
Machinery variable costs	150.48	2.28	290.28	2.43	795.43	2.83	367.03	2.61
Other costs	128.61	1.95	148.32	1.24	321.19	1.14	186.09	1.32
A. Total variable costs	4 184.79	63.30	7 760.93	64.90	20 197.49	71.90	9 595.53	68.31
Management expenses (A × 3%)	125.54	1.90	232.83	1.95	605.92	2.16	287.87	2.05
Permanent labour	953.06	14.42	1 850.47	15.47	2 993.00	10.66	1 786.29	12.72
Building depreciation	171.71	2.60	191.02	1.60	241.34	0.86	196.46	1.40
Building capital interest	287.08	4.34	334.22	2.79	457.75	1.63	347.69	2.47
Building repair cost	52.04	0.79	63.95	0.53	101.71	0.36	69.09	0.49
Cow depreciation	336.73	5.09	644.77	5.39	1 538.39	5.48	755.70	5.38
Cow capital interest	267.37	4.04	550.31	4.60	1 337.74	4.76	643.35	4.58
Machinery depreciation	139.23	2.10	194.56	1.64	357.00	1.27	215.00	1.53
Machinery capital interest	94.01	1.42	135.11	1.13	258.79	0.92	151.09	1.08
B. Total fixed costs	2 426.77	36.70	4 197.24	35.10	7 891.64	28.10	4 452.53	31.69
C. Production costs (A + B)	6 611.56	100.00	11 958.17	100.00	28 089.13	100.00	14 048.06	100.00

1 USD = 1.42 YTL

profit is an important criterion that determines the competitive margin of the production activity of the farm in terms of insufficient resources use. In other words, gross profit is a criterion that shows the success of the enterprise (Erkus et al., 1995). Average gross profit for farms was 5 789.20 YTL, it increased with the increasing farm size, amounting to 1 755.70, 4 335.06 and 13 798.84 YTL for the first, second and third farm group, respectively. Net profit was 1 336.67 YTL for farms and increased with the increasing farm size, amounting to –671.07, 137.82 and 5 907.20 YTL for the first, second and third farm group, respectively. Relative return is another criterion that measures the success of a farm and in this study it increased as the farm size increased ($P < 0.05$). It was 0.90, 1.01 and 1.21 for the first, second and third group of farms, respectively. On average the relative return was 1.10 for farms. It means that farms received 1.10 YTL return for each 1 YTL investment (Table 7).

In this study along with costs and return per farm, costs and return per AU were also determined. It was found out that production costs per AU decreased as the farm size increased, and gross and net profit increased as the farm size increased. Production costs per AU were 2 634.09, 2 252.01 and 1 930.52 YTL for the first, second and third farm group, respectively. Production costs for the first group were significantly lower than for the second and third group ($P < 0.05$). The gross product values per Animal Unit for farms did not differ from each other ($P > 0.05$). They were 2 366.73, 2 227.96 and 2 336.52 YTL for the first, second and third group, respectively. Gross profit per AU was 699.48, 816.40 and 948.37 YTL for the first, second and third farm group, respectively. It was not found

Table 6. Income of dairy production

Income items	Group I		Group II		Group III		Average	
	YTL	(%)	YTL	(%)	YTL	(%)	YTL	(%)
Income from milk sale	3 475.94	58.51	7 352.29	60.78	19 220.80	56.54	8 913.46	57.94
Cattle value appreciation	2 202.41	37.07	4 067.44	33.63	12 225.00	35.96	5 467.46	35.54
Milk premium	142.14	2.39	338.79	2.80	1 523.33	4.48	572.43	3.72
Manure sale	116.02	1.95	323.26	2.67	935.71	2.75	400.87	2.60
Feed bag sale	3.98	0.07	14.21	0.12	91.49	0.27	30.52	0.20
Gross product value	5 940.49	100.00	12 095.99	100.00	33 996.33	100.00	15 384.74	100.00

