Alternatives to soya for dairy cows

What are the alternatives to soya for dairy cows?

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Legumes Translated

Soybean meal is considered the gold standard for supporting high milk yields in dairy cows. However, it is falling out of favour with milk processors, consumers and dairy farmers for many reasons. Environmental concerns around how imported soybean is produced, a desire to reduce the carbon footprint of milk, and pressure from milk buyers means that farmers are looking at alternatives. This practice note discusses the reasoning behind seeking alternatives and the nutritional considerations to bear in mind when formulating dairy cow rations without soya.

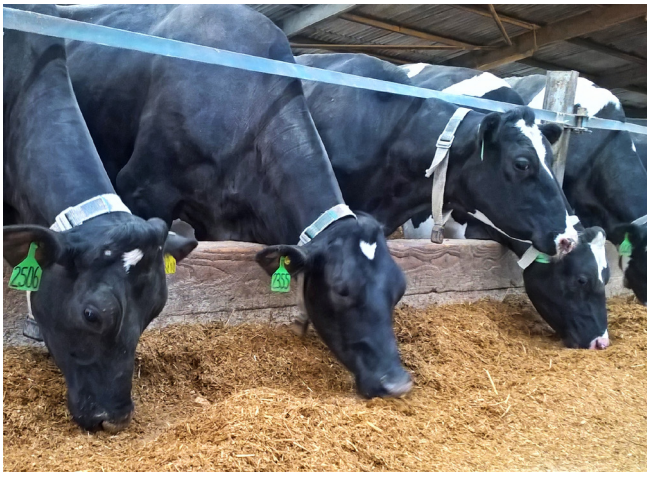

Figure 1. High yielding dairy cows feeding. Photograph: Hugh McClymont (SRUC)

Applicability

Theme: Dairy cow nutrition

For: Dairy farmers, nutritionists, and the feed manufacturing industry

Where: All UK dairy farms

Timing: Most relevant for winter feeding period (or all year round for herds that are fully housed)

Impact: Reduced reliance on soya which will help to reduce the farm's carbon footprint and conform to some milk buyers' expectation

Outcome

Soybean meal can be replaced as a concentrated protein source for dairy cows without compromising milk yield or quality. There may be economic benefits depending on the price of soya and other protein sources. Switching to other high-protein feed ingredients is likely to reduce the carbon footprint. In future, milk buyers may reward farmers who do not use soya-based feeds. Since imported soya is the main source of genetically modified products used in agriculture, switching makes production 'GM-free'. Some of the alternatives (rapeseed meal and legume grains) can be home-grown, reducing the dependence on long supply chains. The information provided here can help the reader decide whether it is in their interests to remove soya from dairy rations, how it can be substituted, and how that might affect milk production.

What's the problem with soya?

A very large proportion of soya used in the European Union and the United Kingdom is imported from North- and South America. Despite a rapidly growing organic soya area in Central Europe, much organic soya used in organic systems comes from China or India. Particularly for soya from South America, there are a range of societal concerns now impacting on public policy and on food markets. This is evident also from the recent Farm-to-Fork Strategy that sets out the European Commission's vision for the future of agri-food policy. Imported soya is acknowledged as a major link between the European economy and deforestation. It is also the major source of genetically modified products which are rejected in some dairy markets. For example, the German and Austrian dairy sectors are now almost 'GM-free'. While soya production in

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Europe usually contributes to diversification of cropping systems, much of the imported soya is grown in simple systems based on soybean monoculture. Concerns about the link between soya and deforestation have been partially offset by the availability of certified sustainable soya. There is a growing interest in declaring and reducing the carbon footprint of food using alternative home-produced raw materials.

While soybean meal is an expensive feed component on a per tonne basis, it is widely regarded as the cheapest and default source of concentrated plant protein. Hipro soya is 55% protein on a dry matter basis and so the rate of inclusion is relatively low. This creates more "space" in the ration to include, for example, cereals which are one of the cheapest sources of energy, or more forage. Soya is now the protein source of choice due to its high bypass protein or DUP (digestible undegradable protein) content. It is a particularly good source of ileal digestible lysine. Soya is however low in the essential amino acid methionine. Methionine has a key role in milk protein production and together with lysine, they are the first limiting amino acids for dairy cows.

What are the alternatives?

The forage and the basic ingredients of the concentrate feeds, usually cereals, provide most of the protein in the diet. Soya or its alternatives supplement this foundation. There are many alternative concentrated protein sources. The most commonly used one is rapeseed meal, which has been proven to fully replace soya with no detrimental effect on milk yield or milk composition. Rapeseed meal is thought to be underestimated in its metabolisable protein content compared to soyabean meal.

