Economic analysis of different laying hen farm capacities in Turkey

Ekonomická analýza drůbežích farem zaměřených na produkci vajec s rozdílnou kapacitou v Turecku

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Abstract: In this study, different capacity laying hen farms in Afyon province, which are of a considerable importance in the laying hen farming in Turkey, were compared in the terms of performance, including feed consumption, production cost and profitability per chick and egg and the most profitable farm size was determined. Data were obtained by conducting a questionnaire research with 75 farmers. Laying hen farms were divided into three groups according to their sizes and were analyzed accordingly. It was found that higher capacity farms had a higher egg yield and a better feed efficiency. It was also found that farms with a higher capacity were advantageous in terms of the technical and economic criteria. Results showed that as farm capacity increased, production cost per hen decreased and net profit per hen increased. It was found that profit margin was negative for group I and positive for group II and III, and profit margin increased as the farm capacity increased.

Key words: laying hen, performance, cost, profitability

Abstrakt: V této studii byly porovnávány farmy s rozdílnou kapacitou zaměřené na produkci vajec v provincii Afyon, která je pro tento typu živočišné produkce v Turecku velmi významná, a to z hlediska výnosů, spotřeby krmiv, produkčních nákladů a dosaženého zisku na jednu nosnici a jedno vejce. Byla rovněž determinována nejefektivnější velikost farmy. Údaje byly získány prostřednictvím dotazníkového výzkumu u 75 farmářů. Farmy specializované na produkci vajec byly rozděleny do tří skupin podle velikosti a podle tohoto rozdělení byly také analyzovány. Zjistilo se, že farmy s vyšší produkční kapacitou dosahují vyšší průměrné snášky a vyšší efektivnosti spotřeby krmiv a dosahovaly lepší výsledky v technologických a ekonomických kriteriích. S růstem produkční kapacity farmy se snižují náklady na jednu nosnici a zvyšuje se dosažený čistý jednotkový zisk. Mezní zisk roste s rostoucí produkční kapacitou farmy a byl negativní pro skupinu farem I a pozitivní pro skupinu II a III.

Klíčová slova: nosnice, výnosy, náklady, ziskovost

The sector of animal husbandry is one of the important sub-sectors of agriculture, which meets important needs of human beings such as meat, milk and eggs. In many countries, including the EU countries, the share of the animal husbandry sector in the total agricultural income generally varies between 30–50%. Animal-origin foods are important basic foods. The decline of animal-origin food intake below a certain level results in the inadequate nutrition. Today, varying according to the age groups, it is recommended that a minimum 40–60% of the daily protein consumption be taken from the animal-origin foods (SPO 2007). Eggs are one of the animal-origin foods and have a great importance in the adequate and balanced diet

for human beings. Two eggs consumed in one day can meet nearly half of animal-origin protein needs of a human being. When compared to the world average and developed countries, it was found that egg consumption per capita in Turkey was low. According to the data of 2005, while the annual egg consumption per capita was 115 in Turkey, the world average, the USA, Japan, France, Germany and Austria were 144, 255, 330, 253, 206 and 228, respectively (Anonymous 2008).

The poultry sector is considered to be the most developed branch of animal production. The level of Turkey in the poultry sector, both in terms of egg production and meat production, is equal to those of developed countries. In the poultry sector, there are nearly 10 000 broiler and 5 000 egg production farms. It is estimated that around 2 million people earn their living from the poultry sector (SPO 2007). Due to the need for animal protein, the possibility of intensification, the contribution of scientific improvements in the field of breeding and feeding, the need for relatively smaller areas when compared to other animal husbandry branches and its contribution to rural development, the poultry sector has an important role in animal production.

In recent years, significant improvements were achieved in the poultry sector in Turkey, especially in the number of hens, production, yield, production technologies and marketing organization. As a result of these improvements, the traditional village poultry activities were replaced by the commercial and industrial poultry farms. While the total number of hens in Turkey was 64 078 000 in 1990, in 2006 it reached 344 819 845, a 5.4-fold increase. The total egg production in Turkey increased around 1.9-fold between 1990–2006 from 384 930 tons to 733 348 tons. The total number of laying hens in Turkey was 58 698 484 according to the 2006 data, and the share of laying hens in the total number of hens was around 17% (TSI 2006). Turkey ranked 11th in the world in terms of egg production according to 2006 data (FAO 2006). Turkey's egg exports have increased 19 times between 2000–2007, reaching 68.1 million U.S. dollars from 3.6 million U.S. dollars (UFT 2007).

