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ECONOMIC EFFICIENCY OF BULL FATTENING OPERATIONS IN THE CZECH REPUBLIC

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Abstract

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Fattened bulls are the main source of beef in the Czech Republic (CR) and in most other EU countries. Profitability of fattening operations is a fundamental prerequisite for increasing domestic beef production. The objective of this study was to assess the economic efficiency of bull fattening operations in CR during 2013 and 2014. Data from 17 operations were collected using a questionnaire. Major cost items were determined and the return on costs was calculated while either including or excluding support payments. In 2013, average total costs reached 24,038 CZK per bull and a 1,152 CZK loss was incurred. In 2014, total costs were similar as in 2013 but the loss was 3,238 CZK per bull as a result of a higher initial purchase price of bulls at the beginning of the fattening period. Break-even points, defined as those points at which the operation reaches zero profitability, were estimated for daily live weight gains (1,189 and 1,290 g/day in 2013 and 2014, respectively) and for selling prices of bulls (91.19 and 96.05 CZK/kg of carcass in 2013 and 2014, respectively). A sensitivity analysis revealed that the most influential parameters were purchase and selling prices and live weight gains of bulls.

Keywords: break-even point, bull fattening, costs, price, sensitivity analysis

INTRODUCTION

Beef production worldwide reached about 64 million tonnes (dressed carcass weight) in 2013, representing per capita consumption of 8.9 kg per year (Faostat, 2015). After milk production, beef production is the second most important segment of the cattle industry. In most European countries, the main source of beef consists in intensively fattened bulls of beef and dairy breeds or their crosses. Such animals contribute approximately 50 % to the overall beef production in the European Union as well as in the Czech Republic (CR). A total of 222,987 cattle (of which 98,583 were bulls) were slaughtered in CR in 2014, yielding beef and veal production of 65,529 tonnes and per capita consumption of 7.9 kg per year (Czech Statistical Office, 2016b). Per capita beef consumption has been declining since 1989 and is 25 % lower than the EU average (Ministry of Agriculture, 2015). Among other factors, beef production is related to the size of the cattle population within a given country. The population of cattle in CR (as of 1 April 2016) was 1.416 million head, of which 125,328 were bulls over 1 year of age (Czech Statistical Office, 2016b).

A reasonable level of profitability is one of the main prerequisites for increasing domestic beef production and the number of fattened bulls (Kvapilík, 2008). Beef production is a significant component of agricultural output as well as of gross domestic product generally. Furthermore, it contributes to employment and constitutes an important commodity for foreign trade. Most previous studies have agreed that the strongest determinant of profitability in fattening bulls is live weight gain (Wolfová *et al.*, 2004; Topcu and Uzundumlu, 2009). Increasing daily gain tends to reduce days on feed and thus it improves the overall profitability (Garip *et al.*, 2010). The variability in profit per head and the economic efficiency of

I: *Basic indicators of fattening bull operations analysed*

Item	2013				2014			
	Mean	Min	Max	SD	Mean	Min	Max	SD
Weight gain (g/day/head)	1,125	872	1,439	177	1,092	850	1,300	121
Fattening period (days)	421	270	600	104	428	380	450	29
Death losses (%)	2.99	1.00	6.50	1.89	3.70	2.00	6.79	1.83
Slaughter live weight (kg/head)	649	497	750	73	670	618	730	38
Carcass yield (%)	55.7	53.8	57.0	0.88	55.7	53.8	56.9	1.1
Carcass weight (kg/head)	362	277	420	43	374	332	414	28

SD = standard deviation

fattening operations are also strongly influenced by the price of slaughter cattle (Kvapilík, 2008) and by input costs, especially feeding costs (Norton, 2005). To achieve success in competitive markets, fattened cattle prices should reflect changes in feed prices (Zhao *et al.*, 2011). Prices of inputs (feeds, labour, energy, etc.) are reflected in total costs encompassing animal purchase, feeds, and operating and capital costs. The initial purchase price of a bull at the beginning of the fattening period is closely related to its age and live weight and markedly influences the level of subsequent profitability. The aim of every fattening operation is to achieve highest production with lowest costs and thus to maximize profit. It is necessary to seek to optimize production intensity, however, inasmuch as minimizing costs is often associated with reduced growth (lower live weight gains and longer fattening period), and that can result in lower income and overall profitability. Focusing on maximum weight gains may increase costs but, through elevating output, may also result in increased profitability (Ruiz *et al.*, 2000).

