Journal of Animal and Feed Sciences, 10, Suppl. 2, 2001, 33 – 39

Performance of multibreed beef nurse cows with calves on ecological and fertilized pasture

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ABSTRACT

Seventy beef cows (multibreed crosses with a dominant proportion of Limousin or Blonde d'Aquitaine genes) were assigned to 2 groups of 35 animals each. During the summer, they were grazed with offspring on two separate pastures: one fertilized with nitrogen (120 kg N/ha in the 1st season and 60 kg N/ha in the 2nd season), group F, and the other unfertilized, group E. The pastures had not been fertilized for the previous 9 years. During the winter, the cows and calves were fed according to the INRA system. Nitrogen fertilization increased pasture yield by 40% (1st season) and by 28% (2nd season). With a similar number of grazing animals, increasing the area of pasture E almost twice compared with pasture F increased the accessibility of herbage but decreased the efficiency of its utilization. The daily intake of beef cows with calves on a pasture fertilized with 120 kg N/ha was 14 kg DM, 1340 g PDI and 12 UFL. After each grazing season, the body condition score of the cows was an average of 3.5 points on pasture F and 3.0 points on pasture E. Winter feeding of the cows made it possible to achieve a body condition score of 2.7 points before grazing. The rations of young bulls and heifers during the winter period helped to achieve predicted weight gains.

KEY WORDS: beef calf unit, grazing, feeding

INTRODUCTION

Although many studies have already been carried out on the efficiency of rearing calves with beef nurse cows (Dobicki, 1996; Zalewski et al., 1998), the principles and the system of feeding nurse cows under Polish conditions have not been elaborated yet.

The aim of the present work was to determine:
- the intake of nutrients by nurse cows with calves, expressed in INRA units, from a fertilized and ecological (unfertilized) pasture,
- the effect of summer grazing on a fertilized and ecological pasture on the productivity of cows and rearing efficiency of calves,
- the efficiency of the INRA feeding system in the winter feeding of multibreed nurse cows.

MATERIAL AND METHODS

The studies were carried out in northeastern Poland on 70 multibreed cows with a large proportion of Limousin and Blonde d'Aquitaine cattle (46 cows and 24 heifers) and their offspring. The animals were assigned to two groups of 35 each that were similar in terms of genotype and age. Animals from group E were grazed on an "ecological" pasture (unfertilized for 9 years) and those from group F on an "intensive" pasture that was supplied with mineral fertilizers during the experiment (including 120 kg N/ha in the 1st season and 60 kg N/ha in the 2nd season). Pasture area was 20 ha for pasture F (in both seasons) and 35 and 25 ha for pasture E (in the 1st and 2nd season, respectively). Strip grazing was used in both groups for an average of 174 days. A Limousin breeding bull accompanied each group of cows (F and E).

At the end of the grazing season, cows in each group received "winter" rations that were formulated from grass silage according to the INRA system (1988), taking into account the cow's body weight, its body condition after grazing using a 5-point scale (Barlow et al., 1987), and its physiological status. Rations for the offspring were formulated taking into account body weight at the end of grazing and assuming liveweight gains (g/day) of 700-800 g for heifers and 1100-1300 g for young bulls.

Basal feed analysis was performed according to AOAC (1989). Pasture yield was assessed following the method of Kostuch (1994) and forage intake according to the differential method using the control paddock system by Różycki. Statistical calculations were performed using the Statgraphics ver. 5.0 package (1991).

RESULTS

Mineral fertilization increased the yield of pasture F by about 40% in the 1st season and by 28% in the 2nd season, improved the efficiency of herbage utilization by 15 and 6 percentage points, respectively (Table 1), and increased the percentage proportion of high quality grasses from 60 to 66% while reducing the

TABLE 1

Yield and efficiency of pasture, feed and nutrient intake of cow-calf unit

Item	Grazing season			
	first		second	
	pasture			
	F[1]	E[2]	F[1]	E[2]
Yield of pasture, DM t/ha	6.0	3.6	5.5	3.8
Herbage allowance per cow-calf unit, DM kg	3529	4145	3333	3100
Stocking rate of pasture	**1.70**	0.87	1.65	1.16
cow-calf unit	2.50	1.20	2.23	1.50
big head	735.0	693.0	677.9	664.8
Average liveweight of cow-calf unit, g day^{-1}	67.3	58.5	73.4	69.5
Feed and nutrient intake, average/day[1]				
green forage, kg	74.5	74.8	70.8	68.4
dry matter, kg	14.3	14.3	13.3	12.6
crude protein, g	2332	1892	1770	1518
PDIN, g	1465	1271	1097	999
PDIE, g	1341	1272	1168	1094
UFL	11.92	11.71	11.33	11.08