This study was carried out in the Turkey's Afyon province, which has a high potential for the laying hen farming. The total number of laying hens in the Afyon province is 6, 186, 223; egg production of the province is 87 839 tons and the egg export is around 12 million U.S. dollars. The shares of these values in Turkey are 10.5%, 12% and 17.6%, respectively (TSI 2006; UFT 2007). According to these figures, the Afyon province ranks first in Turkey in the terms of egg production and export. In addition, the Afyon province

has a significant trade potential due to its location at the junction of many highways, and its proximity to large consumption centres such as Ankara, İzmir and Antalya. All these characteristics of the Afyon province contribute to the originality of the study.

By the analysis of poultry farms, the information which will help in the accurate determination of poultry policies at the macro level can be obtained. From this aspect, studies involving the economic analysis of laying hen farms should be carried out. The purpose of this study was to make an economic analysis of laying hen farms of various sizes in the Afyon province, which has a significant share of the laying hen farming in Turkey. In the study, farms of various sizes were compared in terms of performance, feed consumption, chick and egg production costs and yield. The farm group with the highest yield was determined and various suggestions were made for more profitable laying hen farming in the region.

DATA AND METHODS

The data used in the study were obtained from the questionnaires administered to the producers at laying hen farms in the Afyon province. In addition, similar studies carried out by various persons and institutions and related statistics were also made use of. The data were collected in the year 2006.

Based on the data obtained from technical personnel in the Afyon Provincial Agricultural Administration and from the records of the laying hen farming sector, the Afyon province city centre, Basmakcı, Bolvadin and Suhut counties, where the laying hen farming is carried out, were selected as the study areas. According to the records, there were 126 farms in the area. It was planned to interview all the farm owners; however, since some of the farms were closed down and some of the producers did not want to give the information, only 75 producers were interviewed. Since the number of laying hens owned by the farms showed a significant variation, and with the purpose of obtaining homogenous populations, laying hen farms were analyzed by categorizing them into groups. Laying hen farms were divided into three groups according to the number of hens. The farms having 1–10 000 laying hens (37 farms) were included in group I; the farms having 10 001–30 000 laying hens (21 farms) were included in group II, and the farms having 30 001+ laying hens (17 farms) were included in group III. The data obtained from the farms were analyzed with the Excel software and are shown in tables. The GLM option in the SAS program (SAS

1999) was also used to determine significance levels of the dependent variables.

Depreciation costs were calculated for buildings and tool-machine capital. For the concrete buildings, 2%; the adobe and wood buildings, 4%; the stone buildings, 1.5%; and for the tool-machine capital, 5% depreciation was taken into account (Erkuş et al. 1995).

On the date when the questionnaire was administered, the annual nominal interest rate was 23.5% and the inflation rate was 11.58%. So, the real interest rate was calculated as 10.68% and this value was used in calculating interest cost for machinery and building.

On the analyzed farms, generally more than one production activity was carried out. For this reason, fixed and variable costs for some tools-machines are the common costs. In the distribution of common costs, the utilization ratios of tools-machines in the laying hen farming were taken into account. General management costs were calculated by taking 3% of variable costs. In the calculation of wages for family members, the wages paid to the non-family members in the region were used. In the cost calculation of egg production, since the eggs are produced and sold on a daily basis, the revolving fund interest was not calculated (Kıral et al. 1999). However, the revolving fund interest was calculated for the chick growing period. The revolving fund interest was calculated by applying to variable costs half (3.5%) of the interest rate applied by the Republic of Turkey Agriculture Bank to the poultry sector loans.

By addition of the values of the products obtained from laying hen farming, gross production value was found. By deduction of variable costs from the gross production value, gross profit was obtained. And by deduction of production costs from the gross production value, net profit was calculated, and with the ratio of gross production value to production costs, the relative return was calculated (Erkus et al. 1995; Rehber 2005).

