SPRING 2026

KnowHow

HOME-GROWN FEED PROCESSING AND PRESERVATION

HERE TO HELP YOU

ride out the storms

Ronan Keating topped the UK charts in July 2000 with 'Life is a Rollercoaster' and whilst he was referring to love at the time, the same could often be said of the UK agriculture industry.

We are constantly at the mercy of the weather, input price volatility (especially fuel and fertiliser at present), government policy and fluctuating prices.

When faced with a lower milk price, dairy farmers often look at where they can cut costs and, as we approach the silage season, Jonathan Hill of Promar shares his views on how better quality forage is the key to profitability (page 13).

Whatever the milk price, milk from forage and other home-grown feeds is the cheapest milk to produce so a short-term saving achieved by choosing an additive on price alone, or even not using one, or using poorer quality sheets will undoubtedly lead to higher costs or poorer performance next winter.

On page 21 we look at how Lancashire farmers, Fred, Mark and Jake Riding, turned to us last autumn and used the new preservative MultiMax, making great quality silage in wet conditions in September. We also feature another article by Dr Horst Auerbach on page 28 where he further explains the mode of

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Also in this issue:

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action of MultiMax, shares new trial results and demonstrates why a proven preservative is so important in challenging conditions.

We are increasingly working with more arable farmers who are trying to protect their businesses by either adding value to their current crops or adding other crops to their rotations. One such farmer is Mike Greenwood who, with the help of his agronomist, began growing grain maize for crimping two years ago. We follow the maize to Dumfriesshire dairy farmer, Angus Kerr, who has been buying it to feed alongside his crimped barley to one of his milking herds, with insight from his nutritionist as to why it feeds so well in the diet.

This story shows not only the benefits to the two farming businesses but the strength of cooperation between farmers and their advisors who can work together to shorten the supply chain, cut out the middleman and keep more profit on the farms.

As we are almost three years into the Nitrogen Climate Smart Project (NCS), we hear from the team at the James Hutton Institute about their work on bi-cropping with legumes and lifecycle analysis (page 16). We also return to Richard Barker's North Lingy Moor Farm, previously featured in KnowHow (Autumn 2024), as he hosted one of the beef feeding trials (page 24).

Finally, we introduce Dr Donald Lawson of Premier Nutrition, with whom we have recently partnered to improve our mineral range (page 10). Most dairy farmers already use a quality bespoke mineral, balanced to their diet, but it is something often overlooked by beef producers. Donald looks at the differences between grass silage and wholecrop beans and highlights the benefit of diet-specific minerals. Advances in forage mineral analysis mean that testing is now relatively inexpensive and state-of-the-art production facilities mean that bespoke minerals can be made in small batches to match specific nutritional requirements.

We can't change the external pressures on your business but we can help you with scientifically proven products and technical advice to ensure you stay on the right track when it comes to making the most of home-grown or locally sourced feeds as you ride the ups and downs of farming.

GRAIN MAIZE ON THE RISE

The UK's maize acreage is on the rise and predictions suggest that climate change will drive this further. Prolonged wet weather has become a regular feature of UK winters which is challenging the growth of traditional cereals, particularly in the west.

Maize is said to represent a logical alternative, generally being drilled after winter rains and floods have subsided and reaching deep for moisture during summer droughts.

This presents opportunities for more home-grown livestock feeds – not just through the high tonnage of forage the crop can produce but for the opportunity it offers to be harvested as grain.

Grain maize can be crimped to make a concentrate feed of high nutritional quality, with the prospect of 68-73% starch and a metabolisable energy (ME) of around 14-14.5MJ/kg DM. It can be safely fed to ruminants in higher quantities than dry grain, and is increasingly forming part of progressive producers' livestock diets.

However, where growers have no livestock of their own, grain maize is opening up opportunities for the farm-to-farm trading of high-quality, transportable feed.

All of this is driving a spread of maize beyond its traditional areas, and the northwest of England – where wheat and barley are particularly challenged – has seen new growers trying maize for the first time, specifically for grain. With no established trading platform for this maize to be sold, it has been important for the growers and users to be linked, which is forming a virtuous chain.