[1] pasture with mineral fertilizers
[2] ecological pasture

proportion of legumes from 20 to 14%. Compared to pasture E, herbage allowance on pasture F was about 15% lower in the 1st season and about 7% higher in the 2nd season. Cloudy and rainy days were found to be more frequent in the 1st season than in the 2nd. The stocking rate of the pasture, both in cow-calf units and in BH/ha was almost twice as high in the 1st season and about 1.5 times as high in the 2nd season on pasture F than on pasture E (Table 1). Dry matter content of the forage from pasture F was an average of 1.2 percentage points higher in the 1st season than in the 2nd, and that of the forage from pasture E by about 0.7 percentage point. On both pastures, cows with calves received less dry matter, crude protein, PDI and UFL in the 1st season than in the 2nd.

In both grazing seasons, cows from group F were characterized by higher liveweight gains and better body condition than animals from pasture E (Table 2). Compared to group E, cows from group F were observed to have a slight improvement in calving efficiency and a higher estimated milk yield for 210 days of lactation.

Winter feeding of nurse cows according to the INRA system (1988) made it possible to achieve a body condition score of 2.7 points prior to grazing (Table 2),

while the rations ensured daily intakes of energy (UFL) and protein (PDI) as specified under this system for Limousin and Blonde d'Aquitaine cows.

In both grazing seasons, no significant differences (P>0.05) were observed between the groups of calves from pastures F and E for daily liveweight gains and feed conversion (Table 3). Bulls from group N had about 6% better daily gains and heifers in both seasons had about 3% better gains than in group E.

TABLE 2

Performance of cows and milk composition[1]

Item	Group[4]		SE
	F	E	
Liveweight before grazing, kg	566.2	557.6	9.15
Condition score before grazing, points	2.73	2.73	0.04
Liveweight after grazing, kg	596.5	578.6	8.15
Condition score after grazing, points	3.5[a]	3.14[b]	0.05
Liveweight gain, g/day	176[a]	122	13.05
Calving after grazing, %	86.5	83.7	4.89
Total milk production during lactation, kg[2]	1957	1865	39.33
Milk yield around peak lactation, kg[3]	9.3 (7.8 - 10.2)		
Composition of milk, %			
solids	12.66 (10.84 - 14.55)		
fat	4.21 (3.94 - 4.34)		
protein	3.43 (3.15 - 3.76)		
lactose	4.83 (4.65 - 5.18)		

[a, b] – P<0.01

[1] average of both grazing seasons

[2] calculated according to Filistowicz (1998)

[3] obtained from 6 cows (3 cows with 75% Limousin genes and 3 cows with 75% Blonde d'Aquitaine genes)

[4] as in Table 1

DISCUSSION

An increased yield of pasture as a result of using various levels of nitrogen fertilization was also observed in other studies (Mikołajczak, 1996; Mc Grath et al., 1998). An increase in the yield of pasture of 20 kg DM/kg N in the 1st grazing season and of 26 kg DM/kg N in the 2nd season suggests that even small nitrogen doses may ensure good efficiency of fertilization and production on pastures that had not been fertilized for many years.

TABLE 3

Liveweight and daily gains of calves in the grazing period[1] in the winter period and feed utilization

Item	Bulls			Heifers		
	Group[3]		SE	Group[3]		SE
	F	E		F	E	
Grazing period						
liveweight before grazing, kg	68.6	59.5	4.12	58.7	56.5	3.91
liveweight after grazing, kg	220.4	198.1	10.36	212.4	192.4	8.72
grazing, days	150.8	162.8	6.36	160.5	159.1	6.00
liveweight gains, g/day	1004	943	22.65	869	853	17.92
Winter period						
initial liveweight, kg	240.2	222.4	9.96	188.0	204.8	7.77
final liveweight, kg	450.1	423.0	11.68	312.0	321.0	7.89
age, months	12.2	12.7	-	11.8	12.2	-
feeding, days	171	171	-	169	169	-
liveweight gains, g/day	1227	1173	27.99	734	687	13.52
Feed conversion per 1 kg of gain						
dry matter, kg	5.33	5.41	0.14	6.10	6.73	0.19
crude protein, g	878	898	22.09	875	940	21.25
PDI	524	531	13.79	570	617	14.31
JF[2]	4.81	4.89	0.13	5.80	6.39	0.17

[1] average of two grazing seasons

[2] UFV-bulls, UFL-heifers, according to the IZ-INRA system (1997)