RESULTS AND DISCUSSION

The farms in the study area purchase chicks from various breeding farms and feed them until the egg laying period. It was found that 75% of the chicks in the study area were of white (Lohmann, Nick Chick, Bovans White) and 25% were of brown genotype (Hy-Line, Brown Nick). The average number of chicks on the farms, growing period and feed consumption are given in Table 1. It is understood from the table that, as the farm groups get larger, the number of chicks per farm increases ($P < 0.05$). It was found that the average number of chicks per 1 farm was 5 499 in group I; 18 130 in group II and 81 125 in group III. It was found that there was no significant difference between the farm groups in the terms of the chick growing period. It was found that the average chick growing periods were 16.46 weeks in group I; 16.73 weeks in group II and 16.48 weeks in group III. The daily feed consumption per 1 chick was found to decrease as farm size increases. However, this difference between the farm groups was not statistically significant ($P > 0.05$). The daily feed consumption per 1 chick in the analyzed farms was found to be 61.96, 59.59 and 56.77 g respectively in groups I, II and group III. Thus, it can be suggested that large farms are more advantageous in terms of feed consumption. In the laying hen farming, it is known that there is a high risk of disease. Diseases such as gumboro, diphtheria and typhus may cause the chick population to decline considerably. When the average mortality ratio was analyzed, it was observed that Group III had the lowest mortality ratio and Group I had the highest mortality ratio. The average mortality ratio was 7.25%, 7.20% and 6.41% respectively in groups I, II and III. These values are lower than the values obtained by Bayaner (1991). In that study, the average mortality ratio was 21.61%.

The chick growing period cost items are given in Table 2. The study results indicate that variable costs constituted a significant part of the chick growing period costs, and that as the farm size increased, the

Table 1. Number of chick, growing period and feed consumption in farms

	Farm groups		
	I	II	III
Number of chick (chick/farm)	5 499[a] ± 3 023*	18 130[b] ± 3 334	81 125[c] ± 3 400
Growing period of chick (week)	16.46 ± 0.47	16.73 ± 0.52	16.48 ± 0.62
Feed consumption (g/chick/day)	61.96 ± 2.06	59.59 ± 2.27	56.77 ± 2.72
Feed consumption (kg/chick/growing period)	7.12 ± 0.31	7.00 ± 0.34	6.54 ± 0.40
Mortality rate (%)	7.25 ± 0.99	7.20 ± 1.09	6.41 ± 1.30

[a,b,c]means with different superscripts in the same row differ ($P < 0.05$); *standard error

share of variable costs increased ($P > 0.05$). The share of variable costs in the total costs was found to be 85.38% in group I; 91.63% in group II and 92.71% in group III. It was found that the share of fixed costs decreased as the farm size increased. The share of fixed costs in the total costs was found to be 14.62%, 8.30% and 7.29%, respectively in groups I, II and III. Feed ranks first in cost items in the study area. It was found that, parallel to the farm size, the share of feed cost in the total costs increased. The share of feed cost in the total costs in groups I, II and III farms was calculated as 61.04%, 66.20% and 68.51%, respectively. These shares are consistent with the findings of a study carried out in another region. In a study carried out by Bayaner (1999), the share of feed cost in the total costs was found to be 62%. Another important cost item in the chick growing period was the chick purchasing costs. The share of the chick purchasing cost in the growing period costs was found to be 10.35% in group I, 12.22% in group II and, 13.47% in group III. These figures indicate that, as the farm size increases, the share of the chick purchasing cost in the growing period costs also increases.

The Turkish poultry sector is considerably dependent on external sources in terms of brood chick, feed materials, feed additives, vaccinations, antibiotics, biological and chemical substances and growing factors, all of which are important, especially in the chick growing cost items. Thus, the sector is unable to compete with developed countries such as the USA and the EU, which do not have to import such items.

The performance values of egg production on the analyzed farms are given in Table 3. As the farm groups increased in size, so did the number of hens per farm ($P > 0.05$). The number of hens per farm was 5, 155.05 in group I, 17, 725.48 in group II and 73, 908.82 in group III. When the keeping period of hens in egg production was analyzed, it was found that group II had the highest period. The keeping period of hens in egg production was found to be 56.81, 61.71 and 59.71 weeks respectively in groups I, II and III. In the study carried out by Bayaner (1991), the keeping period of hens in egg production was found to be around 58 weeks. And in the study carried out by Ozyaltirik (1987), the keeping period of hens in egg production was found to be 57 weeks. It was found that the results obtained from this study were parallel with the findings of similar studies. It was found that group II had the highest egg yield per hen and group I had the lowest egg yield per hen. Egg production per

Table 2. Growing period cost of chick in farms (YTL)

