

Estimation of optimal laying period by Hybrids of Hy-line Brown production*

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Summary: This research was conducted to determine the optimal laying period in commercial egg production. The research, which was carried out on 34900 Hy-line Brown chicks in a commercial enterprise, is completed between December 2002 and July 2004. The first twenty week period of the study occurred as chick growth, and 21st-80th weeks occurred as egg yield period. The optimal laying period was determined according to the Law of Diminishing Returns. In laying period, mortality was 8.17%; FCR 2.55; egg output 72%; total egg yield 302 number/hen and broken and fissured egg rate was 1.70%. In this period, components of costs as pullet were 15.16%; feed 58.50%; labor 1.87%; veterinary and medicine 2.31%; energy 2.01%; viol 4.22%; general management costs 1.83%; maintenance-repair 1.66%; built-equipment depreciation 2.78%; hen depreciation were 9.66%. Estimated financial profitability was -0.01, with a profitability factor -0.01, and O/I rate were 0.96. The enterprise has made a profit (break-even point) between 40th and 41st weeks and reached maximum profitability between 54th with 55th weeks. After this point, continuing the production caused a loss for the enterprise. Therefore, input and yield prices should be considered in market and the production should be completed according to profitability of enterprise within the limits of the Law of Diminishing Returns.

Key words: Commercial egg production, marginal cost, marginal income, profitability

Kahverengi ticari yumurtacı hibritlerle (Hy-line Brown) yapılan üretimde optimal üretim süresinin tayini

Özet: Bu araştırma, ticari yumurta tavukçuluğunda optimal üretim süresinin tespit edilmesi amacıyla yapılmıştır. Özel bir ticari işletmede 34900 adet kahverengi hibritlerle (Hy-line Brown) yürütülen araştırma, Aralık 2002-Temmuz 2004 arasında tamamlanmıştır. Üretimin ilk 20 haftası civciv büyütme, 21-80. haftalar arası yumurta verim dönemi olarak gerçekleşmiştir. Optimum üretim süresinin tayininde Azalan Marjinal Verimler Kanunu dikkate alınmıştır. Yumurta verim döneminde mortalite %8.17; FCR 2.55 kg, yumurta randımanı %72, toplam yumurta verimi 302 adet/tavuk ve kırık-çatlak yumurta oranı %1.70 olarak tespit edilmiştir. Bu dönemde maliyet unsurlarından yarka %15.16; yem %58.50; işçilik %1.87; veteriner-sağlık %2.31; enerji %2.01; viyol %4.22; genel idare giderleri %1.83; bakım-onarım %1.66; bina-ekipman amortismanı %2.78 ve canlı demirbaş amortismanı %9.66 olarak hesaplanmıştır. Mali rantabilite -0.01, rantabilite faktörü -0.01 ve masraf hasıla oranı da 0.96 değerinde bulunmuştur. İşletme 40 ile 41. haftalar arasında kara geçmiş (başabaş noktası), 54 ile 55. haftalarda maksimum karlılığa ulaşmıştır. Üretimin bu noktadan sonra sürdürülmesi işletmenin bu üretim dönemini zararla kapatmasına neden olmuştur. Bu nedenle piyasadaki girdi ve ürün fiyatları da dikkate alınarak, üretimin Azalan Marjinal Verimler Kanunu çerçevesinde sonlandırılması işletme karlılığı açısından oldukça önemlidir.

Anahtar sözcükler: Ticari yumurta üretimi, marjinal maliyet, marjinal gelir, karlılık.

Introduction

For commercial table egg production, the variables that state production performance affect the profitability of the enterprise directly. Feed conversion rate (FCR), mortality, age at point-of-lay, age at peak-of-lay, peak yield, average laying yield, total egg yield and laying period are the main variables of the economic efficiency (19, 21, 27, 29).

Amongst these variables, laying period may be affected by the market egg prices and input costs along

with inner elements of the enterprise (11). In accordance with "The Law of Diminishing Returns" which is seen at the input output relation for production, it is also compulsory to determine the optimum laying period in commercial table egg production. According to this, the production must be aborted during laying period, on the day when weekly production costs (marginal cost) meet weekly total enterprise income (marginal income) (15).

In addition to this, minimum (peak yield, average laying yield and total egg yield per hen) and maximum

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(for age at point-of-lay, age at peak-of-lay and laying period) limits can be calculated with the help of “quadratic function models” to reach maximum level in profitability in commercial egg production. According to this, minimum values represent break even point for the enterprise and maximum values represent optimum level in order to make maximum net profit (12).

