BEEF PRODUCTION IN BELGIUM AND PROSPECTS FOR EXTENSIFICATION

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SUMMARY

More than half of beef production in Belgium is carried on nowadays in intensive systems with Belgian-Blue bulls and heifers reared indoors. Alternative systems have been examined. A grazing period has been introduced before finishing indoors on concentrates. The live weight gain varied according to the stocking rate at grass but was on average slightly over 1.0 kg/day. Compensatory growth was observed indoors. Although animal performance was lower in the grazed animals, the economic performance was improved due to a reduction in production costs. When liveweight gain at pasture was low as result of a very high stocking rate, the compensatory growth was larger but there was not full recovery because optimum finish was reached at a lower liveweight. The finishing of Belgian-Blue bulls at grass appears difficult: the killing-out proportion was low, the carcasses were too lean and poorly coloured and the sale price was much reduced.

BEEF PRODUCTION

GENERAL SITUATION

Beef production in Belgium is carried on, since the early sixties, in specialized units in which a large number of animals are kept at the same time. Most of the units are located in the central and the northern parts of the country. These areas are either crop producing lands or close to the harbours and the large feedstuff manufacturers. In the recent past and at present, most of the weaned suckled entire beef calves were bought from the market as young stock at live weights of 250-300 kg. They are offered fattening diets based either on maize and pressed sugar beet pulp silages or concentrates. The main ingredients of the concentrate diets are cereals and byproducts such as middling, corn gluten feed, sugar beet pulp or cakes. With such diets, animal performance is high (e.g. average daily gain of 1.3-1.6 kg and feed conversion ratio of 5.5-7.0 kg/kg). Such a system could be considered intensive (Fiems et al., 1990; Clinquart et al., 1991; Dufrasne et al., 1991; Boucqué et al., 1992).

GRAZING OF BEEF CATTLE

In the early eighties it was suggested that a grazing period be introduced into the standard system in order to extend the use of pasture and therefore allow fattening in areas where that type of production was previously not possible. The reason why such a practice was delayed until the eighties was because there was a lack of confidence in grazing high value Belgian Blue double-muscled animals in less favourable environmental conditions (cold rain, wind, hot summer). Nevertheless, experiments were carried out. The main objective was to introduce an initial grazing period to be followed by indoor finishing. In a first

rial, two grazing intensities were used and compared with an indoor system. The results from Dufrasne et al. (1995a) are given in Table 1. A total of 40 Belgian Blue bulls of double-muscle type were allocated to three treatment groups of 8, 16 and 16 animals each, respectively. The first group of eight bulls (control group, FI) was fattened indoors on a concentrate diet based on sugar beet pulp and supplemented with cereals, wheat middlings and protein of vegetable origin. Straw was always available in a rack. The 32 remaining bulls were grazed during the first part of the fattening period (groups GFI). They were subdivided in two groups of sixteen. One group was grazed at a medium stocking density of 6 bulls/ha (MGFI) and the other at a high stocking density of 8 bulls/ha (HGFI). The grazing period started at the beginning of May and continued for 140 days. Ammonium nitrate (27% N) was spread at similar rates on both pastures. During the grazing period, the bulls were offered 1 kg/day of a supplement comprising of sugar-beet pulp (500 g/kg) and rolled barley (500 g/kg). At the end of the grazing period, the animals were moved indoors in a free stanchion barn. They were penned in groups of eight as they were grazed in order to avoid fighting. After a transition period, they were managed as the FI group. The experiment was repeated over 2 years consecutively.

Average daily gains during the grazing season were 1.15 and 1.00 kg ($P<0.001$) for treatments MGFI and HGFI respectively (Table 1). The total live-weight gain per ha was 966 and 1118 kg for groups MGFI and HGFI, respectively. During the indoor finishing period, the bulls from the MGFI group required 96 days to obtain the target finished weight while the length of the finishing period was 101 days for the HGFI group ($P>0.05$). The subsequent indoor live weight gains were 1.01 and 1.24 kg/d ($P<0.001$), while food intakes were 8.20 and 8.12 kg/d with food conversion ratios of 8.11 and 6.55 kg/kg.