At Kelvin Cave we have identified and supported some of our clients through the process, often working alongside independent agronomists and nutritionists. In this article (overleaf), we talk to:

- An **arable farmer** near Liverpool who is switching land from cereals to grain maize and selling his crop to livestock producers.
- The **agronomist** who made the recommendation for this switch to be made.
- A **Scottish dairy farmer** who is buying grain maize from this grower to use in rations for his milking cows.
- And the **nutritionist** who is formulating the rations for this herd.

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Kelvin Cave's role in the supply chain

The Kelvin Cave team is passionate about producing home-grown feeds – shortening supply chains, reducing carbon footprint, cutting out middlemen, improving livestock performance and ultimately keeping more profit behind the farm gate.

With an established customer base of livestock producers and crimping contractors as well as good working relationships with respected independent nutritionists and agronomists, will aways do our best to link arable growers with livestock producers who want to find reliable markets and sources for their products.

As farming profits are squeezed from every direction; as pressure grows to reduce imports and carbon footprint; and as incentives arise for regenerative farming practices, we become more and more convinced that home-grown feeds represent the future for a resilient UK farming industry.

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THE GROWERS

Mike Greenwood and Helen Knight run a mixed arable and suckler beef operation based around Headbolt Farm in Formby, on the west coast between Liverpool and Southport, and branched into crimped grain maize around two years ago. Farming around 600 acres (243ha) of their own land, they also contract-farm up to 1,000 acres (405ha) of wheat, oats (for human consumption) and occasionally beans. They sell all their grain maize as crimp to livestock producers.

Mike says:

We wanted to try something different as we've been finding it harder and harder to grow cereals, which just weren't performing like they used to. Years ago, spring crops would do a lot better on this farm and yields of winter wheat would be around 3-3.5t/acre. We've never been a 4t/acre farm, as we have very wet ground which I'd describe as silty, flat, moss land.

But now, the weather is wetter and we may get as little as 1.5t/acre in a poor year. We also find winter crops are too hungry – they are too dependent on fertilisers and chemical inputs, and were losing us money.

So, we introduced maize in 2024 which turned out to be a really bad year to go into something new. We had a late, wet spring and were late sowing, as well as a wet harvest.

We always intended to take the maize as grain rather than forage, as we could harvest it with a combine on tracks, cart it to the trailers on headlands and make no mess.

We initially thought we'd sell the grain dry and planned to harvest at a moisture content of 27% and dry it to 14-15%. The drying would have cost us £40-£50 per tonne although that would be more at current fuel prices. However, we were introduced by our agronomist [Paul Sweeney, see panel, p6] to the idea of crimping and decided to set everything up to crimp instead of dry. This turned out to be a blessing as the maize came in at 35% moisture, which would have been too wet to dry.

Crimped maize at Mike Greenwood's Lancs farm.

We used James Tomlinson, a local contractor, to carry out the crimping and it worked brilliantly – it was a bit like making silage. As long as we're careful to roll, use the right preservative – we use CrimpSafe 300 – and compact, sheet and keep the clamp tightly sealed, we get a really high-quality product which is no problem at all to transport to other farms.

Paul also introduced us to Michael Carpenter [Kelvin Cave Ltd] before we started and the two of them have helped us find several outlets for the crimped maize and driven the process forward.

Angus Kerr [see page 7] takes an artic load as he requires, and is feeding it to his dairy cows. Dairy producers want a consistent product and we can keep them happy with that at a given price. We base this around the price of wheat and try not to change that once it's agreed for the season. He seems to be very happy with it – as are the other producers we supply.

We grew maize again in 2025 and had a better year with yields of around 3.5-4 tonnes/acre. The crop is making a profit, but we keep experimenting and still want to improve. For 2026 we are sowing around 200 acres [81ha] and have switched to a variety – Pioneer 7326 – which seemed to perform consistently better than others we've tried.

We have also now purchased a Murska 2000 to do the crimping ourselves as we were so impressed with the build-quality of our contractor's machine and the sample it was producing. However, we decided to go for specialist 4mm fluted maize rollers which will increase output, instead of the multi-purpose rollers used in our contractor's machine. We've also opted for a weighing system and Silaspray SP applicator to ensure we apply the CrimpSafe 300 as accurately as possible.

We like the flexibility maize is giving us and particularly like harvesting for crimp when we can crack on early with harvest. At the other end of the season, we have even harvested a small amount remaining in March 2026, which has overwintered well and demonstrates the flexibility of the crop when it's harvested as grain.