Cost items	Farm groups					
	I	%	II	%	III	%
Chick purchase cost	3 030.56[a] ± 1 629	10.35	9 602.22[b] ± 1 797	12.22	42 468.75[c] ± 2 154	13.47
Feed	17 881.94[a] ± 8 084	61.04	52 041.55[b] ± 8 919	66.20	215 950.38[c] ± 10 694	68.51
Electricity	177.86[a] ± 134	0.61	489.13[a] ± 148	0.62	1 705.00[b] ± 177	0.54
Heating	415.00[a] ± 208	1.42	1 209.57[b] ± 229	1.54	2 601.25[c] ± 275	0.83
Veterinary – medication	2 034.82[a] ± 947	6.95	5 202.17[b] ± 1 045	6.62	16 468.75[c] ± 1253	5.22
Cleaning – disinfecting	178.04[a] ± 123	0.61	350.00[a] ± 134	0.45	1 028.13[b] ± 163	0.33
Machinery variable cost	363.81[a] ± 335	1.24	535.61[a] ± 370	0.68	1 989.07[b] ± 444	0.63
Other cost	84.20 ± 41	0.29	166.80 ± 45	0.21	159.69 ± 54	0.05
Revolving fund interest	845.82[a] ± 340	2.89	2 435.90[b] ± 375	3.10	9 882.99[c] ± 450	3.14
A. Total variable costs	25 012.03[a] ± 10 053	85.38	72 032.95[b] ± 11 092	91.63	292 253.99[c] ± 13 299	92.71
Building capital interest	810.61[a] ± 716	2.77	1 718.09[a] ± 790	2.19	6 241.13[b] ± 948	1.98
Building depreciation	303.60[a] ± 268	1.04	643.48[a] ± 296	0.82	2 337.50[b] ± 355	0.74
Building repair cost	267.86[a] ± 265	0.91	580.43[ab] ± 292	0.74	1 278.13[b] ± 351	0.41
Rental cost of hen house	811.43 ± 317	2.77	130.43 ± 349	0.17	375.00 ± 419	0.12
Machinery capital interest	334.07[a] ± 221	1.14	644.39[a] ± 244	0.82	3 190.11[b] ± 293	1.01
Machinery depreciation	312.80[a] ± 207	1.07	603.36[a] ± 229	0.77	2 987.00[b] ± 274	0.95
Permanent labour cost	1 442.13[a] ± 729	4.92	2 205.20[a] ± 804	2.81	6 559.09[b] ± 964	2.08
B. Total fixed costs	4 282.51[a] ± 1 503	14.62	6 525.38[a] ± 1 658	8.30	22 967.95[b] ± 1 988	7.29
Total costs (A+B)	29 294.54[a] ± 10 991	100.00	78 558.33[b] ± 12 127	99.93	315 221.94[c] ± 14 541	100.00

[abc]means with different superscripts in the same row differ ($P < 0.05$); 1 USD=1.43 YTL

Table 3. Performance characteristics of hen in farms

	Farm groups		
	I	II	III
Number of hen (hen/farm)	5 155.05[a] ± 2545	17 725.48[b] ± 3 378	73 908.82[c] ± 3 755
Laying period (weeks)	56.81 ± 1.92	61.71 ± 2.55	59.71 ± 2.83
Number of eggs per farm per day	4 052[a] ± 2090	14 100[b] ± 2 774	59 238[b] ± 3 083
Number of eggs per farm during laying period	1 611 359[a] ± 849 905	6 090 777[b] ± 1 128 138	24 759 706[c] ± 1 253 855
Number of eggs per hen (egg/hen)	312.58 ± 10.78	343.62 ± 14.31	335.00 ± 15.91
Egg yield (%)	78.60 ± 1.12	79.55 ± 1.48	80.15 ± 1.65
Mortality rate (%)	8.50 ± 1.05	9.37 ± 1.39	8.56 ± 1.55

[a,b,c]means with different superscripts in the same row differ ($P < 0.05$)

