

## Estimation of Optimum Fattening Period by Cattles of Brown Swiss Hybrid (F<sub>1</sub>) Fattening <sup>[1]</sup>

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### Summary

This research was carried out to assess cattle fattening activity in terms of estimation of break-even point and optimum fattening period and technical and economic aspects of livestock enterprises. The data consisting of the results compiled after fattening 45 male Brown Swiss Hybrid (F<sub>1</sub>) cattle approximately 12-14 months old for 180 days form the material of the research carried out in November 2004-May 2005. In fattening activities the live weight per head of cattle has been calculated as 249.89 kg, end of fattening period live weight as 495.10 kg, average daily live weight gain as 1.36 kg, and the average feed conversion ratio as 6.62. The enterprise broke even at around 45-60 days. The optimum fattening period providing maximum profitability was determined to be between 135-150 days. Furthermore the price margin of the whole herd was 1.94% and the weight margin was 98.06%. When the ratio percentages of input materials used in the study are examined the ratios were determined to be as follows: fattening material consists of 60.48%, feed consists of 26.20%, labor 9.97%, vets-and-meds 1.82%, energy-fuel consist 1.12% while miscellaneous expenses constitute 0.41% of the total input. The partial productivity of feed in terms of dry matter content was 0.16 kg. The partial productivity of labor was 40.88 kg/day. The financial rantability ratio was 9.43%, rantability factor 13.49% and output/input rate 1.16 in the enterprise.

**Keywords:** Cattle fattening, Break-even point, Marginal cost, Marginal income

## Montofon Melezi (F<sub>1</sub>) Sığırlarla Yapılan Beside Optimum Besi Süresinin Tespiti

### Özet

Bu araştırma, sığır besi faaliyetinde, kara geçiş noktası ve optimum besi süresinin tespiti ile işletme sonuçlarının teknik ve ekonomik yönden değerlendirilmesi amacıyla yapılmıştır. Araştırmanın materyalini, Kasım 2004-Mayıs 2005 tarihleri arasında, 12-14 aylık yaşlarda 45 baş erkek montofon melezi (F<sub>1</sub>) sığırlarla yapılan, 180 günlük besiyeye ait kayıtlar oluşturmuştur. Yapılan besi faaliyetinde; besi başı canlı ağırlığı 249.89 kg, besi sonu canlı ağırlığı 495.10 kg, ortalama günlük canlı ağırlık artışı 1.36 kg, kuru madde cinsinden yemden yararlanma oranı da 6.62 olarak hesaplanmıştır. İşletme 45 ile 60. günler arasında kara geçmiş; 135 ile 150. günler arasında da maksimum karlılığın sağlandığı optimum besi süresini yakalamıştır. Ayrıca tüm sürüye ait fiyat marjı %1.94; ağırlık marjı ise %98.06 olarak hesaplanmıştır. Araştırmada kullanılan girdi unsurlarının toplam girdi içerisindeki yüzde oranları incelendiğinde; besi materyalinin %60.48; yem'in %26.20; işçilik'in %9.97; veteriner-sağlık giderlerinin %1.82; enerji-akaryakıt giderlerinin %1.12 ve diğer giderlerin %0.41 oranında pay aldığı tespit edilmiştir. Kuru madde cinsinden yem kısmi verimliliği 0.16 kg; işçilik kısmi verimliliği ise 40.88 kg/gün olarak hesaplanmıştır. İşletmede, mali rantabilite %9.43, rantabilite faktörü %13.49 ve masraf/hasıla oranı da 1.16 değerinde bulunmuştur.

**Anahtar sözcükler:** Sığır besiciliği, Başabaş noktası, Marjinal maliyet, Marjinal gelir



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## INTRODUCTION

Whether or not cattle fattening is a profitable and productive activity depends upon various technical and economic criteria. One of these means finalizing the fattening period when optimum fattening period has been reached. As is the case with other sectors, "The Law of Diminishing Returns" which is observed by the input-output ratio in production is also a valid economy related criteria for livestock fattening. According to this law, when daily fattening costs (marginal costs) during fattening period become even with daily live weight increase value (marginal income) the fattening period must be finalized. Otherwise, even though the producers profitability will decrease when the available resources continue to be used <sup>1-4</sup>.