We can't speak highly enough of the help we have received from Paul Sweeney and Kelvin Cave, and may increase our acreage further if it keeps doing well and we know there's a customer base. We crimp all the maize we grow and we might even feed some to our own stock but we've sold out every year so far.

Contractor, James Tomlinson crimps the maize with his Korte 2000.

Excellent clamp management combined with CrimpSafe 300 ensures stability and maximum nutrient retention.

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THE AGRONOMIST

Paul Sweeney is the agronomist at Mike Greenwood's farm [see pages 4 and 5], where he encouraged the switch from traditional wheat and barley and into grain maize. He confidently predicts grain maize will become one of the largest acreage crops grown in the UK, and has helped drive its success on many northern farms.

Paul says:

In some of the northwestern counties I cover, including south Lancs, it's becoming increasingly difficult to maintain consistent yields of traditional cereals.

Climate change is undoubtedly driving weather extremes, and it's no longer uncommon for prolonged wet conditions from September to April to be followed by drought through the summer months.

Waterlogging over winter does not suit winter wheat or barley, and the problems it causes are exacerbated on heavy land. These same problems can also make it difficult for spring cereals to be drilled in a timely way.

In contrast, maize does not need to be sown until late April or early May, by which time, conditions tend to be drier. Once established, the crop's rooting structure can reach deep, giving it a drought tolerance not seen in cereals. In areas worst hit by dry conditions in 2025, it was obvious on many farms that maize was the crop which thrived.

Specialist arable farmers tend to find maize is an easy crop to grow, although as with anything new, it might take two or three years for the skills to be acquired.

Weed and disease control are fairly simple and a maize crop will need a fraction – about a quarter – of the agrochemicals required for wheat. It normally requires no fungicide or insecticide and may potentially be treated once or twice for weeds.

The downside is the seed cost – at least double that of wheat – and it's important to get seed rate right to optimise yields and profits.

Mike Greenwood combining maize in March 2026 - the crop has stood well over winter and still yielded 3t/acre..

We know harvesting maize silage can have a bad press because of soil damage from tractors and trailers, but this isn't a problem when maize is harvested as grain. Beginning harvest from late October, although a maize header is required, a traditional, wheeled combine is usually up to the job. In some cases, farmers and contractors prefer to use tracked combines to further reduce compaction, although in many cases this is not essential. The leaf and stem left in front of the combine make a bed on which the machine runs

and if left over winter, protect the soil from run-off and add structure and organic matter when they're ploughed in.

Growers may be put off by having to dry grain maize which is likely to need reducing in moisture content by around 10 percentage points. That's both too slow and expensive, which is why I'm recommending to some clients they consider crimping instead. Around 200 tonnes per day can be harvested and crimped at an ideal moisture content of 30-35%. If well compacted, sealed and preserved with CrimpSafe 300, it can be stored in a covered clamp and can easily be transported and re-ensiled.

I've recommended to growers like Mike that we need to line up livestock farmers who'd like to buy crimp, and provided those relationships can be established, I think they could develop a thriving trade.

The attraction for the livestock producer is that crimped grain maize is about the most energy dense crop they'd be able to buy.

Longer term, growing maize, in particular for grain, is a great prospect for arable producers: it's a good break from wheat, and potentially oilseed rape, and can be grown year after year.

THE FEEDER

Angus Kerr runs two dairy herds totalling around 750 milkers based around Crochmore Farm, 10 miles west of Dumfries. Also keeping some 200 head of beef-dairy crosses to rear and finish, the total area of the two farms of around 1,000 acres (405ha) supplies all the forage, including wholecrop cereals, for the dairy and beef rations. However, a starch shortfall has been made up by crimped maize, which was bought in last year.

Angus says:

We had already experienced crimp when we'd bought barley off the combine last harvest. We switched to crimping this, using CrimpSafe Hi Dry, on the recommendation of our nutritionist, Stephen Caldwell [see page 9] and after we'd seen its success, it was a natural progression to move to crimped maize.

Previously we'd used a urea-based product to preserve our grain but we hadn't been happy with the consistency, with some particularly bad areas where the ammonia [from the breakdown of urea] hadn't penetrated the grain.