[3] as in Table 1

Increasing the percentage proportion of grasses on pasture F compared with pasture E, accompanied by a decrease in the proportion of legumes, which do not respond to nitrogen fertilization, is a commonly known phenomenon (Ostrowski, 1994; Grynia et al., 1997). According to Marshal et al. (1998) changes in the botanical composition of grass-legume pasture do not reduce its nutritive value. This is confirmed by the production parameters obtained on pastures F and E in both grazing seasons. An approximately 615 kg DM/ha higher herbage allowance in the 1st grazing season on pasture E compared with pasture F (despite its lower yield) was because pasture E was almost double the size of pasture F, with a similar number of grazed animals (Morrison et al., 1999).

The production effects of cows and calves in both grazing seasons were favourably affected primarily by nitrogen fertilization, although the influence of weather conditions related to rainfall (Goszczyński and Witkiewicz, 1996; Mikołajczak, 1996; Zalewski et al., 1998) and the fact that the calves originated from multibreed herds (Barlov, 1987; Velde, 1996) cannot be disregarded.

The body weights of calves could also be affected by the intake of more milk from crossbred nurse cows, whose milk yield is higher than that of purebred beef cows (Velde, 1996). Daily nutrient intake from the pasture fertilized with 120 kg N/ha and the productivity results of cows and calves indicate that daily intake from the pasture of about 14 kg DM, 1340 g PDI and 12 UFL with a ratio of (PDIE – ODIN)/UFL = –10 g may ensure adequate body condition of multibreed nurse cows (about 3.5 points) and liveweight gains of young animals of about 1 kg/day in bulls and 850 g/day in heifers at the end of grazing. The body condition of cows before turning out to pasture and at the end of the grazing season was similar to that reported in other countries (Barlow et al., 1987; Petit and Agabriel, 1988). During the winter, daily intakes of energy (UFL) and protein (PDI) by nurse cows were similar to those specified by the INRA system (1988) for Limousin and Blonde d'Aquitaine cattle when taking into account the body condition and physiological period.

CONCLUSIONS

The summer feeding of multibreed beef cows with calves on a pasture fertilized with 120 kg of N/ha makes it possible, with a stocking rate of 1.7 cow-calf units (at an average weight of 730 kg), to meet the nutritional requirements of the cows and to achieve adequate fertility and body condition of the cows at the end of grazing (about 3.5 points) and high weight gains of the calves of about 1 kg/day for bulls and 850 g/day for heifers, with a daily nutrient intake by the cow-calf unit of 14 kg DM, 1340 g PDI and 12 UFL.

Winter feeding of multibreed beef cows makes it possible to obtain a body condition of 2.7 points prior to grazing, while daily intakes of energy (UFL) and protein (PDI) conform to the requirements specified by the INRA system (1988) for Limousin and Blonde d'Aquitaine cows.

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STRESZCZENIE

Efektywność żywienia krów mamek z cielętami, mieszańców ras mięsnych na pastwisku ekologicznym i nawożonym

Siedemdziesiąt krów mamek (mieszańców wielorasowych z dominującym udziałem genów bydła rasy Limousine lub Blonde d'Aquitaine, przydzielono do 2 grup (po 35). W okresie letnim wypasano je z potomstwem na dwóch oddzielnych pastwiskach: nawożonym azotem (120 kg/ha w 1. sezonie i 60 kg N/ha w 2. sezonie) – grupa F lub nie nawożonym – grupa E. Wcześniej pastwisk nie nawożono przez 9 lat. W okresie zimowym krowy i cielęta żywiono wg norm INRA. Nawożenie azotowe zwiększyło wydajność pastwiska o 40% (1. sezon) lub o 28% (2. sezon). Prawie dwukrotne zwiększenie powierzchni pastwiska E w porównaniu z pastwiskiem F, przy podobnej ilości pasących się zwierząt, poprawiło dostępność porostu, ale pogorszyło jego wykorzystanie. Krowy mamki z cielętami pobierały dziennie na pastwisku nawożonym 120 kg N/ha: 14 kg SM, 1340 g BTJ i 12 JPM. Po obu sezonach pastwiskowych kondycja krów wynosiła średnio 3,5 punktu na pastwisku F i 3,0 pkt. na pastwisku E. Zimowe żywienie krów umożliwiło uzyskanie przed wypasem 2,7 punktowej kondycji ciała. Dawki pokarmowe dla buhajków i jałówek w okresie zimowym pozwoliły na uzyskanie przewidywanych przyrostów masy ciała.