The animal performance of the two groups of grazing bulls for the total finishing period was compared with the performance of bulls fattened indoors. The main differences between both managements were higher average daily gains (1.44 v. 1.11 or 1.10 kg/day; $P<0.001$), shorter finishing period (187 v. 236 and 241 days; $P<0.001$), higher food intake during the corresponding indoor period (9.50 v. 8.20 and 8.12 kg/day) and an intermediate food conversion ratio (7.26 v. 8.11 and 6.55 kg/kg) for the FI group v. MGFI and HGFI groups.

When slaughtered, the bulls from the grazing treatments had a higher dressing proportion (645 and 641 v 633 g/kg; $P<0.05$) than the animals fattened indoors (Table 2). The main differences in carcass composition were trends for a lower proportion of bone and a higher proportion of adipose tissue in the FI animals. The quality of meat was also influenced by the type of fattening. The pH was higher ($P<0.05$) in the carcasses of the MGFI and HGFI bulls. The meat was also darker in these groups as indicated by lower L* values ($P<0.05$) and higher colour values ($P>0.05$). There were no effects either on myoglobin content or on tenderness. The meat appeared to lose more water (higher cooking losses and free water value) in the animals which were firstly grazed. An economic balance was calculated for the different fattening systems. The net profit was 7994 BF per head with the bulls fattened indoor while it was 8608 and 9276 BF per head for the bulls in the MGFI and HGFI groups. Expressed per ha, the net profit was 51648 and 74208 BF respectively.

Performance of bulls during the initial grazing period, the indoor finishing period and the overall period (from Dufrasne et al., 1995a)

	Treatment			
	MGFI(1)	HGF(2)	FI(3)	*s.e.d.*
Number	32	32	16	
Liveweight (kg)				
Initial	307.6	307.1	301	*11.02*
End of grazing	467.7	446.8	-	*14.16*
Final	566.4	571.8	564.3	*13.25*
Days (d)				
At grass	140	140	-	
Indoors	96	101	-	*6.59*
Total	236.0^{b}	241.0^{b}	186.9^{a}	2.55
Average daily gains (kg/day)				
At grass	1.15^{b}	1.00^{a}	-	*0.063*
Indoors	1.01^{b}	1.24^{a}	1.44	*0.046*
Total	1.11^{b}	1.10^{b}	1.44^{a}	0.041
Feed intake (kg/day)	8.20	8.12	9.50*	
Feed conversion ratio (kg/kg)	8.11	6.55	7.26*	

a, b: means on rows with different superscripts are significantly different ($p<0.001$).

*: calculated on the corresponding indoor period of the two other groups.

(1) - Bulls grazed at a medium stocking rate and finished indoors.

(2) - Bulls grazed at a high stocking rate and finished indoors.

(3) - Bulls fattened indoors.

It could therefore be concluded from the above results, that alternative management for beef meat production could be developed in Belgium in which beef cattle are usually produced in intensive indoor systems. Although the performance was slightly poorer, the economic balance was in favour of a fattening system with a grazing period owing to lower costs of production mainly for food intake and husbandry.