Egg producer, who can't control outer factors in his enterprise, can increase his profitability to the maximum level by controlling the inner elements. For that purpose he should act in accordance with economical principle in production. In other words, waste of resources must be kept at the minimum level, and resources must be used more effectively (9).

In accordance with the purpose mentioned, in this research which is done using Brown hybrids (Hy-line Brown) in a private enterprise, technical and economical performance values that effect the profitability of the enterprise have been calculated and profit point (break even point) and optimum period of production when maximum profitability is provided have been ascertained.

Materials and Methods

The material of the research has been acquired from the production records of a private enterprise involving 34900 commercial brown hybrids (Hy-line Brown) from December, 2002 to July, 2004. The first 20 weeks of the production was the chick and pullet, whereas 21 to 80 weeks (60 weeks) was the egg yield period.

The production process has been conducted in the supervision of the researchers. The owner of the enterprise has been informed about optimum laying period and enterprise profitability and the production is terminated with the decision of the enterprise manager.

Some technical and economical performance values, break even point and optimum laying period have been determined in the scope of the methods stated below.

Feed conversion rate (FCR); was calculated by dividing the amount of consumed feed per week (kg) into the amount of egg (kg) obtained during the same period. 16 eggs were considered to be 1 kg in the study (5).

Egg yield (%); was calculated by dividing the amount of egg produced into the number of the hens and then into the period of production (60 weeks).

Cost and income; the total costs during the chick raising period have formed the pullet costs (chick + feed + labor + veterinary and medicine + energy + general management + repair and maintenance + depreciation costs). Related to the egg yield period, feed, labor, veterinary and medicine, energy, viol, general management, repair and maintenance and depreciation costs (Live inventory and building-equipment) have been

calculated. Proper eggs obtained during the production have been considered as the base income and broken or cracked eggs and spent hens which were sold at the end of the period have been considered as the secondary income (7).

Profitability analysis; as no liability capital has been used during production, the active capital was considered as the equity capital. Ratios related to financial profitability which is known as the rate of the net income to equity capital and profitability factor which is known as the rate of the net profit to total income have been calculated. “Economical rate” which is an indicator of the enterprise's success and calculated by dividing the total sales income (output) into overall total of the costs (input) has also been ascertained (20).

Estimation of break even points and optimal laying period; the ongoing of the data about total cost and total income during production have been observed and the point where these two become equal has been determined as the break even point. Optimal laying period has been determined by using the equality of marginal cost that states total weeks cost and marginal income that states total egg amount per week (9).

Standard deviation and average values of some weekly data in the research were calculated using SPSS 15.0 windows program.

Results

The yield period when the initial egg was taken at the 21st week has started with 33882 pullets (mortality rate in chick raising period is 2.92%). The performance values related to the egg yield period can be seen in Table 1.

Table 1. Technical results
Tablo 1. Teknik bulgular

Parameters	Realized value	Target value
Initial pullet quantity (number)	33882	-
Laying period (week)	60	-
Mortality rate (%)	8.17	4.20
Age at point-of-lay (day)	147	133
Age at peak-of-lay (day)	182	182
Peak yield (%)	90	94-96
Cracked-broken eggs (%)	1.70	-
Total egg yield (number/hen)	302	355
FCR (kg feed/kg egg)	2.55	1.96**
Average daily feed intake (g/hen)*	114.77±7.084	109
Average laying yield (%)*	71.93±15.067	83
Average feed price (YTL/kg)*	0.339±0.015	-
Average egg price (YTL)*	0.076±0.010	-
Average cracked-broken egg price (YTL)*	0.027±0.002	-

* $\bar{X} \pm S_x$

**21-74 weeks

The values of proportion of costs elements, capital inventory, profitability and output/input rates are given in Table 2 and Table 3.