As evidenced in a number of studies, cattle fattening may be a risky venture. Belasco *et al.* (2009) reported that net returns for fattening cattle in Kansas from 1981 to 2006 oscillated from large profits to heavy losses over short time periods. Similarly, although fattening cattle prices were at record high levels in Western Canada, the feeding sector was experiencing near record losses of 2,500 CZK to 5,000 CZK per head in 2012 because of high priced calves due to expensive feed and other costly inputs (Duckworth, 2013). A study investigating the level of cattle fattening profitability in CR during 2007 and 2008 had revealed that these operations were generally unprofitable even if government supports were included (Kopeček *et al.*, 2009).

The objectives of this study were to evaluate the costs and profitability of cattle fattening in CR during 2013 and 2014, determine minimum profitability requirements, define the factors with the strongest impact on the economic efficiency of fattening operations, and assess farmers' views on these factors.

MATERIALS AND METHODS

Data

Input data were collected from farm operations located in different regions of CR and engaged in fattening bulls of beef and combined breeds. The data were obtained for 2013 and 2014 using a questionnaire containing 60 questions structured in five parts: basic information, production characteristics, revenues from sales and support payments received, annual costs, and farmers' views on various factors influencing the economic performance of their operations. For reasons of the participating operations' accounting, a single calendar year was taken as the observation period. A total of 17 operations of different size responded to the questionnaire, 14 of which were the same in both years. The data were obtained on the basis of 3,768 bulls (an average of 222 per operation) in 2013 and 3,387 bulls (an average of 199 per operations) in 2014. Mean values and the variation of basic production traits are presented in Tab. I. Clearly outlying input values were excluded from further analyses.

Methods

Total revenues included those from bull sales and support payments obtained. The income realized on bull sales was based on carcass weight and the price per 1 kg of carcass weight. The percentage of death losses during fattening were deducted from revenues, and support payments were calculated in proportion to length of fattening period. The following equation was used to calculate the revenue per bull sold:

$$RB = (CW * PC) - DL + \left(SP * \frac{DFT}{DFY} \right) \quad (1)$$

where:
RB.....revenue per bull sold,
CW.....carcass weight,
PC.....selling price per kg of carcass,
DL.....death losses,
SP.....support payments,
DFT....total days on feed,
DFY....days on feed per year.

The cost structure used was created following the methodologies of Kvapilík (2008) and Poláčková *et al.* (2010). Total costs included the costs of feed (own and purchased), labour, veterinary services, energy and fuels, depreciation of fixed assets, intracompany costs, overheads, and other costs. Other costs included purchased material and services. The value of manure as a secondary output of animal production was deducted from total costs. As different cost items as well as support payments were observed per calendar year, the total costs of fattening were calculated according to the following equation:

$$CT = \frac{(CY - PM)}{DFY} * DFT \quad (2)$$

where:
CT.....total costs,
CY.....costs per year,
PM.....price of manure,
DFT....total days on feed,
DFY....days on feed per year.

Total profit also depends on the initial cost of the bull (own stock or purchased) at the beginning of the fattening period. If purchased, its market price is based on the live weight and price per kg of live weight. The price of own-stock bulls reflects actual rearing costs. Total profit was defined as follows:

$$PT = RB - \left(CT + \left(ILW * PLW\right)\right) \quad (3)$$

where:
PT = total profit, RB = revenue per bull sold, CT = total costs, ILW = initial live weight, PLW = price per kg of initial live weight.

Profitability is generally defined as the ratio of revenue to resource consumption. In this study, return on costs was calculated as the quotient of the total profit divided by total costs:

$$ROC = \frac{PT}{CT} * 100 \quad (4)$$

where:
ROC...return on costs,
PT .....total profit,
CT.....total costs.

The support payments used to calculate the profitability included shares of the following payments: Single Area Payment System (SAPS) – direct payments, Transitional National Subsidies (PVP, earlier TOP-UP) for agricultural land and ruminants, and Payments for Less Favoured Areas. These shares were specific for each participating enterprise according to its production conditions and the system of support payment budgeting.