Table 2. Dressing proportion, carcass composition and meat quality characteristics of the *Longissimus thoracis* muscle of growing fattening bulls either grazed initially and finished indoors or fattened indoors (from Dufrasne et al., 1995a)

	Treatment			
	MGFI(1)	HGFI(2)	FI(3)	*s.e.d.*
Number	32	32	13	
Dressing proportion (g/kg)	645	641	633	*4.2*
Carcass composition (g/kg)				
Number	8	8	13	
Muscle proportion (g/kg)	799^{b}	727^{a}	724^{ab}	*38.2*
Adipose tissue proportion (g/kg)	127^{b}	136^{ab}	148^{a}	*8.5*
Bone proportion (g/kg)	134	138	128	*4.4*
pH	5.53^{b}	5.52^{ab}	5.48^{a}	*0.02*
Brightness L* (%)	36.71^{ab}	35.65^{b}	37.51^{a}	*0.76*
Colour a*/b*	1.84	1.93	1.82	*0.06*
Myoglobin content (mg/g meat)	2.60	2.68	2.67	*0.25*
Cooking loss (g/kg)	346.4^{b}	347.0^{b}	316.5^{a}	*3.16*
Drip (g/kg)	66.0	66.4	67.6	*0.62*
Free water value (g/kg)	355.1	367.5	340.7	*0.68*
Peak shear force (N)	50.21	49.26	50.50	*4.26*

a, b : means on rows with different superscripts are significantly different ($p<0.05$)

(1) - Bulls grazed at a medium stocking rate and finished indoors.

(2) - Bulls grazed at a high stocking rate and finished indoors.

(3) - Bulls fattened indoors.

GROWTH RATE AT GRASS, COMPENSATORY GROWTH AND MEAT CHARACTERISTICS

The experimental work reported above was extended to include a group of bulls grazed at a very high stocking rate (10 bulls/ha, LGG) so that the daily gain was reduced owing to lower availability of grass (Dufrasne et al., 1995b; Hornick et al., 1995a). They were compared to another group grazed at a stocking rate of 6 bulls/ha (NGG) so that good quality grass was generally available allowing live weight gain of around 1 kg per day. At the end of the grazing period, both groups were finished indoors on concentrates.

. Performance of bulls either fattened indoors or firstly grazed at two different stocking rates and then finished indoors (from Dufrasne et al., 1995b; Hornick et al., 1995a)

	Treatment			
	Control	NGG(1)	LGG(2)	*s.e.d*
Animal performance				
At pasture				
Initial live weight (kg)		255.0	254.0	*12.80*
Final live weight (kg)		405.5	324.3	*25.54*
Weight gain (kg)		150.5	70.4	*17.83*
Length (d)		139	131	
Av. dail. gain (kg/d)		1.08	0.54	*0.13*
Indoors				
Initial live weight (kg)	260.8	405.50	324.4	*27.01*
Final live weight (kg)	603.8	567.3	535.4	*19.09*
Weight gain (kg)	343.0	161.8	211.0	*24.25*
Length (d)	265	114	139	*11.88*
Av. dail. gain (kg/d)	1.29	1.26	1.54	*0.14*
Total				
Weight gain (kg)	343.0	312.3	281.4	*16.37*
Av. dail. gain (kg/d)	1.29	1.17	1.04	*0.08*
Slaughter performance				
Slaughter weight (kg)	594.8	560.3	524.0	*19.39*
Cold carc. weight (kg)	385.5	359.1	327.9	*13.18*
Kill-out (%)	64.8	64.1	62.5	*0.81*
Muscle proportion (%)	75.54	74.25	74.43	*1.27*
Connect-adip. tiss. prop (%)	11.88	13.00	12.40	*1.16*
Bone proportion (%)	12.58	12.75	13.17	*0.55*
Muscle yield (kg)	291.0	263.1	244.1	*10.69*
Connect-adip. tiss. yield.(kg)	94.5	91.2	83.8	*5.00*
Meat quality				
L*	44.13	41.15	42.63	*1.67*
a*	16.36	16.16	14.92	*1.13*
b*	16.77	16.09	15.39	*1.02*
a*/b*	0.98	1.00	0.98	*0.05*
Cooking losses (%)	21.68	22.6	21.94	*1.50*
Drip (%)	5.31	4.88	4.50	*0.78*
Peak shear force (N)	44.15	29.42	31.25	*5.29*
Meat composition				
Dry matter (DM) (%)	25.20	24.79	24.39	*0.36*
Crude protein (% DM)	84.13	91.07	89.22	*1.12*
Ether extract (% DM))	6.25	3.76	3.16	*0.97*
Cholesterol (g/kg DM)	1.93	2.86	2.59	*0.44*
Economic balance (BF)	1985	7676	1781	

(1) - Bulls grazed at a normal stocking rate and finished indoors.
(2) - Bulls grazed at a very high stocking rate and finished indoors.