Figure 2. Example of concentrate feed – purchased blend including rapeseed meal, protected rapeseed meal, distillers wheat dark grains, sugar beet pulp and palm kernel expeller. Photograph: Hugh McClymont (SRUC)

Figure 3. Faba bean. Photograph: Seed Technology Ltd.

Many farmers in the UK are replacing soya with rapeseed meal which has been processed (by heat or using chemicals) to improve the DUP content. This is perhaps more applicable to grass silage-based rations which are usually not short in rumen degradable protein. Rapeseed meal also has a more favourable methionine content and so it is likely to benefit milk protein content when substituting for soya. Other commonly used feeds include distillers dark grains (wheat or maize based) as a byproduct from ethanol production.

This leaves the question of the suitability of the classical legume protein crops – pea, faba bean and lupin. Currently, these alternative grain legumes can also be considered but they are not always easy to source for industrial feed production, particularly in Scotland. This strengthens their role in home-feed production. With this in mind, Table 1 sets out the basic nutritional information about these alternatives. More of these feeds need to be fed to come close to replacing the amount of protein provided by soya and therefore the total feed cost must be considered to ensure alternatives are cost-effective.

Table 1. Nutritional value of hipro soya and alternative concentrated protein sources

Feed ingredient	Dry matter (DM) %	Metabolisable energy MJ/kg DM	Crude protein % DM	DUP % DM	Total lysine % DM	Total methionine % DM	Starch % DM
Hipro soya	90	13.6	55.0	24.5	3.1	0.70	5
Extracted rapeseed meal	88	12.1	38.5	8.9	2.1	0.80	5
Distillers dark grains-wheat	90	13.7	38.5	8.9	2.1	0.80	5
Beans	86	14.0	29.0	3.9	2.0	0.25	40
Peas	86	13.6	26.0	3.8	1.8	0.25	44
Lupins	86	14.5	32.0	8.1	1.9	0.30	9

Source: Ewing, 1997

Going by the DUP content of feeds listed in Table 1, it is clear that using these feed ingedients to replace soya is likely to result in a lower supply of bypass protein in the diet. This must be taken into consideration when diets are reformulated without soya. The most commonly used alternative feed in the UK is protected rapemeal, with available products having a DUP typically about 18-26% in the dry matter, with up to 75% of the crude protein content being DUP.

Key practice points

- There are a number of alternative feed sources, including other legume grains, that can be used to replace soya in dairy rations, although it may be harder to meet bypass protein requirements with some of these feeds. Careful formulation is required to balance amino acids. Methionine supplementation with a rumen protected source is recommended to maintain milk yield and milk protein content.

- The most common replacement for soya is protected rapeseed meal but others such as extracted rapeseed meal, distillers dark grains and grain legumes (peas, beans and lupins) can also be used alone or in combination (Figure 4).

- Care must be taken when replacing soya to account for any difference in energy and starch content of the alternative products used.

- Cost is an important consideration. Any change in production must be evaluated against the different ration costs to assess whether the change is cost-effective or not.

Figure 4. Flowering pea. Photograph: Robin Walker (SRUC)

Further information

Watson, C., Reckling, Preissel, S., Bachinger, J., Bergkvist, G., Kuhlman, T., Lindstrom, K., Nemece, T., Topp, C.F.E., Vanhatalo, A., Zander, P., Murphy-Bokern, D., Stoddard, F.L., 2017. Grain legume production and use in European agricultural systems. Advances in Agronomy 144, 235-303.

Cefetra Certified Soya, website: www.certifiedsoya.com

Donau Soja Organisation provides on its website a daily price information about certified soya meals from European production ('GM-free'). www.donausoja.org/en/dses-soya-bean-meal-prices/

Fraanje, W., 2020. Soy in the UK: What are its uses? www.tabledebates.org/blog/soy-uk-what-are-its-uses

Sources

Ewing, W.N., 1997. The Feeds Directory: Commodity Products. Context Products Ltd.

Gautheir, H., Swanepoel, N., Robinson, P.H., 2019. Impacts of incremental substitution of soybean meal for canola meal in lactating dairy cow diets containing a constant base level of corn derived dried distillers' grains with solubles. Anim. Feed Sci. and Tech., 252, 51–63.

Hutanen, P., Hetta, M., Swensson, C., 2011. Evaluation of canola meal as a protein supplement for dairy cows: A review and a meta-analysis. Can. J. Anim. Sci., 91(4), 529–542.

Martineau, R., Ouellet, D. R., Lapierre, H., 2013. Feeding canola meal to dairy cows: A meta-analysis on lactational responses. J. Dairy Sci. 96, 1701–1714.

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