Table 7. Gross profit, net profit and relative return for dairy farms

	Group I	Group II	Group III	Average
Gross product value (YTL/farm)	5 940.49	12 095.99	33 996.33	15 384.74
Gross product value (YTL/AU)	2 366.73[a]	2 277.96[a]	2 336.52[a]	2 332.98
Variable costs (YTL/farm)	4 184.79	7 760.93	20 197.49	9 595.54
Variable costs (YTL/AU)	1 667.25[a]	1 461.57[b]	1 388.14[b]	1 449.48
Production costs (YTL/farm)	6 611.56	11 958.17	28 089.13	14 048.06
Production costs (YTL/AU)	2 634.09[a]	2 252.01[b]	1 930.52[b]	2 122.06
Gross profit (YTL/farm)	1 755.70	4 335.06	13 798.84	5 789.20
Gross profit (YTL/AU)	699.48[a]	816.39[a]	948.37[a]	874.50
Net profit (YTL/farm)	–671.07	137.82	5 907.20	1 336.67
Net profit (YTL/AU)	–267.36[a]	25.95[b]	405.99[c]	201.91
Relative return	0.90[a]	1.01[b]	1.21[c]	1.10

[abc]means with different superscripts on the same row are different ($P < 0.05$)

[abc]means with the same superscripts on the same row are not different ($P > 0.05$)

to differ statistically ($P > 0.05$). Net profit per AU was –267.36, 25.95 and 405.99 YTL for the first, second and third farm group, respectively. Each group was different from the others statistically ($P < 0.05$; Table 7).

Milk production costs are given in Table 8. It was found that with the increasing farm size milk production costs decreased ($P < 0.05$). Milk production costs were 0.538, 0.482 and 0.420 YTL/kg for the first, second and third farm group, respectively. There was no difference in milk sale prices between the farm groups since the milk price is determined by the cooperative in the region. Average milk sale price in the area was 0.468 YTL/kg and average milk production costs were 0.455 YTL/kg, thus the profit margin for milk, which is a difference between the average milk sale price and average milk production costs, was 0.013 YTL/kg and the ratio of this value to the milk sale price was 2.77%.

DISCUSSION

The purpose of this study was to analyze the economic structure of different dairy farm sizes in Burdur province in Turkey. Information acquired from 132 farms using questionnaire interviews was evaluated. The average forage and grain cultivation area (2.595 ha; Table 1) and the proportion of forage and grain cultivation area in total land area were higher than those found by Ozen and Olug (1996) in the same area. Ozen and Olug (1996) found that the

Table 8. Milk production costs on farms

	A Ratio of milk sale value and milk premium in gross product value (%)	B Total production costs (YTL)	C = A × B Ratio of milk production costs in total production costs	D Amount of milk produced	E = C/D Milk costs (YTL/kg)	F Milk sale price* (YTL/kg)	G = F – E Profit margin (YTL/kg)
Group I	60.90	6 611.56	4 026.44	7 478.52	0.538[a]	0.468	–0.07
Group II	63.58	11 958.17	7 603.00	15 777.44	0.482[b]	0.468	–0.014
Group III	61.00	28 089.13	17 139.99	40 824.57	0.420[c]	0.468	0.048
Average	61.66	14 048.07	8 662.04	19 023.71	0.455	0.468	0.013

[abc]means with different superscripts in the same column are different ($P < 0.05$)

*determined by the cooperative in the region

forage and grain cultivation area was 1.469 ha and the proportion of forage and grain cultivation area in total land area was 29.44%. This shows that there has been an improvement in forage and grain cultivation in the study area. The average of milk yield per cow in the study area was 4 506.71 kg/year and this amount was higher than the average of Turkey (1 691 kg/year) and world average (2 165 kg/year), however it was lower than the average of European Union countries (5 930 kg/year; FAO, 2003). One reason for cattle in this area to have higher milk production could be that cattle stocks kept in this area were mostly European breeds, mainly Holstein breed. Even though domestic breeds, crossbreeds and European breeds account for 37, 44 and 19% of the cattle population in Turkey, respectively, the proportion of European breeds in total cattle population in Burdur province was 98% (Anonymous, 2002, 2003); European cattle breeds raised for milk production in Turkey are mainly Holstein, Brown Swiss and Simmental breeds.