From Table 3, it is clear that the live weight gain at grass was as expected at 1.08 kg/d for NGG and 0.54 kg/d for LGG (P<0,05). During the finishing period indoors, both groups showed compensatory growth but it was significantly higher for LGG (1.54 v 1.26 kg/d; P<0,05). Nevertheless, when both groups were compared with a fattening system on concentrate indoors, animal performance was poorer in terms of average daily gain, slaughter weight, killing-out percentage, and proportion and yield of muscle. The meat quality and composition is also given in Table 3. The main differences between the animals which were firstly grazed and then finished indoors and the normal indoor fattened group were trends for slightly darker carcasses and a more tender meat in the grazed animals. Their meat was also characterized by a significantly higher protein content, a reduced fat content, a higher cholesterol content and a lower proportion of saturated fatty acids. When economic balances were calculated, the largest profit was obtained with the NGG group (7676 BF per head) as compared with 1985 BF for the control group and 1781 BF for the LGG group. The lower balances were due to the higher feeding costs for the animals fattened indoors, and to the losses during the period at grass and the overall longer period for the LGG group.

FINISHING OF BELGIAN BLUE DOUBLE-MUSCLED BULLS AT GRASS

As previously stated, in Belgium, beef meat is mainly produced with double-muscle type bulls reared from 300 to 600 kg in stanchion barns, on diets based mostly of dried beet pulp or maize silage. Alternatives exist to this approach. Dufrasne et al. (1995a) showed that young bulls may spend one season on pasture before a finishing period indoors. This allows the production of meat which corresponds to the market demand and at a lower cost of production.

The use of pasture for beef production was further extended in order to assess if it was possible to slaughter bulls immediately after a grazing season in order to further minimize the feeding cost. Scarce data are available on characteristics of carcass and meat produced by such a method in Belgium. The effects of finishing at grass on animal performance and meat quality was therefore studied in two experiments, consecutively conducted in two years. In the first experiment, eight Belgian Blue double muscled type bulls were put to pasture at a light initial liveweight (360 kg) and grazed for 5 months before slaughter. They were compared with eight similar bulls, maintained in a free stanchion barn and fed with a concentrate diet. From the results of that experiment, it appeared that an improvement could be obtained using heavier bulls. So, in the second year, a similar experiment was conducted but with animals with an initial live weight close to 410 kg, in order to obtain heavier bulls at the end of the fattening period. The results have been partially presented by Hornick et al. (1995b).

Table 4 summarizes the data for animal performance and meat characteristics, as well as the economic balance for both groups in year 1 and year 2. Initially lighter animals on pasture achieved as good performance as animals indoors (about 1.42 kg/d) so that the final live weight was similar in both groups. This contrasts with the results observed the second year when animals started at heavier weights. The poorer performance of the heavier animals at grass suggests that grass, although of good quality, could not meet the feed requirements of Belgian Blue double-muscled bulls. The carcass weight was significantly lower in grazed animals than in controls and the killing-out percentage was also lower. Although the proportion of muscle in the carcass was similar or even higher in grazed animals, the absolute yield of muscle was lower. The meat temperature decreased more quickly in the carcass from

imals on pasture, reflecting probably a higher degree of leaness. Few differences were found in t quality, but meat produced on pasture tended to be more red, more tender and to lose less water as ip. The meat composition revealed that animals on pasture had a higher proportion of protein and consequently a lower proportion of fat. The net profit per animal was respectively 74% (year 1) and 327% (year 2) lower for animals fattened at pasture than for those fattened indoors. This was due to lower carcass price because of insufficient fat cover on the carcasses.