1 hen was found to be 312.58, 343.62 and 335.00 eggs respectively in groups I, II and III. The fact that the keeping period of hens was longer in group II can be the reason for the high egg production in that group. When the farms were analyzed in terms of egg yield, it was observed that parallel to the farm size, the egg yield increased. The difference between the farms in egg yield was not statistically significant ($P > 0.05$). It was found that egg yield was 78.60% in group I, 79.55% in group II and 80.15% in group III. Thus, it can be suggested that large-size farms are more efficient in egg yield. In the study by Tugluk and Yalcin (2004), the egg yield was found to be between 70–80%, and in the study by Sarikoca (1997) egg yield was found to be 65%. It was observed that the mortality ratio on the farms varied between 8.50% and 9.37% in the groups and that group I had the lowest mortality ratio while group II had the highest. In the study carried out by Lance (1977) in the state of Georgia in the USA, which made an economic assessment of the traditional commercial egg production systems under different environmental conditions, it was found that the mortality ratio varied between 7.87% and 13.8% among production systems. In the study by Tugluk and Yalcin (2004), the mortality ratio was found to be 5.9%, and in the study by Badubi and Ravindran (2004), the mortality ratio was found to be 8.46%. There may also be some other factors affecting the performance of a farm such as experience, education, age, income level of the farmer. However, since the main objective of this research was to analyze economics of different capacity laying hen farms, the aforementioned factors affecting performance of farms were not analyzed.

Feed consumption values of egg production on the farms are given in Table 4. According to the table, the daily feed consumption per 1 hen is higher in group I when compared to other groups ($P > 0.05$). While the daily feed consumption per 1 hen was 121.41 g in group I, it was 117.57 g in group II and 117.06 g in group III. The feed efficiency ratio on the farms was determined in physical (kg feed/kg egg) and economic (YTL feed/YTL egg) terms. It was found that large farms had higher feed efficiency ratios in physical and economic terms. The feed efficiency ratio in physical terms was not found to be statistically significant between the groups ($P > 0.05$); however, the difference between group I and group II in the feed efficiency ratio in economic terms was found to be significant ($P > 0.05$). The feed efficiency ratio in physical terms was found to be 2.47, 2.36 and 2.34, respectively and the feed efficiency ratio in economic terms was found to be 0.75, 0.70 and 0.63, respectively in groups I, II and III. The feed efficiency ratio in physical terms was found to be 2.77 by Kurtaslan (1997), 2.33 by Badubi and Ravindran (2004) and 2.71

Table 4. Feed consumption of hen in farms

	Farm groups		
	I	II	III
Daily feed consumption (g/hen)	121.41[a] ± 1.08	117.57[b] ± 1.43	117.06[b] ± 1.59
Feed consumption during laying period (kg/hen)	48.25 ± 1.67	50.72 ± 2.22	48.94 ± 2.47
Feed efficiency (kg feed/kg egg)	2.47 ± 0.06	2.36 ± 0.08	2.34 ± 0.09
Feed efficiency (YTL feed/YTL egg)	0.75[a] ± 0.02	0.70[ab] ± 0.03	0.63[b] ± 0.03

[a,b]means with different superscripts in the same row differ ($P < 0.05$)

by Al Awadi et al. (1995). In the study by Horne and Bondt (2003), it was reported that the average feed efficiency ratio was 2.09 in Germany, 2.11 in France, 2.14 in England, 2.20 in Poland, 2.30 in Ukraine, 2.14 in Brazil and 2.21 in India.

Cost items of laying hen production were analyzed by categorizing them into fixed and variable costs. Egg production costs are given in Table 5. As is indicated in the table, variable costs constitute a significant part of the egg production period costs. The share of variable costs in the total costs was found to be 71.44% in group I, 77.18% in group II and 75.18% in group III. The share of fixed costs in the total costs was found to be 28.56%, 22.82% and 24.82%, respectively in groups I, II and III. The main reason for the high share of variable costs is the feed costs. Hen feed prices nearly tripled in Turkey between 2000–2006 (SPO 2007; Anonymous 2008). On the analyzed farms, feed cost ranks first among the cost items making up the costs. The share of the feed cost in the total costs in groups I, II and III was 65.31%, 71.77% and 68.87%, respectively. These results are parallel to the results obtained in other studies. In the study of Bayaner (1991), the share of feed cost in the total costs was reported to be 67.82%. In the study of Bostan (1980),

the share of feed costs in the total production costs was found to be 73.4% in average.

To minimize feed costs, which constitute the most important expense in the laying hen farming, the necessary precautions should be taken. Since corn and soy, which are the raw materials of hen feed in Turkey, can not be produced in adequate amounts, 30% of the corn and 90% of the soy are imported (MARA 2004). To enable the adequate production of corn and soy in Turkey and to reduce the dependency on external sources, incentive premiums should be increased. Another important cost item in the egg production period is the chick growing costs. The share of the chick growing cost was found to be 17.90% in group I, 15.20% in group II and 16.03% in group III.