In order to increase milk production on farms, farmers must be given extension services and must be educated in husbandry, nutrition and health subjects. Perez et al. (1991) reported that producers in San Pedro had a lower return and lost some money due to deficiencies in nutrition, husbandry and health of cattle. They also mentioned that technical support must be provided to farmers to improve dairy production in the area.

It was found that with the increasing farm size production costs per Animal Unit decreased (Table 5). According to this result it can be said that larger farms have a greater price margin compared to smaller farms. The proportion of variable and fixed costs in total costs in the study area was 68.31 and 31.69%, respectively. Similar results were reported by Karaaslan and Karkacier (2001) in a study conducted in Tokat province of Turkey. The proportion of variable and fixed costs in total production costs was 68.53 and 31.47%, respectively (Karaaslan and Karkacier, 2001). Feed costs were the main reason for variable costs to be high. The proportion of feed costs in total production costs was 58.20% in the study area and these results are parallel with other results obtained from other regions. The proportion of feed costs in total production costs was 58.14% in Bursa (Icoz, 2004), 50.20% in Adana (Yurdakul, 1978), 51.10% in İzmir (Aras and Izmirli, 1976). It was found that the average proportion of feed costs in total variable costs was 85.20% (Table 5). In other studies conducted in other regions of Turkey the proportion of feed costs in total variable costs was 79.76% in Tekirdag (Inan, 1989), 86.60% in Kayseri (Sahin, 2001) and 85.60% in Adana (Gul, 1998). Since feed costs account for the highest portion of variable costs, farmers should seek a way of decreasing feed costs. Good quality and cheap roughage and adequate ration should be incorporated into cattle feeding. A study conducted in Switzerland showed that the feeding of roughage to cows was more advantageous in terms of feed costs (Hilfiker, 1996).

Income from milk sale was the main contributor to income in the gross product value with the proportion of 57.94% (Table 6). Similar results were found by other researchers in other regions of Turkey such as in Van province 54.21% (Bal and Yildirim, 1999) and in Bursa province 59.07 (Icoz, 2004). In order to sustain the farms and improve their situation, the income from milk sale that makes a major portion of the gross product value should be increased. If this were not accomplished, then the exit of farms from the market would be

inevitable. Gross product value per AU was not different between farms, however, net profit increased as the farm size increased. One reason for this might be a decrease in fixed costs per AU with the increasing farm size. Fixed costs per AU for the first, second and third group were 966.84, 790.44 and 542.38 YTL, respectively. Net profit per AU was –267.36, 25.95 and 405.99 YTL for the first, second and third farm group, respectively and the average for all farms was 201.91 YTL (Table 7). In a study conducted in Pennsylvania it was found that net profit per AU was low and it was suggested to increase cattle stocks on the farm in order to increase net profit per AU (Hyde and Dunn, 2002). In another study, Bischoff (1968) stated that technological and economic progress forced dairy farms to become more specialized and that larger farms had advantages over small farms.

The results showed that there was a decrease in milk production costs as the farm size increased. Average milk sale price and milk production costs were 0.468 and 0.455 YTL/kg, respectively. Due to the small difference between these two prices profit margin was low (0.013 YTL/kg). Feed is the most important input that raises milk production costs. Thus farmers should focus their efforts on the lowering of feed expenses. In the study area, it was found that in dairy production along with milk production, especially the cattle value appreciation increased farm income.

In the study area larger farms were found to be more profitable. However, the average income of all farms was not high enough to sustain a farm household. Thus in the study area policies that will have a positive impact on an increase in the cattle population on the farm should be developed. In addition, policies decreasing feed costs and increasing farm income by milk premium and subsidy of forage cultivation should be applied.

REFERENCES

Anonymous (1996): DPT (State Planning Organization) Burdur Province Report 2463, Ankara.

Anonymous (2001): DPT (State Planning Organization) Animal Husbandry Commission Report, Ankara.

Anonymous (2002): DIE (State Statistics Institute) Agricultural Structure (production, price, value) Ankara.

Anonymous (2003): Reports of Burdur Province Office of the Ministry of Agriculture and Rural Affaires.

Aras A., Izmirli R. (1976): Economic analysis of dairy farms in Izmir province (in Turkish). Ege Üniv. Zir. Fak. Yayın, İzmir, No. 279.

