Pea-Barley Bi-Crop Silage in Milk Production

M. Tuori
Helsinki University, Finland

P. Pursiainen
Helsinki University, Finland

A. -R. Leinonen
Helsinki University, Finland

V. Karp
Helsinki University, Finland

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M. Tuori, P. Pursiainen, A.-R. Leinonen and V. Karp
Helsinki University, Department of Animal Science, FIN-00014 Helsinki, Finland,
Email: mikko.tuori@helsinki.fi

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Introduction Whole crop silage (WCS) from barley or wheat has many advantages as roughage feed. The possibility to use the same harvest machinery as in harvesting grass reduces investment costs. The farms which are specialised in grass production may have shortage of open field area for manure spreading, in which case WCS can be the answer. However, digestibility and protein content of WCS is usually lower than in grass silage, which is limiting the feed intake and performance of the dairy cows. Cultivation of grains with grain legumes increases digestibility and protein content of the stand (Lunnan, 1988). Feeding of bi-crop pea-wheat silages has increased forage intake and milk yield compared to grass silage (Salawu *et al*., 2002; Adesogan *et al*., 2004). In this experiment pea-barley bi-crop silage was studied since in Finland barley harvested for WCS is more digestible than wheat.

Materials and methods Barley (*Hordeum vulgare* var. Mette) and pea (*Pisum sativum* var. Perttu) were intercropped on a 2.4 ha field in Helsinki, Finland (60E N 13', 25E 0' E). The seed rates used were 55 and 250 germinating seeds/m^2, respectively. The bi-crops were harvested at 10 wk after sowing. The growth stages of the peas and wheat was early to full pod and the early dough stage, respectively. The control timothy-fescue (TF) sward was harvested at booting. Both silages were wilted, ensiled to round bales using formic acid-based additive 5 l/t. Silages were fed to 8 multiparous dairy cows (four cows fitted with a rumen cannula) in two 4x4 latin squares. Treatments differed in the proportion of pea-barley silage (PB) to grass silage: 0, 33, 67 and 100% of the total amount of silage dry matter (DM). Silages were fed *ad libitum* and concentrate (192 g CP/kg DM) was given at fixed amount of 12 or 14.5 kg/d in the different squares.

Results The proportion of pea was 74% in the PB silage DM, which in laboratory scale has shown to improve ensiling compared to pure pea sward (Pursiainen *et al*., 2002). D-value was about the same for PB and TF silage (645 and 658 d/kg DM). Dry matter content was lower in PB silage compared to TF silage (255 and 559 g/kg) and crude protein content was higher (170 and 131 g/kg DM). PB silage was more abundantly fermented than TF silage: amount of total fermentation acids was 120 vs 12 g/kg DM, respectively. Ammonia-N content was higher (108 vs 31) and pH lower (3.96 vs 5.16) in PB than TF silages. Butyric acid content was low in both silages. Thus silage intake index (Huhtanen *et al*., 2002) was lower for PB silage (85 and 101). However increasing PB silage in the diet increased silage intake up to the 33% diet, but after that it decreased (9.2, 9.7, 9.0, 7.1, SEM 0.72 kg DM/d for 0, 33, 67 and 100). Milk production was the highest with the 100% diet (28.7, 28.5, 29.5, 30.3, SEM 2.27 kg/d, lin. $P<0.05$). The increase of liveweight gain decreased with increasing amount of PB silage (0.58, 0.49, 0.46, 0.10, SEM 0.24 kg/d). However, the protein content in milk decreased with PB (38.5, 37.8, 37.0, 37.1, SEM 1.03 g/kg, lin. $P<0.05$). The effect of PB silage on protein yield tended to be quadratic (1099, 1063, 1083, 1115, SEM 75.0 g/d, quadr. $P<0.10$). Microbial protein synthesis estimated from urine secreted purine derivatives per kg digested carbohydrates was the highest in the 100% diet (lin. effect $P<0.05$). NDF pool in the rumen, measured in the evacuation technique, decreased with increasing PB silage ($P<0.01$). However, INDF pool in the rumen was the highest on 100% diet.

Conclusions Pea-barley bi-crop silage increased milk yield, decreased silage intake and liveweight gain of the cows compared to grass silage diet. Decreased intake of pea-barley silage was likely due to lower dry matter content and more abundant fermentation products in the pea-barley silage.

References

Adesogan, A.T., M.B. Salawu, S.P. Williams, W.J. Fisher & R.J. Dewhurst (2004). Reducing concentrate supplementation in dairy cow diets while maintaining milk production with pea-wheat intercrops. *Journal of Dairy Science,* 87, 3398-3406.

Huhtanen, P., H. Khalili, J.I. Nousiainen, M. Rinne, S. Jaakkola, T. Heikkilä & J. Nousiainen (2002). Prediction of the relative intake potential of grass silage by dairy cows. *Livestock Production Science,* 73, 111-130.

Lunnan, T. (1988). Blandningar av bygg og ulike belgvekstar til grønfôr. *Norsk Landbruksforskning,* 2, 219-232.

Pursiainen, P., M. Tuori, J. Nousiainen, H. Miettinen & U. Kämäräinen (2002). Field bean, field pea and common vetch ensiled with whole crop wheat using formic acid or inoculant. In: Gechie, L.M. & Thomas, C. (eds.): *The XIIIth International Silage Conference*, September 11-13, 2002, Auchincruive, Scotland. p. 120-121.

Salawu, M.B., A.T. Adesogan & R.J. Dewhurst (2002). Forage intake, meal patterns, and milk production of lactating dairy cows fed grass silage or pea-wheat bi-crop silages. *Journal of Dairy Science,* 85, 3035-3044.