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ROOTS AND POTATOES AS SUPPLEMENTS TO AN ALFALFA – GRASS DIET TO DAIRY COWS

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Abstract

Fourteen multiparous dairy cows were used in 3 × 3 change-over experiment designed to study effects of replacing barley by roots and potatoes in diets based on leguminous forage on feed intake, milk production and utilisation of feed nitrogen. The cows received a mixture of alfalfa (*Medicago* L.) and grass silage ad libitum and an isoenergetic quantity of a supplement based on either barley and potatoes (Ba/P), fodder beets (*Beta vulgaris* L.) and potatoes (Be/P) or barley (Ba). The grass in grass silage was dominated by timothy (*Phleum pratense* L.). Total DM intake as well as yield of milk and energy corrected milk was significantly lower on diet Be/P than on the other diets. The recovery of N in milk was around 20% of N-intake on all diets.

Keywords: Dairy cows, roots, potatoes, intake, milk yield, N-recovery.

Introduction

The high yield of the modern dairy cow imply some kind of supplementation of the forage. At the most conserved forage alone could sustain the energy requirement of maintenance plus 15 - 20 kg milk. In the western countries the supplements are often based on

grain like barley, oats and maize. An alternative to grain could be roots and potatoes and perhaps especially at organic milk production and in areas not suitable for grain production. The carbohydrate composition of those two feeds might also result in a improved utilisation of degraded protein in the rumen which is of special importance with legume diets (Herrera-Saldana & Huber, 1989). The sugar in roots could serve as an instant fuel for rumen microbes, while the potato starch is an slowly available source of carbohydrates that could help to maintain the microbial population between feedings. There are also indications that inclusion of roots in the diet could improve DM-intake of forage and of the total diet (Roberts, 1987; Gruber, 1992).

The aim of this study was to investigate the influence of substituting grain by fodder beets and potatoes on feed intake, milk production and utilisation of feed nitrogen.

Material and Methods

Fourteen multiparous dairy cows of the Swedish Red and White Breed in mid-lactation were fed a mixture of alfalfa and grass silage (60/40 on DM-basis) ad libitum and an isoenergetic quantity of a supplement based on either (1) 4.9 kg DM barley, (2) 4.0 kg DM barley and 0.9 kg DM potatoes or (3) 4.1 kg DM fodder beets (*Beta vulgaris* L.) and 0.9 kg DM potatoes. Furthermore all cows received daily 1 kg of rape seed cake and 1kg of hay. The study was performed as a change-over experiment with three periods of four weeks. The cows were adjusted to the treatments during the first two weeks of each period. They were milked twice a day and treated and fed individually throughout the whole experiments. All feeds was fed four times a day beside potatoes and hay which was fed twice and once a day respectively. The silage used was wilted to an average DM content of 30% for alfalfa and 44% for grass. The dominating grass in the grass silage was timothy (*Phleum pratense* L.) with a smaller proportion of meadow-fescue (*Festuca pratensis* Huds.). Average content of

crude protein and metabolizable energy in the silage mixture was 19.3% and 10.3 MJ per kg DM.

Samples of milk and feeds were analysed as described by Olsson et al., (1996) and by Eriksson (1999).

During the last week of each period quantitative collection of urine and faeces was performed on eight of the cows in the experiment. Simultaneously rumen samples were collected from four of the cows fitted with a rumen cannula. Data from these collections are not analysed yet but will be presented at the conference.

Results and Discussion

Results from an earlier in vitro study demonstrated a higher digestibility of the organic matter and a higher efficiency in microbial protein synthesis with a potato adapted rumen fluid compared to rumen fluid from cows fed fodder beet or fed at maintenance with hay and a grain based concentrate (Eriksson, 1999). This result was found on a range of incubated diets and is an indication that rumen fermentation is highly related to the carbohydrate source. The design of the present experiment was based on the observations from the in vitro study as well as on data from preceding intake studies with fodder beets and potatoes.

As shown in Table 1 total intake of DM was significantly lower in diet Be/P than in the other diets due to a lower silage intake and some refusals of the supplement. The positive effect on total intake with roots shown elsewhere (Roberts, 1987; Gruber, 1992) was not found in this experiment. Differences in feed allowance and design among studies is probably a contributing factor to the different results. Yield of milk and energy corrected milk (ECM) was significantly lower on diet Be/P compared to the other diets. The recovery of N in milk was around 20% of N- intake on all diets. Thus the data did not confirm the results found in the in vitro study regarding the positive effect of potatoes. The relatively low N-return in milk

is not surprising considering the high N-content in the silage and illustrates the general problem with high N losses in diets with protein rich forages.

It can be concluded that inclusion of restricted amounts of fodder beets and potatoes in the diet as in the present experiment is not expected to give any positive effect on intake and milk production. The generally high content of crude protein in leguminous forages often leads up to high N-losses and low N-return in milk. Still usage of those feeds may be an interesting alternative in many situations, e.g. at organic farming or in areas not suitable for grain production.

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Table 1 - Intake of total DM, silage DM, milk yield, composition of milk and nitrogen efficiency for cows in the experiment. N=42.

	Ba/P		**Be/P**		**Ba**	
	Mean	SD	Mean	SD	Mean	SD
Total intake, kg DM/d	19.76	1.95	18.67	2.09	20.18	1.98
Silage intake, kg DM/d	13.58	1.89	12.68	1.51	13.57	2.01
Milk, kg/d	23.15	3.72	21.70	3.66	23.43	3.85
ECM, kg/d[1)]	24.56	3.73	22.97	3.74	25.39	4.87
Fat, %	4.61	0.52	4.62	0.56	4.73	0.69
Protein, %	3.16	0.17	3.14	0.19	3.21	0.17
Lactose, %	4.79	0.16	4.77	0.18	4.77	0.19
N recovery [2)]	19.9%	2.4%	20.8%	2.3%	20.2%	3.0%

1) ECM = Energy corrected milk
2) N in milk as percentage of N in feed