Table 2. Costs elements and its proportions in the total costs of the table egg production

Tablo 2. Maliyet unsurları ve yumurta üretimindeki toplam maliyetler içindeki oranları

Cost elements	%
Feed	58.50
Pullet	15.16
Live inventory depreciation	9.66
Building-equipment depreciation	2.78
Repair and maintenance	1.66
General management	1.83
Packing (viol)	4.22
Energy	2.01
Veterinary and medicine	2.31
Labor	1.87
Total	100.00

Table 3. Capital inventory, financial profitability, profitability factor and output/input rates

Tablo 3. Sermaye envanteri, mali rantabilite, rantabilite faktörü ve sermaye/hasıla oranları

I. Active capital (YTL)	1.590.296
1. Immovable capital	560.000
2. Equipment capital	120.000
3. Enterprise capital	910.296
a. Pullet	138.030
b. Material	591.925
c. Bank	180.341
II. Liability (Foreign) capital (YTL)	0
III. Equity capital (YTL)	1.590.296
Financial profitability (%)	-0.01
Profitability factor (%)	-0.01
Output/input rate (%)	0.96

The break-even point was between 40th and 41st weeks. On the 54th and 55th weeks when maximum profitability was achieved, weekly production costs (marginal cost) and weekly egg income (marginal income) have been determined as the closest values to each other (Table 4). On the 54th and 55th weeks when maximum

Table 4 Total and marginal production and income analyses according to weeks

Tablo 4 Haftalara göre toplam ve marjinal üretim ve gelir analizleri

Week	Marginal yield (Egg number)	Egg yield (%)	Marginal cost (YTL)	Marginal income (YTL)	Total cost (YTL)	Total income (YTL)
21.	35476	15	10412	1535	148443	139565
25.	187523	80	12033	10262	192491	169326
30.	209776	90	14474	13764	255917	238300
35.	206269	89	12627	14657	319665	312085
39.	200732	87	13026	14263	370568	369278
40.	195895	85	14003	13920	384571	383198
41.	195685	85	13403	14922	397974	398119
42.	195475	85	12553	14906	410526	413025
45.	183393	80	12507	13985	448493	456076
50.	175511	77	13923	13383	512926	524195
51.	170751	75	12461	13021	525388	537216
52.	170555	75	12850	13007	538238	550223
53.	170359	75	12450	12991	550688	563214
54.	170163	75	12450	12976	563138	576190
55.	165438	73	14088	12618	577225	588808
56.	165249	73	13120	12603	590345	601412
57.	165046	73	12709	12588	603054	614000
58.	158074	70	12873	12054	615926	626054
59.	157878	70	12850	12039	628776	638093
60.	157689	70	14200	12024	642976	650117
64.	145782	65	12641	11400	695127	697373
65.	145593	65	13078	11385	708205	708758
66.	145404	65	13030	11370	721235	720129
67.	138509	62	13018	12026	734253	732155
70.	133329	60	13556	11576	773934	767727
75.	120855	55	14132	10493	842856	822914
80.	112819	52	13196	9796	910296	873285

profitability has achieved (optimal laying period), obtaining a little bit more profit initiative of the enterprise owner dominated although it was essential to stop production. As a result of this, starting from the 66th week of the production the enterprise started to lose money because of the decreasing marginal income and increasing marginal cost. As production continued for 14 weeks more after this point the enterprise closed this production period in loss.

Discussion and Conclusion

The chosen commercial brown hybrids have a 30-50% heavier body structure compared to the white hybrids. Therefore, it is probable that feed consumption and egg cost of the brown hybrids may be high. Although eggs are little bit heavier, compared to the white eggs, the egg shell is thinner (13). Çiçek et al. (10) stated that brown hybrids were preferred more by the producers because they were less stressed compared to the white ones.

The results of FCR and mortality ratio seem to be similar with the results of the literature. In the mentioned researches these values are stated between 1.72-2.99 and 6.8-14.2% (21, 27, 28, 29). Accordingly, the results of age at point-of-lay, peak yield and average laying yield are also close to the results of some researches. In the some researches these values are stated between 126-145th days; 90-92% and 67.34-74.05% (2, 12, 16, 21, 27). However, age at point-of-lay and total egg yield per hen values seem different from the studies notified in the literature. In some researches these values have been stated between 200-224th days and 206-277 pieces/hen (in 52 and 72 week production) (12, 19, 24).

Flock management which was applied during the chick raising period and caring and feeding conditions are considered to be effective in reaching the peak in earlier period. Because it is known that the performance during chick raising period reflects to the period of egg yield period (13). On the other hand, obtained egg yield per hen is excessive due to keeping the production period long.

The technical results of the research have also been compared with the prospectus values (4) of the used animal material. According to this, although egg production started two weeks late, reaching the peak-of-lay in the same period was achieved. But the peak yield achieved during the production period and the average egg yield was found to be lower than the prospectus value. Beginning the egg production with a delay as well as some factors such as deficient lighting and heat, feed quality, stress and mortality rate might have effected this result. Egg yield's lowness and excessive consumption of daily feed are thought to be effective in increasing the FCR value. This state indicates that, feeding system wasn't treated carefully during the egg production period.