The crimped barley, in contrast, was well preserved all the way through and we used it in total mixed rations for dairy and beef. With this success we were happy to move on to crimped maize which helped balance a shortfall of starch.

We balanced its high energy with some traditional sources of bought-in protein, such as rapemeal and we found this approach to be more cost-effective and give us a better quality true protein than treating with urea.

Last year, we arranged to buy five artic loads of crimped maize direct from Mike Greenwood [see

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Angus Kerr's TMR includes crimped maize from Mike Greenwood.

pages 4 and 5], just organising delivery – through Bulman Bulk Haulage – ourselves. Each time we wanted another load, we'd just give them three or four days' notice and they would organise collection with Mike.

Mike kindly split the delivery cost of £17 per tonne which meant the product was £181 per tonne delivered. There was no cut for any middleman, although Michael Carpenter at Kelvin Cave helped set everything up.

When a 29-tonne load of crimped maize arrives on the farm, we store it in a temporary clamp made of bales inside a silage pit. It's tipped, compacted, sheeted and fed, and we move through the clamp at a rate of about 2.5 tonnes per day. It comes out really fresh every time and we order a load roughly every 10 days.

The crossbred herd [Holstein x Montbeliarde x Scandinavian Red] calves in a block from late July to early November and is yielding just short of 10,000 litres at 4.7% fat and 3.65% protein [2x]. It's on a TMR which includes the crimped maize at a rate of 7kg/cow/day, wholecrop and crimped barley, grass silage, molasses, chopped straw and a premix.

We're very pleased with the butterfat which suits our Arla contract and is a good indication of a healthy rumen. The cows are healthy and cudding well, with no major health issues at all. Although we reckon the cost of crimped maize might be more than ground maize on a dry matter basis, there is no comparison between the two feeds. From a rumen health point of view the crimp is so much better and can be fed in far higher quantities.

Last year, we went on to order more loads of maize than originally arranged but after the seventh – about 200 tonnes – there was no more available. We will definitely buy from Mike again this year and are discussing quantities at an earlier stage to help him plan before buying his seed.

Angus Kerr's crossbred herd yields 10,000 litres at 4.7% fat and 3.65% protein on a TMR including crimped maize.

THE NUTRITIONIST

Stephen Caldwell has been formulating the milking ration for Angus Kerr's 500-head, autumn calving crossbred herd for many years. He was keen to move the herd on to crimp for its rumen health benefits and impact on milk quality.

Stephen says:

We'd been pushing up yields in Angus's herd [see pages 7 and 8] over many years with a focus on milk solids for his Arla contract. So, I was very keen for him to see the benefits of crimp in terms of how it behaved in the ration.

Previously he'd included maize meal which, at 80% dry matter, looked a good value ingredient. However, feeding any quantity of this in the TMR – just like feeding two or three slugs of concentrates – leads to a rapid reduction in rumen pH which impacts rumen health as well as milk solids.

Crimp, in contrast, can be fed at fairly high quantities and I was completely happy to include 7kg/head of crimped maize in the dairy ration. It won't cause the severe drop in pH which dry rolled or ground cereals produce.

Combining the crimped maize with crimped barley also gave us an opportunity to ditch the urea-treated grain – a product I always discourage. Angus had experienced himself some quality issues with urea-treated feed, although my own objections also stem from the waste it creates and its effects on cattle health.

There is plenty of evidence that much of the nitrogen in urea is wasted as ammonia, which is evident from the smell to anyone feeding urea-treated grain. But more important is that high urea can also produce ammonia in the rumen, which impairs efficiency and cattle fertility.

Nutritionist, Stephen Caldwell, says higher quantities of crimped maize can be fed to the dairy herd than grain maize that's dried.

All round, I am far more comfortable feeding crimp, combined with a source of high-quality protein or amino acids. So, in this instance, we balanced the high energy with protected methionine and lysine, using these amino acids for 30 days before and 100 days after calving.

With this combination, the utilisation of the ration's energy has been far better and milk quality has improved. Weight of milk protein has also increased and fertility has improved because the environment within the cow has been more healthy and stable.

A healthy cow is always going to win and an Arla contract will reward the improvement in solids.

