



Original Contribution

THE EFFECTS OF SOME BIOLOGICAL AND ECONOMIC FACTORS ON PROFITS IN THE FATTENING OF BEEF BULLOCKS

Roumen Otouzbirov*, Zhivka Gergovska

The Trakia University, Agriculture Faculty,
Department of Management, Stara Zagora, Bulgaria

ABSTRACT

The efficiency of beef cattle breeding is limited by the productive performance of animals, by the systems of fattening and sailing and by the prime cost of the produce. In order to establish the relationship among these variables a study with 87 bullocks was carried out. The animals belonged to two productive types – beef and dairy breeds. They had been fattened under two systems – in barns and combined (including pasture period and subsequent fattening in a barn). We used linear models to determine the effects of these variables. Fattening system and age had a significant influence on the prime cost per kilogram of carcass yield and of live weight with all breeds. The combined fattening and the younger age were prerequisites for lower prime cost. Breed, but not the fattening systems, influenced the dressing percentage. The lower prime cost per kg of carcass did not guarantee the lower prime cost per kg of live weight. A significant influence was recorded with regard to prime cost per kg of live weight on the profit per kg of live weight. Sale by live weight was not an incentive for the production of well-fattened bullocks with high dressing percentage.

Key words: Bullocks, Breed, Systems of Fattening and Purchasing, Profit

INTRODUCTION

One of the sectors in our agriculture, particularly animal breeding, that has been influenced to a large extent by the processes of reorganization in this country is beef cattle breeding. According to data by Dimova (1) the number of young animals for fattening has decreased by 26,6% in the last ten years. In the same vein young cattle sold out for beef has decreased in number by 47,8%. Equally decreasing has been their total live weight that has gone down by 48,0%. The production of beef per capita has equally followed a similar downward trend. For example, there has been a drop from 11 kg per capital in the 1970s to 8 kg in 1999 (2). The relative share of beef from the total amount of meat produced in the country has been comparatively low, falling from 22,34% in 1992 to 12,93% in 2000 (3). The reasons behind this trend have been multi-factorial.

Firstly, the purchase prices of fattened animals have been low as against the high prices of concentrates, thereby resulting in low profits and attendant losses to the

producer. Secondly, effective regulatory and purchasing systems to stimulate the production of animals with higher meat qualities have been lacking.

In many countries, as well as in Bulgaria, bullocks have been the main source of beef. In England, according to Fisher and Wood (4), dairy cows are 60% more than the beef ones, but a third of these are made pregnant by bulls from the beef breeds. A similar variant is offered for our realities (5). Another source of beef production is the specialized beef breeds that are still rare in Bulgaria. Its production here has not been given the appropriate attention it should deserve.

The slaughter weight of cattle, according to Legoshin et al. (6), has increased in the developed countries thereby resulting in the increase of beef production during the past decade. In some European countries at present, the average weight of the carcasses ranges from 300 kg through 340, with 58-60% dressing percentage. One of the problems in a number of countries, including Bulgaria, is the lack of an adequate purchasing system (including fiscal acquisition) that will stimulate the fattening of cattle, including

*Correspondence to: Roumen Otouzbirov, Trakia University, Agriculture Faculty, Department of Management, Stara Zagora, Bulgaria

improved lean weight, that should produce greater live weight.

Stimulating the development of this branch is predicated on adequate profits that will guarantee reproduction on the farm and secure normal incomes for the owner. Since profit depends to a large extent on production costs, producers aim to reduce the latter and hence reduce the prime cost of the produce. This practice inexorably leads to the establishment of low-cost fattening systems that will in turn produce, in this kind of vicious cycle, low profit due to small weight and quality of the carcasses (7). Results from studies by a number of authors show that it could be advantageous to prolong the fattening period for one-year-old bullocks. This would maximize the profit when we take into account the difference in prices for quality. The prolonged period produces a higher percentage of animals with better slaughter parameters that obviously attract higher prices (8, 9, 10). These improved indices should form the basis for high-yielding agricultural practices in any society.

Therefore the objective of this paper is to study the effect of some biological and economic factors on profit in the fattening of bullocks of various breeds using different fattening and purchasing systems.