Egg is an easily-breakable and easily-decoyable product. Thus, every produced egg can't reach the consumers. During the period until when eggs go out of the enterprise, precautions that will minimize cracked-broken rate and loss of quality must be taken. Because every egg that is wasted represents profit that is lost. It is known that applications during picking period of the eggs, especially slope of the hutch ground, picking frequency and style, affect this rate (13). Using floored hutches, not having a high level slope for the ground level, picking the eggs three times by embedding into viols prevented the increase of cracked-broken rate in the research. As a result, 1.70% of cracked-broken egg caused 1% loss for the income that was achieved. Durrani (12) reported the rate of cracked-broken egg as 3.74%.

Several researches reported the proportion of feed costs in the total costs between 60-80% (25, 33). In the research it has been considered that self feed production within the enterprise effects cost in the decreasing way. There are researches available which supports this judgment (7).

From the cost aspects showed in Table 2, pullet and labor values are compatible to the results of some researches. In the mentioned researches these values are stated between 6.5-23.1% and 2-5.3% in turn (1, 17, 23, 30). Accordingly, veterinary and medicine and packing (viol) values seem similar to the results of other researches. In the mentioned researches these values were stated between 0.8-7.8% and 3.91-4.10% (3, 7, 14, 22, 26). In some researches energy, general management, maintenance-repair and depreciation costs are stated between 0.48-0.84; 2.72-2.91 and 2.41-2.62 percent in turn (7, 26).

Real success for the enterprises lies down on the point how the emerged cost aspects will affect profitability. Meantime, this success is also a proof of how effectively the capital is used. The most important criterion that represents economical success is the profitability ratio (8). As the production took 80 weeks in the research, profitability ratios had obtained negative value.

Financial profitability, profitability factor and output-input ratios were declared as, in a row, between 1.94-18.73%; 7.23-30.00% and 1.02-1.09% (6, 7, 26, 31).

The optimal laying period does not only depend on inner aspects of the enterprise. The market price of the egg, its demand and input costs can change this period. In countries like Turkey where some problems emerged, mainly, inconsistency of egg prices because of changing supply and demand instabilities and high input costs (especially feed) affect the enterprise profitability and; accordingly the production period (11). Beginning time

to the production becomes more important, the demand according to the season changes. Beginning schedules for production of chick and pullets that combines the times especially when prices get higher with the increasing demand with egg peak time will increase the enterprise profitability.

In the scope of the mentioned method, the producer can not only refresh the flock but also s/he can put the present flock into forced moult after the point when maximum profitability is achieved and optimal laying period is determined. The producers might have to keep their present flock in the second year as well when they see tendency of rise in egg prices or because of cash trouble they have with the decreasing egg prices (13). However, for the forced moult application to be successful, it is demanded that, the mortality in and after the hunger period must be low, laying period to restart in a short time and rise rapidly, occurrence of egg yield, weight, and the FCR at desired level, shell and inner part quality of the egg not to corrupt (18).

However, there has been a reaction towards this application especially in Europe as a result of the increase of the possibility of illness because of immune stamina decrease in flocks which are forced to molt and consequently usage of some medicine. Besides, although it isn't fully banned to famish animals in the scope of limitations about animal welfare that European parliament legislated, it is not also disapproved. On the other hand, application of forced molting is forbidden in free-range system. In the direction of these developments and trends, methods which are more compatible to animal welfare principles have to be developed (32).

In a study where Babcock, Nick-chick, Hy-line and Hisex commercial hybrids took place and outer conditions were considered, the optimal laying period was declared as 36 weeks (54 weeks according to the total period). In the research in which quadratic function model was used, it has been stated that there was a positive correlation between laying period and the net profit obtained and carrying on production after the determined period will decrease the net profit of the enterprise. Moreover, it has been highlighted that seasonal changes of egg market prices might effect this period (12).

As a result, this research which was done using commercial brown hybrids (Hy-line Brown) presents the importance of decisions that are taken according to the principle of being economic in egg production. In the scope of The Law of Diminishing Returns the termination of an egg production both increases the yield in the usage of present resource and forms the roof of economical planning for the next production period. Therefore, a producer who is under effect of outer aspects, can use his/her initiative for inner aspects by

moving more effectively in using resources and can raise his/her profit to maximum level.

In Turkey where there is a very high ongoing potential for commercial egg production throughout the world, the wide spreading of this kind of a rational business sense becomes more important when the negations such as input costs and product prices are considered.

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