New forage means rebalancing minerals for beef

Producers may keep a close watch on energy, protein and fibre in their forage analysis. But what about minerals? Dr Donald Lawson from Kelvin Cave partners, Premier Nutrition, explains why it's particularly important to check the mineral status of any new forage.

Optimising the performance of beef cattle requires the correct mineral and vitamin levels.

Minerals and vitamins are essential for growth, reproduction immunity and health. Minerals are generally split into macro minerals which are required in gram quantities and trace or micro minerals which are required in milligrams. Vitamins are required in quantities known as iu or international units.

To ensure that optimum levels of minerals and vitamins are supplied, supplements can be fed at 50-150g per day depending on the liveweight of the animal.

The level of minerals and vitamins in the supplement are determined by requirements indicated by the latest published research and should be balanced against the supply of the other feeds the animal is consuming.

Home-grown forages will take up a large quantity of those other feeds, and they need to be balanced. Premier Nutrition has partnered with Kelvin Cave to look at the mineral profile of one of the new forages being grown and fed in the UK – wholecrop beans.

Samples from across the UK were sent for mineral analysis by X-ray fluorescence (XRF).

Premier Nutrition's Fradley Park facility is the most modern premix facility in the UK.

Table 1: Macro minerals in wholecrop beans and grass silage

Nutrient DM basis	Wholecrop beans	Grass silage	Difference
Calcium %	0.71	0.63	+12.6%
Phosphorus %	0.31	0.36	-13.8%
Magnesium %	0.19	0.15	+26.7%
Sodium %	0.29	0.26	+11.5%
Potassium %	1.75	2.47	-29.1%
Sulphur %	0.19	0.25	-24.0%
Chloride %	0.51	1.07	-52.3%
DCAD meq/kg	313	278	+12.6%

Table one shows the average mineral analysis of wholecrop beans compared to grass silage.

Wholecrop beans had higher average calcium, magnesium and sodium than grass silage. The higher dietary cation anion difference (DCAD) is calculated from potassium and sodium compared to sulphur and chloride. In this dataset the higher chloride in the grass silage, which has been a noticeable trend this year, pushes the DCAD lower against the higher potassium in grass. Higher DCAD levels encourage higher dry matter intakes.

The lower phosphorus, potassium, sulphur and chloride are not of concern as they are all at levels above the requirements for most diets fed to growing, finishing, pregnant and lactating beef cattle.

The difference in average levels of micro minerals showed more variation, with manganese showing a 67% lower level in the wholecrop beans than in grass silage. For autumn calving suckler cows, this should be kept in mind when shortage of manganese can cause issues with long bone development in the calves. Slightly higher zinc and copper levels are seen

Table 2: Micro (trace) minerals in wholecrop beans and grass silage

Nutrient	Wholecrop beans	Grass silage	Difference
Manganese mg/kg	27.9	84.7	-67.0%
Zinc mg/kg	37.5	28.4	+32.0%
Cobalt mg/kg	0.08	0.18	-55.0%
Selenium mg/kg	0.05	0.06	-16.7%
Copper	9.30	7.65	+21.6%
Molybdenum	1.36	1.86	-26.8%

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in wholecrop beans. The impact of high copper levels on lowering the fertility of maiden heifers shown in recent work at Harper Adams University means that we need to make sure that we take this higher base level into account.

Cobalt levels are lower in the wholecrop beans which can potentially reduce vitamin B12 synthesis which is required for growth. Premier Nutrition is unique in that they add vitamin B12 rather than cobalt and so take out the middle step to ensure the animal has the vitamin B12 levels required.

Molybdenum is lower in wholecrop beans but both molybdenum and grass are at levels that should not pose risk of copper antagonism.

If feeding a new forage source to your herd, it is always worth running a mineral audit to make sure the mineral and vitamin supplementation doesn't require reformulating.

Premier Nutrition is delighted to partner with Kelvin Cave as their chosen mineral and vitamin supplement suppliers. Based in Rugeley, Staffordshire, Premier Nutrition was founded in 1991 by two nutritionists. The business has grown and now manufactures at three sites, with two in Rugeley and the most recent in Fradley Park, Lichfield which is the most modern and efficient premix facility in the UK.

The unique manufacturing process used by Premier Nutrition ensures no cross contamination, and the Rugeley facility where ruminant products are manufactured has ISO 22000 certification for food quality manufacture.