MATERIALS AND METHODS

The research was carried out at the experimental base of the Complex Agricultural Station "Strandzha-Sakar" in Sredets, Burgas County. Bullocks from four different breeds were used in the study. And they comprised the following: Polled Hereford - PH /33 pcs./, Beef three breed crossbreds - BTBC /16 pcs./, Native gray cattle – NGC /22 pcs./ and Black and white breed – BWB /16 pcs./. The bullocks underwent the fattening procedures. Bullocks from each breed were divided into two subgroups according to the system of fattening which were the year-round in a barn and combined, including pasture period and period of further fattening in a barn. In the course of the fattening in a barn (for both systems), bullocks were reared under the same conditions, that is, free in-group boxes in a closed building. During the fattening in a barn all groups received the same total ration mixture based on 50% straw. The animals received the mixture *ad libitum*. The quantities consumed by each group were recorded.

Bullocks were fattened until they reached the desired live weights for slaughter,

which were 350 kg for the NGC and 450 kg for the other breeds. This final live weight was in conformity with the current standard regulations BDS 873-73, which guarantees maximum payment for that weight.

Obtaining the economic parameters, during the fattening process, involved the controlling and computing the following: costs for feeds, labor costs and other costs, including costs for preventive and curative veterinary practices, water supply, electricity, transport, depreciations, etc. On that basis the prime cost of yield was calculated. After adding the value of the calf upon purchasing, the prime cost of live weight was computed. Both prime costs were calculated for 1 kg of carcass weight and 1 kg of live weight. The incomes from the sale and the profits were calculated on the basis of the relevant prices for both purchasing systems currently in use in Bulgaria, that is, pr kg of live weight and kg of carcass weight.

Due to the difference in prices at the time of the experiment and at present, as well as their possible future variations, the so-called Derived Unit /DU/ was used in calculating the economic parameters. The purchase price per kg of live weight was chosen as base price for the dairy breeds and dual-purpose ones /BWB and BBC and NGC/, while all other prices and costs were calculated as percentages from it. Owing to the higher purchase prices for beef cattle and crossbreds, compared to those of dairy and dual-purpose breeds, the analyses were made separately for the breed groups with similar productive performance and the respective purchase prices.

Statistical analyses were made using the respective modules of "Statistica" Software /STATISTIKA Software – N 1234/.

Linear models were used to study the variation and the relationship between factors and signs. Solutions of equations were done using the synthesized method of the least square means /LSM/, and the components of the variances were assessed according to the ANOVA paradigm.

In order to establish the degree of influence of the different factors the following model of the most general kind was used:

$Y_{ijk} = \mu + A_i + F_j + e_{ijk}$, where:

Y_{ijk} is the dependent variable (the studied parameter), μ is the average value for the excerpt; A_i is the i -th effect on each fixed factor, included as a class in the model; F_j is the j -th effect of the other fixed factors, corresponding to the non-class independent variables; e_{ijk} is the effect of the non-included accidental effects (except μ).

Models of the same kind have been employed for each of the studied parameters and they are presented in the respective Tables for variance analysis in “Results and discussion”.

From the analysis of the variance models for each class of fixed factors the following were obtained: the least square means (**LSM**) and the grades of the least square means (**LS-estimation**) which are the sum total of the squares calculated as deviations from the average parameter of the value obtained from the model. The LSM errors have also been given – SE. LSM values are only presented and discussed for significant effective factors.

RESULTS AND DISCUSSION

The average age of bullocks at the beginning of fattening was about one year and there was no significant difference between the groups of the same breed, except in the NGC (**Table 1**). Live weight at slaughter for all groups was achieved as specified in the aim. Dressing percentage differed not only by breeds but also by the fattening system in the same breed. No special regularity was observed in relation to the fattening system. Bullocks from the Hereford and NGC breeds that underwent combined fattening had relatively low growth yield compared to those in barns, but with BWB and the three breed crossbreds similar relationship was not observed.

The submitted mean values of economic parameters varied considerably in bullocks from different breeds and systems of fattening and purchasing. The initial price of the bullock per kg of live weight had high relative share from the prime cost per kg of live weight and it varied considerably by groups ranging from 49,05% for the BWB – in barns, to 76,75% for the PH – combined. The following regularity was not observed – lower prime cost of the bullock giving rise to lower prime cost per 1 kg of live weight. The direct comparison between bullocks from different breed groups by that parameter was a difficult task due to the fact that their purchase price differed according to the productive types – higher for the beef and lower for the dairy and dual-purpose type. Similar was the situation with the profit per 1 kg of live weight due to the varying purchase prices. Due to these considerations the analyses on the effect of the various factors have been made separately for both productive types.