In addition, the participating enterprises were allocated into three groups according to the size of the fattening operation (<100, 100 to 200, >200) in order to determine the relationship between the costs per day on feed and the number of bulls.

A break-even point was determined to assess the efficiency of the operation. It is defined as the point at which the operation reaches zero profitability as the revenues from production sold are equal to the cost (Střeleček and Kollar, 2002). The break-even points for bull fattening operations were determined for daily live weight gain during the fattening period, price of bull at the beginning of fattening, selling price, total costs, and support payments obtained.

Also investigated was the question as to which of the input parameters had the greatest impact on the overall economic result. For this purpose, a sensitivity analysis was undertaken to examine potential changes in the model and their impact on different target variables (Pannell *et al.*, 1997). The impact of a 20 % change in input parameters, as described by Wolfová *et al.* (2004), was examined in this study. The analysed parameters included feed and labour costs, overheads, support payments, initial live weight and price of bulls, live weight gain, length of fattening period, death losses, and selling price of bulls.

Questionnaires were also used to gather farmers' views on the various factors influencing the economic performance of their operations. Analysing such data can contribute to understanding farmers' potential difficulties and preferences (Magne *et al.*, 2012). A total of 11 dimensions were selected and their importance was graphically assessed using a 5-point scale (1 = little importance, 5 = considerable importance). The evaluated dimensions included breed, management strategy, nutrition, animal care, live weight gain, labour management, revenue from sales, support payments, input prices, EU Common Agricultural Policy, and CR agricultural policy.

Where appropriate, the following currency exchange rates were used: 1 EUR = 27 CZK, 1 USD = 25 CZK. All calculations were made using Microsoft Excel 2010.

RESULTS AND DISCUSSION

Total costs and their variability

Average costs per year observed in participating bull fattening operations are given in Tab. II. Total costs per bull were 22,237 CZK and 21,888 CZK in 2013 and 2014, respectively. Despite lower total costs per bull, the costs per 1 kg live weight gain were slightly higher in 2014 than in 2013 (54.9 vs. 54.2 CZK, respectively) due to lower average live weight gains. A previous study (Kopeček *et al.*, 2009) had reported average total costs as determined for 1 kg of live weight in bulls of 48.1 CZK, i.e. 14 % lower than in our report. This difference may have been due to lower prices (feedstuffs, labour, energy, etc.) observed in that study evaluating the costs associated with bull fattening in the period from

II: *Average costs in fattening bull operations analysed (CZK)*

	Per head and year		Per feeding day		Per kg of weight gain	
	2013	2014	2013	2014	2013	2014
	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD
Own feeds	8,594 ± 3,295	8,599 ± 3,825	23.6 ± 9.0	23.6 ± 10.5	20.9 ± 8.7	21.6 ± 9.8
Purchased feeds	4,055 ± 2,587	3,288 ± 2,827	11.1 ± 7.1	9.0 ± 7.8	9.9 ± 7.5	8.3 ± 7.4
Total feed costs	12,649 ± 3,512	11,887 ± 2,548	34.7 ± 9.6	32.6 ± 7.0	30.8 ± 11.2	29.8 ± 6.6
Labour costs	1,653 ± 1,700	1,911 ± 2,559	4.5 ± 4.7	5.2 ± 7.0	4.0 ± 5.0	4.8 ± 6.9
Veterinary services	522 ± 1,294	201 ± 386	1.4 ± 3.5	0.6 ± 1.1	1.3 ± 2.7	0.5 ± 0.9
Depreciation of fixed assets	525 ± 263	762 ± 815	1.4 ± 0.7	2.1 ± 2.2	1.3 ± 0.7	1.9 ± 1.8
Energy and fuels	684 ± 397	518 ± 375	1.9 ± 1.1	1.4 ± 1.0	1.7 ± 1.1	1.3 ± 1.0
Overheads	1,629 ± 1,207	1,392 ± 1,009	4.5 ± 3.3	3.8 ± 2.8	4.0 ± 3.5	3.5 ± 2.9
Intracompany costs	2,921 ± 1,342	3,480 ± 1,726	8.0 ± 3.7	9.5 ± 4.7	7.1 ± 4.3	8.7 ± 4.6
Other costs	1,653 ± 1,799	1,737 ± 1,636	4.5 ± 4.9	4.8 ± 4.5	4.0 ± 3.3	4.4 ± 4.3
Total costs	22,237 ± 3,780	21,888 ± 4,557	60.9 ± 10.4	60.0 ± 12.5	54.2 ± 14.4	54.9 ± 16.2
Manure	1,391 ± 915	1,650 ± 863	3.8 ± 2.5	4.5 ± 2.4	3.4 ± 2.0	4.1 ± 2.1
Total costs minus manure	20,846 ± 3,869	20,238 ± 4,319	57.1 ± 10.6	55.5 ± 11.8	50.8 ± 14.5	50.8 ± 15.4