Dr Donald Lawson began his career as a ruminant nutritionist with a national feed company after completing his PhD at the University of Glasgow. He later moved to a family-run feed compounder and on to Premier Nutrition in 2011. He now heads a team of four ruminant nutritionists. Passionate about advancing on-farm performance, he takes a particular interest in the latest research on mineral and vitamin supplementation and its impact on cattle health, fertility and productivity.

Bulk ingredient day bins dispense into the mixer at Premier Nutrition's plant.

The value of quality silage: a key driver of dairy farm profitability

As milk prices continue downwards, farmers are scrutinising costs of production, with many focussed on the cost of feed. Jonathan Hill, principal consultant with Promar International, explains the value of making more milk from high-quality forage.

For dairy farms, good quality silage is key to maximising milk production from forage and helping to reduce purchased feed costs.

Technical efficiency is a major driver of profitability on any farm and is something that sits firmly within our control.

At the present time of a lower milk price it is more important than ever to challenge feed use to optimise margin over purchased feed.

Why silage quality matters

When silage quality falls short, the cost is quickly reflected in reduced milk output or increased concentrate usage.

Even small improvements can have a significant impact. A 0.5 megajoule increase in silage metabolisable energy (ME) can support an additional litre of milk per cow per day. Across a 200-cow herd over a full winter, that improvement alone could represent an additional 30,000-40,000 litres of milk, or £10,000 more income.

Reducing feed costs

Feed remains the largest variable cost on most dairy farms. Producing better quality silage can significantly reduce reliance on bought-in feeds.

Improving the crude protein of your silage by 2% per kilogram of dry matter can allow a reduction of up to 0.75kg of rape meal per cow per day. At current feed prices, this could equate to savings of around £6,000 for a 200-cow herd over winter.

Working with trusted advisors and using forage analysis effectively can help ensure these gains are realised in practice.

The role of silage additives

Silage additives are sometimes viewed purely as an additional cost, but when used correctly they can provide a strong return on investment.

Products designed to optimise fermentation help ensure the crop ferments rapidly and efficiently, reducing the growth of undesirable bacteria and preserving valuable nutrients within the forage.

For many farms, the cost of a silage additive represents only a small proportion of the overall cost of producing the crop. The benefits of improved fermentation, reduced losses and better feed value can be significant when combined with good clamp management and harvesting practices.

A whole-farm perspective

Every farm system is different, but the principle remains the same: the more milk produced from forage, the more resilient the business becomes.

Working with trusted advisors such as Promar can help ensure that every tonne of forage harvested delivers maximum value back to the business.

FIRM FAVOURITES...

... EVEN IN HEAVY GOING

When the race is on to beat spiralling bought-in feed costs and stay ahead of the field in producing your own home-grown forage, it pays to back some sure-fire winners!

Each one of the products listed here has a tried and tested track record. And by following our simple five-stage field-to-feedout '5Ps' procedure you can be confident of success even in the most challenging conditions.

Go online or call us today for more information and some great tips on how you can make the running in home-grown feed processing and preservation.

PROCESS

Grain Crimping Machines and **Dry Grain Roller Mills**
- to suit every size of projected throughput for cereal grains and pulses, either dry (up to 25% moisture) or crimping and ensiling (from 25 to 45% moisture). We offer an extensive range of Finnish-manufactured Murska machines that meet our exacting standards of engineering excellence and reliability.

PRESERVE

Safesil Pro and **Safesil Challenge**
For all forages, dependent on dry matter. Will ensure fast, efficient fermentation with maximum nutrient retention, dry matter retention and aerobic stability at feedout.

MultiMax
For multicut systems where there is a higher risk of residual nitrogen and contaminants from slurry or multi-species swards with higher protein, MultiMax is specifically designed to destroy undesirable bacteria and facilitate a reliable lactic fermentation for maximum nutrient retention.

BaleSafe
Treating with BaleSafe allows hay and straw to be safely baled up to 25% moisture without wrapping. Also reduces DM loss and improves stability in wrapped haylage at 50-75% DM.

CrimpSafe 300 and **CrimpSafe Hi-Dry**
CrimpSafe 300 ensures a controlled fermentation and maximum nutrient retention for ensiled crimped grain above 25% moisture content. For effective preservation and ensiling of grain below 25% use CrimpSafe Hi-Dry.