Gross production values of gross egg production on the analyzed farms are given according to the farm size in Table 6. As is indicated in the table, gross production value in egg production includes egg sales, re-formed (chicken sales, slaughtered hen value and fertilizer production value. It was found that the gross production value of the farms increased parallel to the farm size. Gross production value was calculated as 149 996.24 YTL, 544 029.69 YTL and 2 226 519.18 YTL respectively in groups I, II and III

Table 5. Production costs of egg in farms (YTL)

Cost items	Farm groups					
	I	%	II	%	III	%
Feed	106 878.82[a] ± 44 689	65.31	370 823.51[b] ± 59 319	71.77	1 354 582.84[c] ± 65 929	68.87
Electricity	1 172.70[a] ± 4 383	0.72	2 453.33[a] ± 5 818	0.47	22 466.47[b] ± 6 467	1.14
Veterinary – medication	943.24[a] ± 478	0.58	1 161.90[a] ± 635	0.22	6 683.82[b] ± 706	0.34
Cleaning – disinfecting	212.49[a] ± 184	0.13	623.81[a] ± 244	0.12	1 858.82[b] ± 271	0.09
Marketing	212.70[a] ± 396	0.13	454.76[a] ± 526	0.09	2 365.00[b] ± 585	0.12
Packing	5 256.32[a] ± 2 717	3.21	19 156.57[b] ± 3 606	3.71	77 753.65[c] ± 4 008	3.95
Machinery variable cost	1 777.53[a] ± 1 710	1.09	3 060.73[a] ± 2 270	0.59	12 262.60[b] ± 2 523	0.62
Other costs	450.14 ± 198	0.28	1 037.57 ± 263	0.20	571.76 ± 292	0.03
A. Total variable costs	116 903.94[a] ± 48 703	71.44	398 772.19[b] ± 64 648	77.18	1 478 544.97[c] ± 71 852	75.18
Building capital interest	1 903.71[a] ± 1 349	1.16	4 157.57[b] ± 1 791	0.80	22 428.00[b] ± 1 990	1.14
Building depreciation	713.00[a] ± 505	0.44	1 557.14[a] ± 671	0.30	8 400.00[b] ± 745	0.43
Building repair cost	593.24[a] ± 347	0.36	1 033.33[a] ± 461	0.20	2 482.35[b] ± 513	0.13
Rental cost of hen house	534.05 ± 172	0.33	371.43 ± 228	0.07	0.00 ± 0	0.00
Machinery capital interest	1 861.51[a] ± 1 092	1.14	3 651.58[a] ± 1 449	0.71	17 781.69[b] ± 1 611	0.90
Machinery depreciation	1 742.99[a] ± 1 022	1.07	3 419.08[a] ± 1 357	0.66	16 649.53[b] ± 1 508	0.85
Permanent labour cost	6 583.35[a] ± 4 079	4.02	13 218.09[a] ± 5 415	2.56	60 917.93[b] ± 6 018	3.10
Growing cost of chick	29 294.54[a] ± 10 991	17.90	78 558.33[b] ± 12 127	15.20	315 221.94[c] ± 14 541	16.03
Management cost (A*0.03)	3 507.12[a] ± 1 461	2.14	11 963.17[b] ± 1 939	2.32	44 356.35[c] ± 2 156	2.26
B. Total fixed costs	46 733.51[a] ± 7 737	28.56	117 929.72[b] ± 10 270	22.82	488 237.79[c] ± 11 414	24.82
Total costs (A + B)	163 637.46[a] ± 54 675	100.00	516 701.91[b] ± 72 573	100.00	1 966 782.75[c] ± 80 661	100.00

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

Table 6. Income of laying hen farms

Income items	Farm groups					
	I		II		III	
	YTL	%	YTL	%	YTL	%
Egg sales	142 735.87[a] ± 74 741	95.16	527 616.02[b] ± 99 208	96.98	2 166 895.05[c] ± 110 264	97.32
Discarded hens sales	919.32[a] ± 2 160	0.61	3 262.43[a] ± 2 867	0.60	1 3 992.72[b] ± 3 186	0.63
Destroyed hen value	6 093.11[a] ± 3 140	4.06	11 104.76[a] ± 4 168	2.04	40 655.35[b] ± 4 632	1.83
Fertilizer sales	247.95[a] ± 674	0.17	2 046.48[a] ± 895	0.38	4 976.06[b] ± 995	0.22
Total gross values product	149 996.24[a] ± 75 786	100.00	544 029.69[b] ± 100 596	100.00	2 226 519.18[c] ± 111 806	100.00

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

($P > 0.05$). Egg sales constituted a significant part of the gross production value. The share of egg sales in the total gross production values was found to be 95.16% in group I, 96.98% in group II and 97.32% in group III. It was found that all income items making up gross production value in the study area increased parallel to farm size.