Also, in traditional livestock fattening activities, the producers do not utilize rational methods to determine the optimum fattening period and when fattening should stop and livestock be transferred to slaughter so either thousands of tons of meat become an economical loss through early slaughter or fattening period is needlessly lengthened and thus resources are wasted <sup>5</sup>.

In order to justify this argument, the production activities in a private sector cattle fattening enterprise were monitored and the enterprise's results were recorded. Afterwards, the results were evaluated by economic analysis within the framework of a determined method, and the break-even point during fattening period and optimum fattening period when profits are maximized were determined. In addition, the proportion of cost elements of the enterprise; feed and labor productivity, profitability ratios and price and weight margins of accrued income were calculated.

## MATERIAL and METHODS

The research material consisted of the records kept at a privately owned livestock fattening facility during the intensive fattening of 45 heads of Brown Swiss cross breed 12-14 month old cattle (F<sub>1</sub>). The mentioned enterprise is a semi-open type with a capacity of 60 heads. The free stall barns made of reinforced concrete have a paddock system in front.

The distribution of cost elements during fattening period in the enterprise, financial rentability and rentability factor ratios and input-output ratios were calculated. The feed conversion rate (FCR) and partial feed and labor productivities were also calculated for the study <sup>4,6,7</sup>.

Optimum fattening period means the point where

marginal cost (total expenses for 15 day period) and marginal income (live weight gain accrued in 15 days as kg x slaughterhouse kg price) are equal to each other <sup>8</sup>.

In determining the break-even point the progress of data pertaining to total income (total live weight of cattle since beginning of fattening in kg x slaughterhouse kg price) and data pertaining to total cost (grand total of all costs since beginning of fattening) are monitored and when they are equal, that is determined as the break-even point <sup>6,9</sup>. Cost factors included in the total cost were: fattening material, feed, vets and meds, energy-fuel oil (variable costs) and labor, general management, maintenance-repair (fixed costs).

Animal retail price increases and live weight increase margins gained during the fattening period were also taken into consideration when determining the income acquired at the end of fattening period. The formula below was used to determine the influence of price and weight margins on the income <sup>10</sup>.

$$I : Wb (Ps - Pp) + Ps (We - Wb)$$

In this formula;

I = Income gained from the sale of 1 head of cattle at the end of fattening (Turkish Lira-TL),

Wb = Average live-weight (LW) of 1 head of cattle at the beginning of fattening (kg),

We = Average LW of 1 head of cattle at the end of fattening (kg),

Pp = Average purchase price paid for 1 kg LW of the cattle to be fattened (TL),

Ps = Average sale price of 1 kg LW of cattle at the end of fattening (TL)

## RESULTS

The enterprise where the study was carried out prepared its own feed concentrate, and used only wheat chaff as rough feed to feed the cattles. The ratios of food components and energy amounts of the feed mixtures used during the production period are given in [Table 1](#).

**Table 1.** Nutrient values and metabolic energy content of the roughage and concentrated feed

**Tablo 1.** Kaba ve konsantre yemdeki besin değerleri ve metabolik enerji

Nutrient matter and energy	Wheat straw (%)	Concentrated feed (%)
Dry matter	90.33	88.11
Raw protein	3.57	13.43
Raw fat	1.22	2.05
Raw cellulose	37.4	5.33
Metabolic energy (kcal/kg)	1540	2635

The values of important findings related to the fattening performance and slaughter characteristics of the cattles at the end of fattening period can be observed in [Table 2](#).

**Table 2.** Technical results

**Tablo 2.** Teknik bulgular

Parameter	Mean (X±Sx)
Average initial live-weight (kg/head)	249.89±4.74
Average live-weight at the end of fattening (kg/head)	495.10±6.70
Daily average live-weight gain (kg/head)	1.36±0.03
Feed Conversion Rate (FCR) (kg)	6.62±0.70