Propcorn NC
A proven, non-corrosive successor to Propcorn. Safer to use, and with 70% less fumes than straight propionic acid, it is suitable for preserving whole or rolled grain and pulses with a moisture content of up to 25%, in aerobic conditions.

ProFlake NC
Designed to improve the physical quality of dry-rolled grain, and increase the storage life of processed cereals by up to 3 months. It inhibits yeasts and mould growth, and mycotoxin formation and ensures significant reduction in dust levels, helping to improve animal health and performance.

PREPARE

KlampClips
Like an extra pair of hands during clamp filling. Manufactured from sprung stainless steel and made-to-measure for different clamp wall thicknesses. Available in packs of 25.

Side Sheets
Essential to ensure a complete airtight seal. Heavy duty, 150µm, clear plastic in 50-metre rolls and in widths of 4, 5, 6 and 8 metres.

SiloBond
A multi-purpose agricultural adhesive formulated to bond silage sheets together or attach them to clamp walls. Makes hanging side sheets safer and easier; reduces the risk of damage when filling; reduces overlap and saves on plastic.

PACK

SilaPactor
Available in a range of widths from 2.1 metres to 4 metres, weighing from 2.5 to 6.0 tonnes. A SilaPactor can increase compaction density by up to 40%, is proven to cut DM losses and it saves time and fuel.

PROTECT

Farmguard
High-strength, recyclable silage sheeting. Uses advanced seven-layer technology for improved durability and tensile strength, tear resistance, a high degree of UV protection and easy, lightweight handling. Farmguard's barrier to oxygen is up to 100 times that of standard silage sheeting.

O_2 Barrier 2in1
The single sheet which transforms into two. Polyamide vacuum film layer up to 10 times less oxygen-permeable than conventional silage film that reduces time and labour required to seal the clamp.

BaleShield 160
Durable protection for hay, straw and wrapped forage bales. Tear-resistant waterproof fleece can be used time and again. Ideal for protecting forage in the open, close to where it's needed. Sheets can be joined with hook and loop tape and held in place with clamps and screws supplied.

ClampShield 500
The ultimate protection for ensiled forage crops but with up to 75% less single-use plastic. This breathable polypropylene fleece can be reused over many years. Waterproof, easy to lay, and affording protection against birds. Sheets can be joined with hook and loop tape.

Through our company's involvement in the Nitrogen Climate Smart (NCS) Project, Kelvin Cave works with many industry partners in the drive to increase the national acreage of home-grown proteins. One partner, The James Hutton Institute, is assessing the value of legumes across intercropping systems. Here, two scientists working on the project, Pete Iannetta and Sam Holden, report on their early findings including how they have increased yield, lifted protein and mitigated risk.

Intercropping for protein yield resilience: peas, beans and cereals in a changing climate

Intercropping - the practice of growing two or more crops together in the same field at the same time to optimise and assure yields with less inputs - is gaining attention. This interest extends beyond traditional pulse-cereal combinations, to pulse-pulse mixtures as a practical way to manage risk, reduce fertiliser inputs and improve home-grown protein production. Recent work on pea-bean combinations, alongside pulse-cereal mixtures, is beginning to show where the real opportunities lie, and where more work is still needed.

Three pea-bean intercrop trials have recently been completed and are under assessment, focusing on nitrogen-fertiliser use offset and following crop effects due to difference in crop-stand density and varietal choice. Alongside this, wider work on pulse-cereal mixtures has explored how winter- and spring-sown legumes grown with cereals can deliver protein yield either as grain, or as wholecrop forage. Together, these studies are helping build a clearer picture of what intercrops can offer on farm.

Pea-field bean intercrops

The early message for pea-bean intercrops is encouraging and realistic. Intercropping peas and beans can increase yield, although the benefits are conditional and not guaranteed. In other words, it works well in some combinations and situations, but not all. Stand density plays a major role, and trials show that beans should dominate the intercrop for highest protein yields, since higher bean density raises overall yield while higher pea density can compromise yields due to competition effects, shattering, and lodging. It is therefore not surprising that peas in this intercrop appear to perform best at lower stand densities when grown with beans.