From the variance analysis (**Table 2**), it was established that the prime cost per 1 kg of live weight for $P < 0,001$ /breed depended on

the dairy breeds. The prime cost per 1 kg of live weight was considerably higher for NGC bullocks compared to that of BWB bullocks. This was probably accounted for by the fact that NGC bullocks had been fattened to a smaller live weight at slaughter. As a result of that all expenses – for purchasing the calf and its fattening, divided by the final live weight – gave higher prime cost. With beef bullocks there was no reliable influence of the breed type on that parameter and there was no significant difference in live weight at slaughter.

The fattening system had a reliable influence both on prime cost of carcass $/P < 0,001/$ and prime cost per kg of live weight $/P < 0,01; P < 0,001/$ for all breeds. It was one of the basic factors influencing the prime cost. The reason for this was the considerably lower costs for the combined fattening compared to the ones in barns. Because of this the prime cost, both of carcass and per kg of live weight was reliably lower for the combined fattening system (**Table 3**).

The higher dressing percentage resulted in lower prime cost per kg of live weight $/P < 0,05/$, which was typical for the beef breeds and crossbreds. They utilize better the nutrients and by intensive fattening for shorter periods they could reach the desired weight at high daily gain.

Another important factor that had a reliable effect on prime cost was the age at the beginning of fattening for bullocks of all breeds (**Table 2**). As calves grew older, 12 months and over, the prime cost per kg of carcass decreased (**Table 3**). The reason for this was faster attainment of slaughter age, as calves grew older. Hence, costs were reduced. The average prime cost per kg of gain was almost the same with a tendency to become higher for the dairy and dual-purpose breed types.

The prime cost of gain is an important parameter that reflects the cost for production of fattened bullocks but more important for the economic efficiency of production is the prime cost per kg of live weight. The age of bullocks at the beginning of fattening had an adverse effect on the prime cost per kg of live weight compared to its effect on the prime cost of gain. The increase of the initial age resulted in an increase of prime cost per kg of live weight (**Table 3**). Older age with higher live weight would inevitably result in a higher price of the bullocks.

Table 1. Average values of the basic biological and economic parameters by breeds of bullock and fattening systems

<i>Parameters</i>	Breeds*/ fattening system (b=barn, c=combined)							
	PH/b	PH/c	NGC/b	NGC/c	BWB/b	BWB/c	BTBC/b	BTBC /c
Biological parameters								
Number of bullocks in the group	19	14	11	11	8	8	8	8
Age at the beginning – days	354,53	391,21	315,82	402,45	334,37	334,62	335,25	320,87
Live weight at slaughter- kg	448,32	441,21	346,00	362,91	460,12	474,50	448,37	445,00
Dressing percentage - %	55,44	53,04	52,31	47,95	55,77	55,32	55,67	56,48
Economic parameters								
Prime cost of 1 kg of live weight gain – DU#	0,299	0,199	0,302	0,206	0,350	0,276	0,353	0,249
Initial cost of bullock per 1 kg of live weight – DU	0,581	0,657	0,515	0,627	0,337	0,362	0,561	0,569
Prime cost per 1 kg of live weight – DU	0,880	0,856	0,817	0,833	0,687	0,638	0,914	0,818
At purchase by live weight								
Income per 1 kg of live weight – DU	1,413	1,391	1,114	1,114	1,053	1,086	1,437	1,428
<u>1. Profit per 1 kg of live weight – DU</u>	0,533	0,535	0,297	0,281	0,366	0,448	0,523	0,661
At purchase by carcass weight								
Incomes per 1 kg of live weight – DU	1,494	1,426	1,105	1,027	1,113	1,150	1,540	1,527
<u>2.Profit per 1 kg of live weight – DU</u>	0,614	0,570	0,288	0,194	0,426	0,512	0,626	0,709
<u>Difference of profit /2-1/ DU</u>	+ 0,081	+ 0,035	- 0,009	- 0,087	+ 0,060	+ 0,064	+ 0,103	+ 0,099

*PH – Pulled Hereford, NGC – native gray Cattle, BWB – Black and White Breed, BTBC – Beef Three breed Crossbred