SD = standard deviation

III: *Average costs per feeding day in 2013 and 2014 depending on the size of operations analysed (CZK)*

Size of operation	< 100 bulls	100–200 bulls	> 200 bulls
Own feeds	23.5	22.6	25.1
Purchased feeds	12.9	9.9	7.7
Total feed costs	36.4	32.5	32.8
Labour costs	6.3	4.4	4.1
Veterinary services	2.2	0.6	0.5
Depreciation of fixed assets	1.6	1.9	1.8
Energy and fuels	1.2	1.8	1.9
Overheads	4.0	4.1	4.5
Intracompany costs	6.9	10.7	8.1
Other costs	4.9	4.6	4.4
Total costs	63.4	60.5	58.1

2005 to 2008. The average annual rate of inflation in CR from 2005 to 2014 was 2.3 % (Czech Statistical Office, 2016a). In agreement with the results in this study, the total costs determined for fattened bulls of beef breeds in CR from 2008 to 2010 ranged from 51 to 65 CZK per 1 kg of live weight and from 24,000 to 27,000 CZK per animal (Boudný and Janotová, 2012). The total costs per feeding day as determined in this study were 60.9 and 60.0 CZK in 2013 and 2014, respectively, and they were approximately 10 CZK higher than those reported by the Institute of Agricultural Economics and Information (ÚZEI, 2015) for 2013. In contrast, total costs determined per fattened bull in Germany were as high as 28,944 CZK in 2011 (Gräfe and Eglinski, 2011) due to higher inputs, the technologies used, and different production conditions. Three fattening systems for young bulls from weaning at 224 kg to slaughter at 450 kg on average were evaluated in Spain (Blanco *et al.*, 2011). Similarly to our study, total costs ranged from 19,440 to 22,491 CZK according to the feeding management used.

Feed costs accounted for 56 % of yearly costs, with self-produced feed constituting 70 % of that. Of all cost items, the highest standard deviation was determined for feed costs, which indicates a high variability and opportunity for optimizing and reducing these costs. Most previous studies have concluded that feed costs represented the major component of total costs (e.g. Kvapilík, 2008; Blanco *et al.*, 2011). In our study, feed costs accounted for 65 % of variable costs, which is somewhat lower than in the study by Norton (2005), who determined that feed costs may represent as much as 86 % of variable costs. Growth of animals, feed intake, feed costs, and overall economic performance are closely related to the feeding management used in different fattening operations.

Total costs per feeding day according to herd size (Tab. III) tended to decrease with the increasing number of fattened bulls. Operations with an

IV: *Calculation of average profitability*

Items	unit	2013	2014
Initial live weight	kg live weight	175	203
Initial price of bull entering fattening	CZK/kg live weight	61.3	66.2
Initial price of bull entering fattening	CZK/head	10,753	13,454
Total costs of fattening	CZK/head	24,038	23,703
Total costs including initial price of bull	CZK/head	34,791	37,157
Price of bull sold	CZK/kg carcass	87.91	87.06
Revenue from bull sale	CZK/head	31,803	32,560
Revenue from bull sale of bulls after deducting death losses	CZK/head	30,851	31,356
Support payments	CZK/head	2,788	2,563
Total revenues	CZK/head	33,639	33,919
Profit without support payments	CZK/head	–3,940	–5,801
Return on costs without support payments	%	–16.39	–24.47
Profit including support payments	CZK/head	–1,152	–3,238
Return on costs including support payments	%	–4.79	–13.66