Bal T., Yildirim I. (1999): Economic analysis of dairy farms in Van province (in Turkish). Yüzüncü Yıl Üniv. Fen Bil. Enst. Derg., Van, *6*, 79–86.

Bischoff T. (1968): Betriebswirtschaftliche Probleme der Milch-und Rindfleischproduction, Mitt. Tierhalt. Heft, 113.

Erkuş A., Bulbul M., Kiral T., Acil A.F., Demirci R. (1995): Agricultural economics (in Turkish). Ankara Üniv. Zir. Fak. Eğitim, Araştırma ve Geliştirme Vakfı Yayınları, Ankara.

FAO (2003): Web Page of the Food and Agriculture Organization. www.fao.org.

Gul A. (1998): Economic comparison of dairy farms in Adana province with or without a project (in Turkish). Çukurova Üniv. Zir. Fak. Yayın, Adana, No. 131,

Hilfiker J. (1996): Dairy farming: milk performance and structure influence the farm result. Agrarforschung, *3*, 291–294.

Hyde J., Dunn J.W. (2002): Efficiency and profitability of Pennsylvania dairy farms. Pennsylvania State University.

Icoz Y. (2004): Productivity and profit analysis of dairy farms in Bursa province (in Turkish). Tarımsal Ekonomi Araştırma Enstitüsü, Yayın, Ankara, No. 16.

Inan I.H. (1989): A research on the determination of optimum farm plans for the dairy farms of Tekirdağ province (in Turkish). DOĞA TU. Vet. Hay. D., *13*, 337–351.

Inan I.H. (1998): Agricultural economics and management (in Turkish). Trakya Üniv. Zir. Fak., Tekirdağ.

Kadlec C.E. (1985): Farm management, decisions, operation, control, Prentice-Hall, Inc.

Karaaslan G., Karkacier O. (2001): Economic analysis of dairy cattle under project in central country of Tokat province (in Turkish). Gaziosmanpaşa Üniv. Zir. Fak. Derg., Tokat, 18, 1.

Kiral T., Kasnakoglu H., Tatlidil F., Fidan H., Gundogmus E. (1999): Data base guide and production cost methodology for agricultural products (in Turkish). Tarımsal Ekonomi Araştırma Enstitüsü, Yayın, Ankara, No. 37.

Korum U. (1976): Sampling methods (in Turkish). İstatistik, İstanbul.

Ozen N., Olug H.H. (1996): Problems of the dairy cattle production in Burdur and some suggestions to solve them (in Turkish). Akdeniz Üniversitesi Ziraat Fakültesi Dergisi, Antalya, *9*, 309–321.

Perez A., Roberto J., Torres H.G., Herrera H., Jose G., Cortez F., Jose I. (1991): Dairy cattle production on diagnosis in two small farms in the state of Puebla. Serie Ciencia. Animal, Agrociencia, Mexico, *1*, 63–75.

Rehber E. (1993): Agricultural management and planning (in Turkish). Uludağ Üniversitesi Güçlendirme Vakfı Yayın, Bursa, No. 84.

SAS (1999): Statistical Analysis Systems User's Guide. 8th ed. SAS Institute Inc., Raleigh, North Carolina, USA.

Sahin K. (2001): A research on structural features and marketing of dairy farms in Kayseri province (in Turkish). Yüzüncü Yıl Üniv. Zir. Fak. Tarım Bilimleri Derg., Van, *11*, 79–86.

Toker E., Zincirlioglu M., Alarslan O.F. (1998): Animal husbandry (in Turkish). Ankara.

Yurdakul O. (1978): Economic structure of dairy farms and milk marketing and consumption in Adana province (in Turkish). Doçentlik Tezi, Adana.

Received: 05–05–30
Accepted after corrections: 05–08–31

Corresponding Author

Dr. Vecdi Demircan, Department of Agricultural Economics, Faculty of Agriculture, Suleyman Demirel University, 32260, Isparta, Turkey
Tel. +902 462 113 873, Fax +902 462 371 693, e-mail: vecdem@ziraat.sdu.edu.tr