Gross, net and proportionate profit per 1 farm and per 1 hen in the study area according to the farm size groups are given in Table 7. Gross profit is an important success criterion in the determination of the competitiveness of production, in terms of the utilization of the inadequate production factors in the farm. In other words, gross profit is an important criterion that indicates the success of the farm organization (Erkus et al. 1995). It can be suggested that on the analyzed farms, the average gross profit per farm increased parallel to the farm size and large

farms were more successful than small farms in terms of the industry criteria ($P > 0.05$). Gross profit was found to be 33 092.30 YTL in group I, 145 257.50 YTL in group II and 747 974.22 YTL in group III. While the average net profit per farm was found to be negative in group I, it was found to be positive in groups II and III. The average net profit per farm was calculated as 13, 641.21, 27, 327.78 and 259, 736.43 YTL respectively. Another criterion measuring the success of the laying hen farming is the relative return. The relative return indicates the income corresponding to 1 YTL cost. To consider a farm successful, the relative return should be higher than 1. On the analyzed farms, the relative return was found to be 0.92, 1.05 and 1.13 in groups I, II and III. Since the relative return is below 1 in group I, the average farm in this group made a loss. The fact that group I farms continue production although they make a loss

Table 7. Gross profit, net profit and relative return in farms

Values (YTL/Farms)	Farm groups		
	I	II	III
Gross product value	149 996.24[a] ± 75 786	544 029.69[b] ± 100 596	2 226 519.18[c] ± 111 806
Variable costs	116 903.94[a] ± 48 703	398 772.19[b] ± 64 648	1 478 544.97[c] ± 71 852
Production costs	163 637.46[a] ± 54 675	516 701.91[b] ± 72 573	1 966 782.75[c] ± 80 661
Gross profit	33 092.30[a] ± 32 518	145 257.50[b] ± 43 163	747 974.22[c] ± 47 974
Net profit	−13 641.21[a] ± 27 436	27 327.78[a] ± 36 417	259 736.43[b] ± 40 476
Relative return	0.92[a] ± 0.03	1.05[b] ± 0.04	1.13[b] ± 0.04
Values (YTL/hen)			
Gross product value	29.10 ± 0.96	30.69 ± 1.27	30.13 ± 1.41
Variable costs	22.68 ± 0.78	22.50 ± 1.04	20.00 ± 1.15
Production costs	31.74[a] ± 0.98	29.15[ab] ± 1.30	26.61[b] ± 1.45
Gross profit	6.42[a] ± 0.62	8.19[ab] ± 0.82	10.12[b] ± 0.91
Net profit	−2.65[a] ± 0.99	1.54[b] ± 1.32	3.51[b] ± 1.46
Relative return	0.92[a] ± 0.03	1.05[b] ± 0.04	1.13[b] ± 0.04

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

can be explained because the farms can meet all the variable costs of the gross production value. In cost analysis, wages were calculated for family members and the interest and depreciation equivalents were calculated for building and machines; all these were included in production costs. In other words, even if the producers made a loss, since they gained in return for their work power and capital, the continuation of their production activities is possible.

In the study area, in addition to the amount of gross, net and relative return per farm, the results per 1 hen were also calculated. Gross profit per hen on the analyzed farms was found to be 6.42, 8.19 and 10.12 YTL, respectively for groups I, II and III. Net profit per hen was found to be negative in group I and positive in groups II and III. Net profit per hen was found to be 2.65, 1.54 and 3.51 YTL respectively in groups I, II and III. According to these results, it was found that the net and relative profit per 1 hen increased parallel to the farm size ($P > 0.05$; Table 7).