V: *Profit per bull (CZK) depending on selling price and daily weight gain*

Year	Indicator		Selling price of bull (CZK/kg of carcass)				
			65	70	80	90	95
2013	Average daily weight gain (g/day/head)	800	–17,812	–16,057	–12,548	–9,038	–7,284
		900	–14,493	–12,738	–9,229	–5,720	–3,965
		1,000	–11,838	–10,083	–6,574	–3,064	–1,310
		1,100	–9,666	–7,911	–4,401	–892	863
		1,200	–7,855	–6,101	–2,591	918	2,673
		1,300	–6,323	–4,569	–1,059	2,450	4,205
		1,400	–5,010	–3,256	254	3,763	5,518
		1,500	–3,873	–2,118	1,392	4,901	6,656
2014	Average daily weight gain (g/day/head)	800	–18,911	–17,110	–13,508	–9,907	–8,106
		900	–15,703	–13,903	–10,301	–6,699	–4,898
		1,000	–13,137	–11,337	–7,735	–4,133	–2,332
		1,100	–11,038	–9,237	–5,635	–2,034	–233
		1,200	–9,288	–7,488	–3,886	–284	1,517
		1,300	–7,808	–6,007	–2,406	1,196	2,997
		1,400	–6,539	–4,738	–1,137	2,465	4,266
		1,500	–5,439	–3,639	–37	3,565	5,366

average number of fattened bulls higher than 200 had 7.5 % lower costs per feeding day than did those with up to 100 bulls. In agreement with the study by Střeleček and Kollar (2002), it was determined that especially labour costs as the main item of fixed costs were reduced with increasing herd size. Similarly, the highest labour productivity was identified in large-sized farms in a study based on the accounting data of 926 Czech farms (Novotná and Volek, 2016).

Calculation of profitability

Total revenues from bull fattening operations depend mainly on the carcass weight and the price per 1 kg of carcass based on the carcass classification system. The average revenues per animal sold reduced by the percentage of death losses were 30,851 and 31,356 CZK in 2013 and 2014, respectively (Tab. IV). The comparison of revenues including relevant support payments and total costs revealed a negative profit per bull and negative return on costs both in 2013 and 2014. The loss of 3,238 CZK per bull in 2014 was considerably greater than that observed in 2013 (1,152 CZK), mainly due to the high price of weaned bulls entering the fattening operation. When the support payments were excluded, the average loss per bull reached 3,940 and 5,801 CZK in 2013 and 2014, respectively. These results are broadly in agreement with the economic losses in fattened bulls observed in 2006 (2,781 CZK per bull) and 2007 (6,560 CZK per bull) (Kvapilík, 2008), and with those estimated for 2013 (4,059 and 1,059 CZK per bull when support payments were

VI: *Break-even analysis*

Item	Unit	2013		2014	
		Break-even point	Difference [1)]	Break-even point	Difference [1)]
Daily weight gain	g/day/head	1,189	+ 64	1,290	+ 198
Initial price of bull	CZK/head	9,601	–1,152	10,216	–3,238
Selling price of bull	CZK/kg carcass	91.19	+ 3.28	96.05	+ 8.99
Number of bulls per operation	head	285	+ 63	318	+ 118
Total costs	CZK/head	22,885	–1,152	20,465	–3,238
Support payments	CZK/head	3,940	+ 1,152	5,801	+ 3,238

[1)] Difference from the average value obtained in a given year.

VII: *Sensitivity analysis of fattening bull operations*

Item	2013				2014			
	+ 20 %		–20 %		+ 20 %		–20 %	
	Profit	Difference[1)]	Profit	Difference[1)]	Profit	Difference[1)]	Profit	Difference[1)]
Feed costs	–4,070	–2,917	1,765	+2,917	–6,022	–2,784	–453	+2,784
Labour costs	–1,534	–381	–771	+ 381	–3,685	–448	–2,790	+448
Overheads	–1,528	–376	–777	+376	–3,564	–326	–2,912	+ 326
Support payments	–595	+ 558	–1,710	–558	–2,725	+513	–3,750	–513
Initial live weight	–1,728	–575	–577	+ 575	–4,088	–850	–2,387	+850
Initial price of bull	–3,303	–2,151	998	+2,151	–5,928	–2,691	–547	+2,691
Daily weight gain	2,389	+3,542	–6,465	–5,313	286	+ 3,523	–8,523	–5,285
Length of fattening period	–5,402	–4,250	3,098	+ 4,250	–7,466	–4,228	990	+4,228
Death losses	–1,343	–190	–962	+ 190	–3,478	–241	–2,997	+ 241
Selling price of bull	5,018	+6,170	–7,323	–6,170	3,034	+ 6,271	–9,509	–6,271