DU – derived units

Table 2. Analysis of the variance for the effect of some biological factors on the prime cost per 1 kg of gain or 1 kg of live weight

Factors	Degrees of freedom (n-1)	Prime cost per 1 kg of gain		Prime cost per 1 kg of live weight	
		Beef breed F P	Dairy and dual-purpose breed F P	Beef breed F P	Dairy and dual-purpose breed F P
Total for the model	49/38 ^{''}	13,26***	22,64***	4,80***	22,64***
$\mu u - y\mu$	1	0,43-	0,06-	1,18-	15,42**
Breed	1	0,11-	0,04-	0,48-	53,73***
Fattening system	1	55,82***	36,14***	20,71***	9,01**
Age at the beginning of the fattening period	3	8,17***	7,08***	4,86**	9,71***
Dressing percentage	2	0,45-	0,76-	4,67*	0,95-

Note: "the first figure refers to the number of beef bullocks and the second one – for the dairy ones.

* - $p < 0,05$; ** - $p < 0,01$; *** - $p < 0,001$

Table 3. Estimations and LS-means about the effect of bullock age at the beginning of the fattening period and the fattening system on prime cost

Variation sources	Beef breed					Dairy and dual-purpose breeds				
	Number r	Prime cost per 1 kg of gain		Prime cost per 1 kg of live weight		Number r	Prime cost per 1 kg of gain		Prime cost per 1 kg of live weight	
		Estim.	LS $\pm$ SE	Estim.	LS $\pm$ SE		Estim.	LS $\pm$ SE	Estim.	LS $\pm$ SE
Average for the model	49	-	0,281 $\pm$ 0,01	-	0,881 $\pm$ 0,01	38	-	0,295 $\pm$ 0,01	-	0,725 $\pm$ 0,01
Age at the beginning of the fattening period:										
Under 280 days	6	+0,030	0,311 $\pm$ 0,02	-0,051	0,831 $\pm$ 0,02	5	+0,015	0,309 $\pm$ 0,02	-0,109	0,615 $\pm$ 0,02
From 281 to 340 days	13	+0,026	0,307 $\pm$ 0,01	-0,003	0,878 $\pm$ 0,02	11	+0,028	0,323 $\pm$ 0,01	+0,030	0,755 $\pm$ 0,02
From 341 to 400 days	17	+0,006	0,287 $\pm$ 0,01	+0,035	0,917 $\pm$ 0,02	13	+0,008	0,303 $\pm$ 0,01	+0,044	0,768 $\pm$ 0,01
Over 401 days	13	-0,062	0,218 $\pm$ 0,02	+0,019	0,901 $\pm$ 0,02	9	-0,051	0,244 $\pm$ 0,01	+0,034	0,759 $\pm$ 0,02
Fattening system:										
In barns	27	+0,049	0,330 $\pm$ 0,01	+0,032	0,914 $\pm$ 0,01	19	+0,034	0,329 $\pm$ 0,01	+0,023	0,747 $\pm$ 0,01
Combined	22	-0,049	0,232 $\pm$ 0,01	-0,032	0,849 $\pm$ 0,01	19	-0,034	0,261 $\pm$ 0,01	-0,023	0,701 $\pm$ 0,01

Table 4. Analysis of the variance about the effect of some biological factors on the costs of bullock purchasing per 1 kg of live weight

Factors	Degrees of freedom (n-1)	Beef breed		Dairy and dual-purpose breed	
		F	P	F	P
Total for the model	49/38	8,07***		73,02***	
μ - $\gamma\mu$	1	2,37-		18,62**	
Breed	1	0,13-		118,09***	
Age of bullock at the beginning of fattening	3	10,69***		28,17***	

Table 5. Analysis of the variance about the effect of some biological and economic factors on the profit per kilogram of live weight with two systems of purchasing

Factors	Degrees of freedom (n-1)	Profit in purchasing by live weight		Profit in purchasing by carcass weight	
		Beef breed F P	Dairy and dual-purpose breed F P	Beef breed F P	Dairy and dual-purpose breed F P
Total for the model	49/38 ¹	26,74***	9,29***	17,19***	13,48***
μ - $\gamma\mu$	1	0,32-	3,20-	1,15-	0,34-
Breed	1	0,02-	1,55-	5,05*	0,95-
Prime cost per kg of gain	3	1,97-	3,93*	1,74-	5,20*
Prime cost per kg of live weight	2	82,68***	10,21***	21,43***	2,83*
Dressing percentage	2	1,79-	0,72-	23,51***	10,74***

Note: ¹the first figure refers to the number of beef bullocks and the second one – for the dairy ones.