**Table 3.** Break-even point and optimum fattening period in enterprise

**Tablo 3.** İşletmede başabaş noktası ve optimum besi süresi

Days	Total live weight (kg)	Marginal live weight gain (kg)	Total cost (TL)	Total income (TL)	Marginal cost (TL)	Marginal income (TL)	Average cost (TL)
0	11.332	-	53.020	45.895	-	-	-
15	12.447	1.115	55.479	51.033	2.459	4.572	4.46
30	13.529	1.082	58.076	55.469	2.596	4.436	4.29
45	14.533	1.004	60.488	59.686	2.413	4.217	4.16
60	15.383	850	63.144	63.214	2.655	3.528	4.11
75	16.401	1.018	65.970	67.438	2.827	4.225	4.02
90	17.430	1.029	68.939	71.709	2.968	4.270	3.96
105	18.405	975	71.823	75.754	2.885	4.047	3.90
120	19.448	1.043	74.437	80.031	2.613	4.276	3.83
135	20.235	787	77.543	83.376	3.106	3.345	3.83
150	20.932	697	80.799	86.338	3.256	2.962	3.86
165	21.683	751	84.227	89.492	3.429	3.154	3.88
180	22.370	687	87.658	92.378	3.431	2.885	3.92

**Table 4.** Proportion of price and weight margins in enterprise income

**Tablo 4.** İşletme gelirinde fiyat ve ağırlık marjlarının dağılımı

Wb* (kg)	We* (kg)	Pp (TL/kg)	Ps (TL/kg)	Price margin		Weight margin		I (TL)
				TL	%	TL	%	
249.89±4.74	495.10±6.70	4.05	4.13	20	1.94	1.013	98.06	1.033

\* X±Sx

**Table 5.** Proportion of costs elements, productivity, rantability and output/input rate values

**Tablo 5.** Maliyet unsurları, verimlilik, karlılık ve output/input oranlarının dağılımı

Costs elements, productivity, rantability and output/input rate	Values
Fattening material (%)	60.48
Feed (%)	26.20
Labor (%)	9.97
Vets. and meds. (%)	1.82
Energy-fuel oil (%)	1.12
Others (Maintenance-repair + general management cost) (%)	0.41
Partial productivity of feed (kg)	0.16
Partial productivity of labor (kg / day)	40.88
Financial rantability (%)	9.43
Rantability factor (%)	13.89
Output/Input rate	1.16

The break-even point and optimum fattening period results acquired during the fattening activity are given in [Table 3](#). In addition, the price and weight margin ratios revealed in the income acquired at the end of fattening period are presented in [Table 4](#).

The ratios of total input costs used at the enterprise, important findings related to feed and labor partial productivity, rantability ratios and output/input ratios are shown in [Table 5](#).

## DISCUSSION

At the end of the 180 day study, average daily-live weight gain increase of 1.36 kg/day and dry matter content FCR of 6.62 were determined. While these values were close to values determined by other studies [10,11](#), some put forth a more positive outlook [1,4,12-14](#).

Both the average high daily live weight increase and the decreased values of FCR (positive) can be attributed to the young age (12-14 month) of the fattened animals and to the relatively low average live weight per head of cattle. It has been mentioned that studies show that live weight of beginning of fattening and the age of the cattle are directly affected by the technical and economic

performance of the fattening <sup>10,13,15</sup>. In addition, while the enterprise was under observation, improvement was noticed in the preparation of rations program prepared for the feeding of the cattles and herd management.

As is the case in all enterprises, the principle aim of cattle fattening enterprises is to gain a profit. Profit maximization in an enterprise can be achieved by being in control of some important factors within the enterprise as well as on the outside <sup>8</sup>. For this reason, as the consumer relates total benefit and marginal benefit and demand from the goods, an enterprise must take a look at the cost, total cost and marginal cost as well as the relation between production and sales amounts in order to maximize profits. Profit maximization can be laid down with the support of marginal analysis. In other words, the maximum period profit is realized when the marginal cost of the establishment is equal to the marginal output <sup>6</sup>.

The study revealed that the break-even point of enterprise is between 45-60 days, while the optimum fattening period is between 135-150 days. During the optimum period, the levels of daily fattening costs and daily live weight gain values were quite similar. In other words, the equalization or proximity of marginal cost-marginal output was achieved at this time. This is the point where the enterprise can achieve maximum profits.