[1)] Difference from the value obtained in a given year.

either excluded or included, respectively) (Kvapilík *et al.*, 2015). The return on costs determined for fattening operations in the report by Kvapilík *et al.* (2015) was –3.3 % and thus by 1.5 and 10.4 percentage points higher (smaller loss) than those observed in our study for 2013 and 2014, respectively.

In 2005, the loss calculated per 1 kg of live slaughter weight of bulls was 1.09 CZK (Kopeček *et al.*, 2009). This is quite similar to the level of loss determined in the present study for 2013 (1.78 CZK) but lower than that for 2014 (4.83 CZK). In contrast, a profit of 2,484 CZK per bull was reported in a study summarizing economic results of 13 bull fattening operations (3,096 bulls) in Saxony-Anhalt (Germany) from 2013 to 2014, mainly due to a markedly higher carcass price of 99.09 CZK/kg (Döring, 2015). Based on the survey by Walter and Hale (2011) on 443,129 steers in Ohio finished from January 2004 to December 2009 the top third of lots averaged a 2,257 CZK/head profit, while the bottom third had a 979 CZK/head loss at average profit 643 CZK/head.

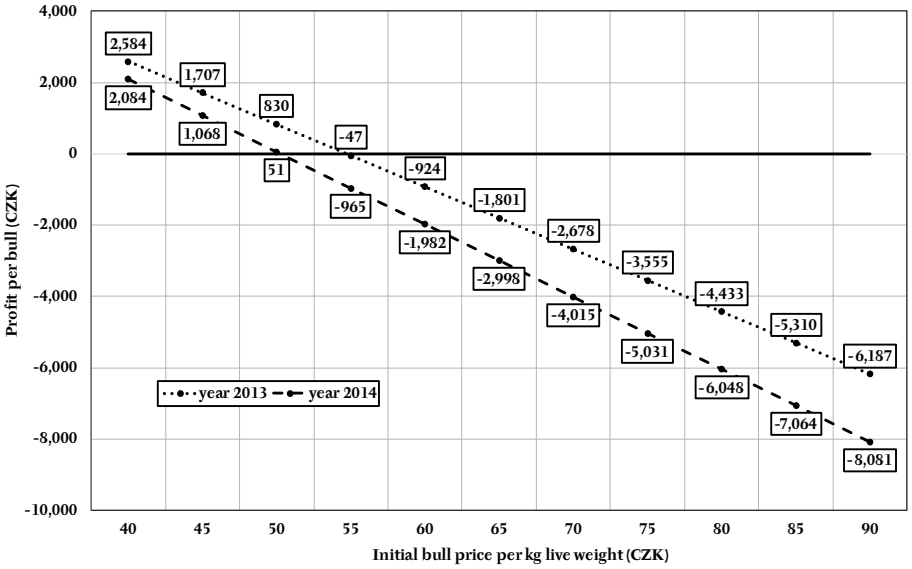
The relationships between daily weight gain, selling price of carcasses, and profit per bull are demonstrated in Tab. V. It is evident that both higher selling price and higher live weight gains were associated with improved profitability. When the selling price (September 2016) was taken into account at 85.65 CZK/kg of carcass (SZIF, 2016), to make a profit it would have been necessary to achieve weight gains of approximately 1,300 and 1,400 g/day in 2013 and 2014, respectively.