* - $p < 0,05$; ** - $p < 0,01$; *** - $p < 0,001$

Table 6. Effect of carcass prime cost on the profit per kg of live weight for the dairy and dual-purpose breeds

Variation sources	Number	Purchasing by live weight		Purchasing by carcass weight	
		LS-estimation	LSM $\pm$ SE	LS-estimation	LSM $\pm$ SE
Average for the model	38	-	0,326 $\pm$ 0,02	-	0,355 $\pm$ 0,03
Prime cost per kg of gain					
Under 0,200 DU#	5	+0,029	0,356 $\pm$ 0,04	-0,009	0,346 $\pm$ 0,05
From 0,201 to 0,300 DU	15	+0,019	0,346 $\pm$ 0,02	+0,058	0,414 $\pm$ 0,03
Over 0,301 DU	18	-0,049	0,277 $\pm$ 0,02	-0,049	0,312 $\pm$ 0,02

As in Table 1

This was confirmed by the analysis of the effect of the basic biological factors on the initial price of the calf per kg of live weight (**Table 4**). The basic factor affecting it was the age of calves at the time of purchasing. Higher age would lead to higher costs of purchase per kg of live weight for bullocks of both types / $P < 0,001$ /. With bullocks of the dairy and dual-purpose type the breed influenced the initial price of the calf as part of the final live weight / $P < 0,001$ /. The reason for this was the lower final live weight of slaughter of NGC, upon which these costs were divided.

Fattening bullocks would have to start at a younger age, that is, between 8 and 10 months. This would produce a lower price for purchase and lower prime cost per 1 kg of live weight. The lower prime cost gain does not guarantee better fattening efficiency that is, prime cost per 1 kg of produced live weight.

Profit depends on the system of purchasing and the difference in prices according to the productive type. The analysis in **Table 5** shows that prime cost per 1 kg of live weight had a reliable influence on profit per kg of live weight when purchasing by live weight for the two productive types. The high prime cost of production per 1 kg of live weight resulted in lower profit in the long run. Breed and slaughter yield had no reliable influence on profit with this system of purchasing. This shows that when purchasing by live weight, producers have no incentive to fatten animals to a greater slaughter yield. The prime cost of gain also had a reliable influence on profit for the dairy breeds with this system of purchasing, but not for the beef breeds.

The prime cost per kg of live weight had a reliable influence on profit when purchasing by carcass weight. Profit was higher for animals with higher dressing percentage for both productive types.

The breed had a reliable influence only in the case of the beef type. The beef crossbreeds had a reliably higher profit per kg of live weight, compared to the Hereford, regardless of the fattening system.

The prime cost of gain had a reliable influence on profit only for the dairy breeds. When purchasing by live weight the high prime cost of growth yield definitely resulted in lower profit (**Table 6**). This was related to the increase of production costs resulting in decrease of profit without taking into consideration the quality of fattened bullocks. When purchasing by carcass weight both high and low prime cost resulted in lower profit.

Only animals with an average prime cost gave higher profit per kg of live weight. With this system of purchasing the attained dressing percentage also had a reliable influence on profit. The extremely high prime cost of gain resulted in an increase of the total prime cost per kg of produced live weight, which could not be compensated by a possible higher dressing percentage.

CONCLUSIONS

The higher prime cost per kg of live weight was not directly related to the prime cost per kg of gain, but was influenced, to a large extent, by the initial price of bullocks for fattening.

The lower prime cost of the gain could have a positive influence on profit only when fattening bullocks of non-beef types and purchasing by live weight.

The purchasing by live weight provided no incentive for producers to produce better-fattened bullocks, with higher dressing percentage. The obtaining of a higher profit was related mainly to the lower prime cost per kg of live weight of beef bullocks and the higher purchase price according to the breed type.

When purchasing by carcass weight the profit would depend largely on the dressing percentage, too. The application of that system would stimulate the production of bullocks with good beef qualities.

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