



CASE STUDY: W & JC HARRISON (BEEF)

How roasting affects faba beans as a soya substitute

W & JC Harrison conducted a trial comparing the performance of roasted versus raw faba beans on the performance of beef store cattle.

Inspired by a dairy project in Denmark, mother and son team Jane and John McArthur set out to see the difference roasting home-grown faba beans could have on the performance of their beef cattle.

John had visited an organic dairy farm which was processing beans as part of an effort to reduce reliance on imported soya. It was reported that roasting the beans preserved them for long-term storage, but also increased bypass protein and starch which supported an increase in the cows' metabolisable protein supply.

With improving sustainability high on the agenda for John and Jane, they were keen to find ways to increase productivity from home-

grown feed. Their feeding trial, as part of the NCS project, was set up under guidance of beef nutritionist Lizz Clarke (LC Beef Nutrition).

The farm's 26 weaned bull calves from 2024 were divided into two groups of 13 animals. Over the following 126 days both groups were fed ad-lib grass silage, plus 5kg/head/day of rolled barley and 1kg/head/day of faba beans, which were all home produced, plus 0.08kg/head of bought-in minerals. One group received rolled beans, while the other had beans that had been roasted and rolled.

After harvest the beans were stored in a grain store before being loaded into a toasting machine which exposed them to high temperatures for a short time.

Table 1: Analysis of the beans

	Roasted beans		Raw beans	
	Fresh weight	Dry matter	Fresh weight	Dry matter
Ruminant ME MJ/KJ		13.7		13.9
Oil A (Ether Extract) %	1.25	1.32	1.06	1.24
Crude Protein (Nx6.25) %	26.2	27.7	24.8	28.9
Moisture %	5.4	94.6	14.2	85.8
Ash %	3.3	3.49	3	3.5
Total Oil (Oil B) %	2.12	2.24	1.79	2.09
NCGD (DM) %		93.7		95.7

*In sacco** tests on the beans were completed by the Flanders Research Institute for Agriculture, Fisheries and Food as part of the NCS project. Results showed that roasting the beans doubled rumen degradable protein while protein digestibility in the small intestine increased by 4%. Roasting also increased bypassed starch by up to 47% while digestibility was unaffected.

Initially there didn't appear to be much difference between the two groups but by the end of October 2024 the roasted bean group was outperforming the control group.

The diets were formulated by Lizz Clarke based on achieving 1.4kg daily liveweight gain however calculations showed that average

daily liveweight gain for the group receiving the roasted beans was 1.54kg compared to 1.39kg for the control group.

During the trial one animal within the raw bean group received antibiotics due to a pneumonia-like illness (not related to its diet). This animal remained within the trial, and brought the figures down. Excluding this animal from the trial data raises the average daily liveweight gain for the raw group to 1.44kg.

Carbon footprinting by Farm Carbon Toolkit showed that, due to the heating process, carbon emissions were higher for the roasted beans at 171kg/tonne compared to 162kg/tonne. The feed also worked out £4.50/tonne more expensive.

However the increase in daily liveweight gain reduced the overall feed cost of rearing the beasts by 5p/kg liveweight gain from 98p/kg for the control group compared to 93p/kg for those fed the roasted beans. Carbon emissions were also lower for the roasted bean group at 6.11kg per kg of liveweight gain compared to 6.61kg.

So, although the roasted beans were more expensive to feed the improved performance brought cost of production – and carbon emissions – down and improved overall productivity and profitability.

Table 2: Trial summary

Metric	Unit	Raw beans	Roasted beans	% Change
Daily Liveweight Gain	kg	1.39+	1.54	+10%
Feed cost	£/kg LWG	0.98	0.93	-5%
Feed emissions	kg CO2e/kg LWG	1.52	1.46	-4%
Value CO2e emission*	£/kg LWG	0.37	0.35	-4%
Total Cost (feed + emissions)	£/kg LWG	£1.35	£1.28	-5%

* social cost of carbon £241/tonne (HM Treasury, The Green Book)

+ excluding the ill animal from the figures increases DLWG to 1.44

*(from previous page) *In sacco* testing is a method used to measure how well a feed is broken down in the rumen of cattle. Small samples of the feed are placed in porous bags and inserted into the rumen, where they are exposed to digestion. After a set time, the bags are removed and analysed to determine how much of the feed was degraded.

Next steps

The McArthurs are moving towards a fully homegrown ration with roasted beans as the primary protein source. To maintain a high standard of nutritional precision and animal performance they continue to analyse feed and silage to ensure accurate nutrient profiling for diet formulation. They also weigh cattle at regular intervals to monitor growth rates and assess the effectiveness of ration formulation.

This approach supports greater self-sufficiency, cost control, and consistency in feed quality, while enabling rapid adjustments based on performance metrics and lab-verified nutritional content.



“Boosting productivity from home-grown feed is key to improving sustainability, so it’s encouraging to see that a simple change to our routine can support both goals.” John McArthur

Briar Farm/ W & JC Harrison

- Near Doncaster, South Yorkshire
- 200 ha
- Arable unit plus 40-cow suckler herd (mixed breeds)
- Spring calving herd put to a Limousin bull
- Progeny sold as stores via Selby market

NCS Project

Nitrogen efficient plants for Climate Smart arable cropping systems (NCS) is a four-year £5.9m research programme aiming to enable UK farming to bring about a reduction of 3.4MtCO₂e p/a or 54% of the maximum potential for the industry through increased production and use of pulses. Led by PGRO it involves 200 UK farms and 17 partners. The project is funded by the Farming Futures R&D Fund: Climate smart farming, part of Defra’s Farming Innovation Programme. Defra is working in partnership with Innovate UK who are delivering the programme.