In conclusion, fattening bulls on pasture appeared to perform as well as indoors in terms of live weight gain when the initial live weight was relatively light (close to 350 kg). However, the lighter carcass produced and the insufficient level of fatness resulted in price discounting by the market. Although dietetically interesting, meat produced on pasture does not help to increase the profit from beef production.

CONCLUSIONS ON THE USE OF GRASSLAND FOR BEEF PRODUCTION

From the work carried out, it appeared that the finishing of Belgian Blue double-muscled bulls at grass is not of interest so far, owing to low animal performance, carcass characteristics which do not meet the requirement of the meat market and therefore low or even negative profit. By contrast, a grazing period followed by indoor finishing on concentrates could be of interest. It should be noted that very low live weight gain at grass is not followed by full recovery indoors in terms of total gain and carcass characteristics. The opposite was observed when liveweight at grass was greater than 1.25 kg/d; the live weight gains indoor was lower than that observed at grass (Dufrasne et al., 1994). Overall, therefore, it is difficult to suggest alternative management strategies for beef production with Belgian Blue double-muscled bulls which are as good in terms of animal performance and meat characteristics as the indoor intensive system now used.

PRODUCTION AIDS

FEDERAL LEVEL

With the CAP reform, in Belgium as in the other countries of EU, animal premia to support the beef industry are paid to farmers. The premia are from the EU budget but are paid by the federal state. To be eligible, conditions related to stocking rate and quota must be met. For beef, the payments are made when the animals have exceeded 10 and 22 months of age. The total number of animals eligible for premium does not exceed 90 per fattening unit. In mixed farms with suckling cows and fattening animals the number of both cows and fattening males is taken into account in calculating the stocking rate.

Table 4. Performance of growing fattening bulls fattened indoors or fattened and finished at grass (from Hornick et al., 1995b).