The egg cost and profit margins of the analyzed farms are given in Table 8. The re-formed chicken sales and fertilizer sales were deducted from the average production costs per farm and the remaining value was assigned to the total egg production and the unit egg cost was calculated. Then by taking the difference between the sales price and the cost of an egg, the profit margin was calculated. It was found that as the farm size increased, the cost of 1 kg eggs decreased; however, it was not statistically significant ($P > 0.05$). The cost of 1 kg eggs in groups I, II and III was found to be 1.553 YTL (0.863 Euro), 1.314 YTL (0.730 Euro) and 1.233 YTL (0.685 Euro), respectively. In a study carried out by Horne and Bondt (2003), the cost of 1 kg eggs was reported to be 0.672 Euro in Germany, 0.668 Euro in France, 0.794 Euro in England, 0.603 Euro in the USA, 0.620 Euro in Poland, 0.577 Euro in Ukraine, 0.461 Euro in Brazil and 0.409 Euro in India. When the

results obtained from this study were compared to the results reported by Horne and Bondt, it was found that the cost of 1 kg eggs in group I was higher than all of the mentioned countries; the cost of 1 kg eggs in groups II and III was higher than all the mentioned countries except England. In addition to the cost of 1 kg eggs, the cost of 1 egg was calculated. As a result of the analysis it was found that as the farm size increased, the cost of 1 egg decreased. However, the difference between the farm groups was not statistically significant. The cost of 1 egg in groups I, II and III was found to be 0.097, 0.082 and 0.077 YTL, respectively. The profit margin was found to be negative in group I and positive in groups II and III. The profit margin was found to be −0.009, 0.006 and 0.011 YTL/egg respectively. Thus, it was found that as the farm size increased, the profit margin increased as well. However, it was not statistically significant ($P > 0.05$).

CONCLUSION

In this study, different capacity laying hen farms in Afyon province, which have a considerable importance in the laying hen farming in Turkey, were compared in terms of performance, including feed consumption, production cost and profitability per chick and egg, and the most profitable farm size was determined. Study results indicate that large farms had the highest egg yield, a lower feed consumption and better feed efficiency ratios. In addition to these technical criteria, large farms were found to be more advantageous in terms of economic criteria. It was found that in the study area, as the farm size increased, production costs per hen decreased and the gross, net and relative return increased. When the analyzed farms are assessed in terms of profit margin, it was found that profit margin was negative in group I, and positive in

Table 8. Cost and profit margin of egg in farms

	Farm groups		
	I	II	III
A. Production costs (YTL/ farm)	163 637.46[a] ± 54 675	516 701.91[b] ± 72 573	1 966 782.75[c] ± 80 661
B. Discarded hen sales (YTL/ farm)	919.32[a] ± 2 160	3 262.43[a] ± 2 867	13 992.72[b] ± 3 186
C. Destroyed hen value (YTL/ farm)	6 093.11[a] ± 3 140	11 104.76[a] ± 4 168	40 655.35[b] ± 4 632
D. Fertilizer sales (YTL/ farm)	247.95[a] ± 674	2 046.48[a] ± 895	4 976.06[b] ± 995
E. Number of eggs per farm during laying period	1 611 359[a] ± 849 905	6 090 777[b] ± 1 128 138	24 759 706[c] ± 1 253 855
F. Egg cost (YTL/egg) (A-B-C-D/E)	0.097 ± 0.009	0.082 ± 0.012	0.077 ± 0.013
G. Egg cost (YTL/kg)	1.553 ± 0.14	1.314 ± 0.19	1.233 ± 0.21
H. Egg sales price (YTL/egg)	0.088	0.088	0.088
I. Profit margin (YTL/egg) (H-F)	−0.009 ± 0.009	0.006 ± 0.012	0.011 ± 0.013

[a][b][c]means with different superscripts in the same row differ ($P < 0.05$)

groups II and III. Profit margin was found to increase parallel to the farm size. For this reason, the farms in the study should pursue a policy of enhancing their capacities. For reducing feed costs in the laying hen farming, raw feed materials (corn, soy, sunflower, etc.) should be supported to a higher extent. The poultry sector is dependent on external sources in the terms of brood. A considerable amount of various products manufactured using advanced technologies (vaccinations, antibiotics, biological and chemical substances, feed additives, growth factors, etc.), and poultry-house, hatchery, feed factory and slaughterhouse equipment are also imported from abroad. All of these factors significantly increase production costs and adversely affect the international competitiveness of the poultry sector. For this reason, Turkey should develop its own hen hybrids for breeding. In addition, investments in manufacturing all the above mentioned products in Turkey should be encouraged. The instability of prices, especially due to the supply-demand imbalance in egg production, may force producers to sell their products below their costs. Like in the developed countries, the excess eggs in the market should be processed by industrial facilities, turning them into more durable products, such as the pasteurized liquid egg and the egg powder.

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