According to some studies regarding optimum fattening periods, the period determined for Limousine x Jersey cross breeds and Holstein breed male cattle is between 84-98 days <sup>4</sup>; while the period for Eastern Anatolian Red bulls is 146 days <sup>16</sup> and 168 and 182 days for Holstein cattle <sup>2</sup> and 224 and 314 days for Simmental bulls <sup>5</sup>.

The lengthening or shortening of the optimum fattening period is dependent upon various factors such as initial live weight of fattening, feed, labor, credit and live weight gain or meat prices. In developed countries who are authorities in livestock sector and have a stabilized market, fattening activity is carried out until marginal income achieved by live weight gain equals marginal costs. In other words, the time determined for the production of an animal for slaughter by this method becomes more stabilized <sup>3,8</sup>.

The study revealed that almost all the acquired income had been generated from the weight margin. Some values reported by some other studies regarding the price and weight margin <sup>1,4,10</sup> are rather different. In other words, the calculated price margin is lower than the values of this study, while the weight margin is higher. The major reason for this is that during the 180

fattening period, live cattle purchase and sales prices per kg showed minimal changes. In line with this development, the purchase prices of slaughterhouses hardly increased either. Besides, it is thought that the high inflation prices during the other studies might led to an increase in the price margin.

The weight gain is not sufficient to increase the gross income of the enterprises on its own, this must be matched with the increase of the price margin. Usually the income acquired by cattle fattening enterprises is contradicted by the age of the cattles taken for fattening, while the income acquired from price margin changes in direct proportion <sup>9</sup>.

While the income acquired from weight margin is substantial, the cultivated breed and cross breeds put to fatten may also benefit from good maintenance and feeding. The price margin may be less than expected as a result of high purchase cost of feed material or the animal is sold for a price below market price at the end of fattening period <sup>4,10</sup>.

A general overview of the cost elements of an enterprise reveal that the primary costs consist of fattening material, feed and labor costs; while veterinary-health, energy-fuel and others (maintenance-repairs + general management costs) compose the second major costs. The proportional values of cost elements repeat the sequence of importance laid out by previous studies carried out in this subject <sup>1,4,7,10</sup>.

1 kg of feed consumed in the enterprise generated 0.16 kg of weight, while one labor force/day generated 40.88 kg of live weight gain. A partial feed productivity of 0.15 and 0.16 kg; with a partial labor productivity of 37.20 and 48.28 kg/day <sup>7,10</sup> have been reported by studies.

Since the enterprise utilized its equity capital during the study period production, an economic rantability calculation was not carried out. The study established a financial rantability of 9.43% while the rantability factor was established as 13.89%.

While there is no clear limit for the rantability ratio, it must be compared to the other rantability factors of the relevant enterprise. Studies carried out to determine the economics of cattle fattening have established the financial rantability to be between 17.0% and 47.2%, while the rantability factor was established as 13.4% and 46.1% <sup>1,7,10</sup>.

By increasing the difference between costs and sales incomes in favor of the income, the profitability of cattle fattening can be increased. In order to increase the

profitability of livestock enterprises, fixed assets must be utilized in the best way possible, meaning more than one fattening activity must be carried during a calendar year<sup>4</sup>.

The enterprise generated a 1.16 unit output with 1 unit of input. Also ratios of 1.16 and 1.37 for capital/output have been calculated in various studies<sup>1,10</sup>.

In conclusion, this study reveals that the breed, age, sex, initial live weight of cattle to be fattened, as well as technical criteria such as feed conversion ratio, live weight gain value, applied ration program are appropriate criteria for fattening. It has been determined that calculated optimum fattening period is directly influenced by market live weight and slaughterhouse purchase prices and by the age of the cattles to be fattened. In other words the optimum fattening period may be extended by the young age of the cattles and by the stagnation of purchase prices of live weight of the cattle to be slaughtered and slaughterhouse. Moreover, because the producer cannot secure the income from the price margin at the end of fattening period, he will endeavor to increase the weight margin. However, this situation increases the input costs and thus decreases the total profit.

This study proves once again that cattle fattening must not be evaluated by technical criteria only, but by the inclusion of various economic criteria as well. Cattle fattening enterprises face serious internal and external problems, so they must calculate the optimum period and finalize the fattening period according to these calculations in order to realize a more profitable productivity. This is the only way economic resources can be utilized in a more efficient and productive manner.

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