Break-even analysis

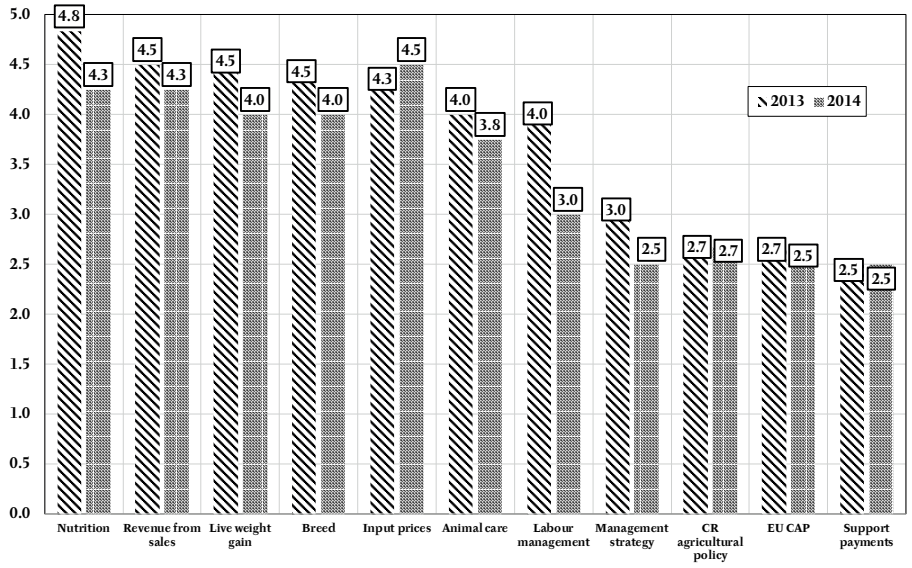
The break-even point is defined as the point at which total costs are covered by total revenues, and thus it indicates a minimum requirement for maintaining sustainability of the bull fattening operation. The analysed operations suffered losses both in 2013 and 2014.

In order to compensate for these losses, higher live weight gains by 64 and 198 g/day, respectively, would have been required (Tab. VI). Increased live weight gains would have reduced fattening periods to 398 and 362 days in 2013 and 2014, respectively, which would have had no influence on the revenues from animals sold for beef but would have reduced total costs and thus improved overall profitability. The break-even points for live weight gain found in this study (1,189 and 1,290 g/day in 2013 and 2014, respectively) were higher than that observed by Kopeček *et al.* (2009) (967 g/day).

In order to achieve a profit, the initial bull price should not have exceeded 9,601 and 10,216 CZK in 2013 and 2014, respectively. The negative relationship between the price per 1 kg of initial



1: *Impact of initial bull price on total profitability of fattening*



2: *Importance of factors influencing fattening of bulls based on farmers' opinions*

live weight and total profit is demonstrated in Fig. 1. It shows that a profit would be achieved when this price is lower than 50 CZK/kg.

In the present study, zero profitability would have been reached if the selling price had been 91.19 and 96.05 CZK/kg of carcass in 2013 and 2014, respectively. When this price is higher, revenues from bulls sold are increased and the operation becomes more profitable. Bull fattening can be profitable even when the selling price is lower, however, as documented by Panter (2006), who calculated the break-even point for the selling price of bull carcasses weighing on average 363 kg as 83 CZK. The break-even points for the selling price per 1 kg of live weight at slaughter determined in this study (51 and 54 CZK in 2013 and 2014, respectively) were somewhat higher than the 43 CZK reported by Kopeček (2009).

Higher number of bulls fattened would improve profitability of the operation as a result of economies of scale. More production will be achieved on a large scale with lower average input costs. As determined in this study, operations with an average number of fattened bulls higher than 200 had 8.5 % higher profitability than did those with up to 100 bulls. The break-point for the number of bulls per operation was calculated as 285 and 318 heads in 2013 and 2014, respectively. However, under certain

conditions, the relationship between farm size and efficiency is not always linear and the efficiency may even fall after a certain size threshold (Helfand and Levine, 2004). A factor productivity can be improved by its scale of use, but the increase in farm size may also unlock opportunities to capitalize on new techniques, technologies and practises that can improve productivity (Veysset *et al.*, 2015).

Economic loss can be diminished by reducing total costs. The fattening operations under study would have achieved profitability if total maximum costs of 22,885 and 20,465 CZK per bull in 2013 and 2014, respectively, had been achieved. The break-even points for the income from support payments were calculated as 3,940 and 5,801 CZK in 2013 and 2014, respectively. These values indicate the minimum level of support that should be directed to this type of agricultural operation.