	Initial live weight				
	Low (experiment 1)			High (experiment 2)	
	Control (n = 8)	Pasture (n = 8)	*P>F*	Control (n = 7)	Pasture (n = 7)
Animal performance					
Initial live weight (kg)	357.5 ± 23.9	363.3 ± 12.9		416.4 ± 61.7	416.3 ± 53.0
Final live weight (kg)	577.0 ± 33.5	566.4 ± 14.8		650.9 ± 40.2	554.3 ± 55.9
Weight gain (kg)	219.5 ± 31.6	203.1 ± 10.9		234.4 ± 35.2	138.0 ± 21.9
Length (d)	156	143		150	140
Av. dail. gain (kg/d)	1.41 ± 0.22	1.43 ± 0.09		1.56 ± 0.03	1.02 ± 0.22
Slaughter performance					
Slaughter weight (kg)	567.1 ± 31.6	547.6 ± 14.0		637.6 ± 40.0	543.3 ± 52.0
Cold carc. weight (kg)	354.8 ± 23.2	329.4 ± 14.5	*0.050*	403.1 ± 23.9	328.7 ± 47.3
Kill-out (%)	64.2 ± 1.0	61.9 ± 1.9	*0.020*	63.3 ± 1.9	60.3 ± 4.5
Muscle proportion (%)	74.7 ± 2.0	75.0 ± 1.6		81.5 ± 3.6	87.0 ± 1.9
Connect-adip. tiss. (%)	12.7 ± 1.6	11.4 ± 1.8		18.5 ± 3.6	13.0 ± 1.9
Muscle yield (kg)	265.1 ± 20.3	247.3 ± 15.3		332.1 ± 22.0	292.2 ± 32.9
Connect-adip. tiss. (kg)	45.0 ± 5.6	37.4 ± 5.0		75.6 ± 16.1	43.7 ± 8.5
Meat quality					
T° 1h slaughter	38.1 ± 0.5	38.6 ± 0.6	*0.100*	40.02 ± 1.0	39.6 ± 0.6
T° 2h slaughter	35.6 ± 1.9	35.1 ± 1.5		39.36 ± 0.7	37.04 ± 1.5
T° 4h slaughter	27.6 ± 2.2	26.7 ± 1.2		32.0 ± 1.0	27.7 ± 2.6
pH 1h slaughter	7.0 ± 0.1	6.6 ± 1.2	*0.002*	6.6 ± 0.20	6.6 ± 0.22
pH 2h slaughter	6.8 ± 0.2	6.3 ± 0.5	*0.050*	6.4 ± 0.24	6.4 ± 0.16
pH 4h slaughter	6.0 ± 0.2	5.9 ± 0.5		5.8 ± 0.18	6.2 ± 0.22
pH 48h slaughter	5.6 ± 0.2	5.5 ± 0.0		5.5 ± 0.05	5.7 ± 0.26
L*	39.7 ± 2.2	40.5 ± 1.5		45.2 ± 2.7	42.2 ± 3.9
a*	15.0 ± 2.0	16.2 ± 1.2		17.4 ± 2.1	18.0 ± 1.5
b*	14.6 ± 1.8	15.7 ± 0.6		17.8 ± 1.4	17.5 ± 1.3
a*/b*	1.03 ± 0.06	1.03 ± 0.06		0.98 ± 0.07	1.03 ± 0.12
Cooking losses (%)	19.7 ± 4.2	24.1 ± 2.6	*0.050*	27.4 ± 1.8	26.2 ± 4.1
Drip (%)	4.1 ± 1.3	3.9 ± 0.6		4.8 ± 0.7	4.5 ± 1.3
Peak shear force (N)	27.7 ± 6.6	27.4 ± 4.8		36.5 ± 6.5	33.4 ± 6.4
Meat composition					
Dry matter (DM) (%)	23.7	24.4	*0.050*	24.3 ± 1.0	23.5 ± 0.6
Crude protein (% DM)	89.6	93.8	*0.050*	90.8 ± 2.0	92.6 ± 1.5
Ether extract (% DM)	5.4	3.3		3.6 ± 1.2	2.0 ± 0.5
Economic balance (BF)	3357	886		1554	-3527

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been previously reported that fattening units are mainly in the Central and the North part of the ntry while the young stock are produced in the Southern part of the country where agriculture is less veloped with mainly suckling herds. The income has dropped over the last years in such farms. The egional government decided to help beef production with direct and indirect aids through a system nanced by both EU and régional funds (PDZR - Project to develop rural area). Indirect aids are ncentrated on groups of producers or to develop regional slaughterhouses or meat processing plants. s far as direct aids are concerned, premia are paid to producers who applied for that particular aid. They ould comply with the criteria which are requested at federal level and have more constrains such as cation of the farm in a less developed rural area, use of diets based on feedstuff produced locally and sbandry in good agreement with practices which are of high animal welfare standards.

CONCLUSIONS

The beef meat industry in Belgium has over the recent years been based on the fattening of a large proportion of Belgian Blue double-muscled animals on diets based on concentrates. It was possible therefore to produce carcasses of very high quality which were appreciated by the Belgian consumers. The illegal use of growth promotors further improved the carcass quality mainly in terms of muscle development, leaness and colour. In such conditions, beef production was highly profitable for the farmer, the meat trade and the dealer of growth promotors. Luckily, since severe controls were successfully implemented over the last 6 months, growth promotors have gone out of use. In the context of prevailing conditions, it is difficult to propose extensive alternative systems which can compete in terms of performance, carcass characteristics, meat quality, meat composition and profit with the present intensive system. From the alternative systems tested so far, the introduction of a grazing period before finishing indoors seems to be the most promising.

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