

Feeding toasted field beans to dairy cows

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Implications

Toasting field beans can improve the protein quality of field beans markedly. In the feed demonstrations carried out in Project EcoProtein testing a new method of toasting with a drum dryer, showed, however, only reduced effect on the protein quality due to a lower than optimal temperature. The toasted field beans were fed in two organic dairy herds, replacing a part of the concentrates in the ration in a cross-over design. Preliminary results showed no milk yield difference in herd 1, but a reduced milk yield level in herd 2.

Background and objectives

Organic dairy herds in Denmark have a high average production level of approximately 8600 kg ECM (Energy Corrected Milk) and the feed rations are in most herds medium to high-input of highly concentrated feed. The concentrated feed consists of grain and protein-rich sources such as soy bean and rapeseed cake, which, in the case of soy beans, are imported from south-eastern Europe and China. The price-level of soy beans has in 2012 -2013 reached extremely high levels, which has increased the feeding cost markedly. The interest of enhancing the homegrown supply of protein is becoming more and more reasonable in the organic herds. Not only considering the economical aspect, but also regarding a growing concern about sustainability, traceability and feed safety.

During 2012- 2015 the Danish project named Project EcoProtein focus on how to grow field beans and lupins, and how to improve the feeding value of the legumes in order to replace imported protein sources in the fed ration of organic husbandry. Preliminary studies show that toasting lupins and field beans can improve the protein quality to ruminants (Jørgensen & Andersen, 2013). According to lab analysis and *in sacco* determinations of the protein digestibility in fistulated dairy cows, toasting the field beans at 120-130°C improved the AAT (Amino Acids available in the inTestine) - value from 110 to 190 gram AAT per kg dry matter (DM)(Jørgensen & Andersen, 2013). The PBV- value (Protein Balance in the Rumen) was oppositely lowered from 142 to 46 gram PBV per kg dry matter. Optimizing feed rations shows that theoretically toasted field beans ought to be able to replace a part of the soy bean and rape seed cake in the feed ration. The objectives of the dairy cow demonstrations of Project EcoProtein are to testfeed toasted field beans in high-yielding dairy herds in order to replace concentrates containing imported protein sources in order to determine whether milk production level and, not least, milk production cost are affected.

Key results and discussion

The demonstrations were carried out from December 2012 to the beginning of April 2013 and the statistical analysis awaits. The method of toasting the field beans in a drum dryer only had reduced effect compared to earlier results due to a lower temperature than expected (110-115 °C). AAT levels were increased from 121 to 144 gram AAT/kg DM. Results from the first 2 demonstration periods showed no difference in milk yield in herd 1, but a reduced milk yield in herd 2 in the groups feed TMR with toasted field beans. The yield loss in herd 2 could not be counteracted by the reduced ration costs. High yielding

dairy cows still need a concentrate supply mainly due to at low fat content in the field beans, but feeding toasted field beans has good potential in order to replace a part of the high-cost protein sources and thereby reduce the feed cost and improve total economy given the milk yield level is maintained. Since the full effect of toasting was not reached in the present demonstrations the full potential of toasting is yet to be demonstrated in practical use.

How work was carried out?

Two organic HF dairy herds participated in a feed demonstration. In both herds, the cows were divided in 2 equal groups and were fed in a cross-over design with one of 2 Total Mixed Rations (TMR). The feed rations consisted of either a concentrate supply with soy bean/rape seed cake or a concentrate supply with toasted field beans. The field beans were toasted by using a drum dryer at maximum temperatures at Danish Agro. This method had not been tried earlier. The planned level of field beans was 4.9 to 5.8 kg per cow per day. The concentrate rations appear in table 1 and 2. Roughage levels were planned to be equal in both rations within herds. The rations were optimized to reach the same levels of energy and protein in both rations within herd.

The demonstration was carried out in winter 2012-13 with 3-4 periods of 4 weeks. In week 4 urine samples were collected from 8 median cows per group. Milk yield, fat and protein content were determined individually and feed control of the 2 TMRs were carried out.

Table 1. The planned concentrate feed ration and cost in herd 1.

	Cost dkr(euro)/kg	Soy bean and concentrate (kg/cow/day)	Field bean, concen- trate and soy bean (kg/cow/day)
Barley	2.50 (0.34)	6.9	3.5
Soy bean cake, toasted	6.10 (0.82)	2.0	0.4
Field beans, toasted	3.50 (0.47)	0	4.9
Concentrate (25% cr. protein)	3.45 (0.46)	2.3	2.3
Concentrate costs, dkr. (euro)/cow/day		37.39 (5.02)	36.28 (4.87)

Table 2. The planned concentrate feed rations and costs in herd 2

	Cost dkr (euro)/kg	Soy bean and concentrate (kg/cow/day)	Field bean and soy bean (kg/cow/day)
Soy bean cake, toasted	7.2 (0.97)	0	0.4
Field beans, crimped	2.3 (0.30)	2.5	1.2
Field beans, toasted	3.5 (0.47)	0	4.6
Concentrate (33 % crude protein)	5.23 (0.70)	3.7	0.0
Concentrate costs, dkr.(euro)/cow/day		36.90 (4.95)	33.30 (4.47)

References

Jørgensen K F and Andersen W S 2013. [Optimér den økologiske foderforsyning](#). Bilag Dansk Kvæg Kongres 2013. Foderforsyning. Herning 25.-26. Februar 2013.