Sensitivity analysis

Sensitivity analysis is a key step in the process of enterprise planning and decision making. In this study, the sensitivity analysis revealed that in both years the profitability was mainly influenced by the price of bulls sold (Tab. VII). A change in this price by ±20 % altered the profitability by 25 % (6,170 CZK) and 26 % (6,271 CZK) in 2013 and 2014, respectively. By comparison, in the study by Wolfová *et al.* (2004) a 20 % selling price reduction diminished profitability by just 11.2 %. The difference can be explained by lower selling prices of bulls and particularly by higher support payments calculated in that study. As a result, the selling price becomes less sensitive because support payments are included into fixed revenues. Based on the data given in the study by Panter (2006), a 20 % increase in the selling price increased profit by 6,200 CZK per bull, which is quite similar to our results. In comparison with the selling price, the initial price of a bull entering fattening affected the profit to a lesser extent. A 20 % decrease in the initial price of a bull increased the profit by 2,151 and 2,691 CZK based on our data from 2013 and 2014, respectively. In contrast, Panter (2006) reported that the same change in the initial price resulted in a profit increase of 4,000 CZK.

The length of the fattening period and live weight gains are major production factors influencing profitability in fattening bulls. A shortened fattening period and increased live weight gains will reduce total costs and improve profitability. Wolfová *et al.* (2004) reported that a 20 % increase in live weight gains resulted in 3.1 % higher profitability, whereas a 20 % decrease in live weigh gains was associated with 4.3 % lower profitability for the bull fattening operation.

Feed costs are considered the most sensitive cost item. Sensitivity analysis of bull fattening operations had been carried out by Blanco *et al.* (2011) and revealed that increasing input feed prices by 25 % resulted in 2–6 % higher total costs and 3–19 % lower profit.

In the present study, 20 % elevated support payments would have increased total revenues by 558 and 513 CZK per bull in 2013 and 2014, respectively, but the operation would still have remained unprofitable. The reason for this may be the uneven accounting distribution of support payments to different operations within an agricultural enterprise.

Subjective evaluation of factors by farmers

Of the 11 dimensions investigated, nutrition, input prices, and revenues from bull sales were seen by farmers as most important for the prosperity of their operations (Fig. 2). High feed costs were perceived by farmers as the main problem affecting beef cattle fattening, as supported also by the study by Sarma *et al.* (2004). By contrast, EU and Czech agricultural policy, management strategy, and support payments were regarded as less significant (about 2.5 points). It must be mentioned, however, that this only applies to the bull fattening sector and the importance of individual factors may be quite different in other areas of cattle production.

CONCLUSION

Bulls of beef, dairy, and dual-purpose breeds constitute the main source of beef in CR and in most other EU countries. Achieving profitability is necessary to secure long-term competitiveness for any operation. The analysis based on data collected using a questionnaire revealed average economic losses incurred by fattening operations at levels of 1,152 and 3,238 CZK per bull in 2013 and 2014, respectively. Average total costs of fattening after deducting secondary outputs were 24,038 and 23,703 CZK per bull in 2013 and 2014, respectively. The sum of total fattening costs after such deduction and the initial cost of a bull at the beginning of fattening was not covered by total revenues from bulls sold.

It can be concluded that under the current system of support payments most of bull fattening operations included in the analysis experienced economic loss. Overall economic efficiency can be improved by increasing daily live weight gains. The break-even points as minimum requirements to reach profitability for live weight gain were calculated as 1,189 and 1,290 g/day in 2013 and 2014, respectively, whereas those for the selling price were 91 and 96 CZK/kg of carcass in 2013 and 2014,

respectively. Due to economy of scale, lower costs by 7.5 % and a higher profitability by 8.5 % will be achieved in large-scale operations with more than 200 bulls fattened.

The results of the sensitivity analysis indicated that the economic efficiency of fattening operations may be substantially altered by only a small change in prices, such as in the carcass selling prices, initial prices of bulls at the beginning of fattening, or feed prices. Additional supporting measures aimed directly at fattening operations should also contribute to improving overall profitability.

The negative profitability observed in most bull fattening operations may also be explained by the distribution of total support payments within an agricultural enterprise. Based on the current regulations of the Common Agricultural Policy of the EU, the highest rate of subsidies is obtained per ha of agricultural land through the Single Area Payment Scheme (SAPS). The way of distributing the subsidies to different production sectors within an enterprise may vary considerably, and this can lead to somewhat biased results.

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