This has clear practical implications. Simply mixing two full-rate crops together is unlikely to give the best result. Instead, careful adjustment of relative seed rates is essential; and variety choice also matters. Some combinations consistently performed better than others. In particular, the pea variety Mantara, especially when combined with the bean variety Ketu,

showed strong and consistent intercrop performance. This suggests that compatibility between varieties is critical in terms of growth habit, maturity and competitive balance. It is not just about species choice, but about which cultivars are paired.

However, the yield advantage of intercrops needs to be considered carefully. Land Equivalent Ratio (LER) values above 1 indicate a land use benefit (ie: more yield per unit area compared to a monocrop), but when pea pre-harvest losses (due to pod shatter) were included, the apparent intercrop advantage was reduced. This is important for farmers, since if some pea varieties are more prone to pod shatter or harvest losses in a mixed canopy, some of the theoretical gain may be lost at the combine. Management and machinery settings will therefore be just as important as biology.

Beyond yield alone, soil nitrogen outcomes are also a major focus. In the pea-bean work, and soon after harvest, monocropped beans appeared broadly nitrogen neutral, while peas and intercrops were nitrogen positive. There is also evidence of distinct species-led residue mineralisation patterns, with pea residues releasing nitrogen earlier, suggesting altered post-harvest nitrogen returns. In practical terms, this could influence nitrogen availability to the following crop and affect fertiliser planning.

Pulse-cereal intercropping

This links directly to the wider pulse-cereal work. In winter-sown systems, faba bean grown alone or with wheat produced some of the highest wholecrop forage yields, in the range of 12 to 15t/ha, though from plot scale trials (which generally tend to over-estimate potential commercial scale yields). These were around 30% higher than the best spring wholecrop yields. When harvested as wholecrop, winter bean-wheat mixtures delivered very high protein yields, and importantly, they did so without the need for 50kg N/ha of synthetic nitrogen fertiliser. In spring-sown systems, a different picture emerged. The highest grain yields, around 8-10t/ha, came from pea-wheat mixtures. Again, these yields were achieved without clear benefit from additional synthetic nitrogen.

In contrast, spring faba bean struggled in the shortened and drought-affected season (2023). This underlines a key point that producers know only too well: performance depends strongly on season and

The table below provides an example of crop species/variety combinations crop-mixtures which gave best protein yields – even with no nitrogen fertiliser added. It should be noted that these per hectare estimates are extrapolated from plot (10 m^2) scale trials.

Crop species mixture *(cultivars)*	**Total yield (t/ha)** **(Protein t/ha, %)**	**Necessity of nitrogen fertiliser use**		
		Pea	**Faba**	**Wheat**
Winter-faba bean and -wheat *(Tundra, or Pantani and Skyscraper)*	**Wholecrop, 12-15** **(1.2-1.9,13%)**	No	Yes	Yes
Spring-pea and -wheat *(Orchestra and WPB Escape)* *(faba = cv. Yukon)*	**Grain, 8-10** **(1.7-1.9,19%)**	Yes	(Yes)	Yes
For comparison: monocrop grain protein yields - UK yield averages *(@15% moisture):* - ***field bean:*** *winter/spring, 3.6/3.5 t/ha - @28% protein = 0.85 t/ha (dry weight)* - ***pea****: spring, 3.2 t/ha - @22.5% protein = 0.61 t/ha (dry weight)* - ***wheat****: winter/spring, 9.0/5.7 t/ha - @12.5% protein = 0.96 t/ha (dry weight)*				

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sowing window. Weather conditions during the trials were challenging, with prolonged winter wetness and frost followed by spring drought. These stresses affected both winter and spring crops. Yet they also provided insight into resilience. Winter-sown bean-based mixtures offered strong wholecrop biomass even when grain options were more limited. Spring pea-wheat mixtures showed grain yield resilience despite limited fertiliser inputs.

This suggest that harvest flexibility may become especially important. The option to harvest either as grain or as wholecrop forage may prove highly valuable in the face of increasingly unpredictable weather. If grain fill is compromised by drought, heat or late-season rain, a wholecrop option may still deliver high protein yield and useful forage value. Wholecrop harvest can also allow earlier field clearance, opening opportunities for timely drilling of the following crop.

As climate change increases weather variability, having this flexibility may be as important as maximising yield in a good year. A system that can switch between grain and wholecrop depending on the season offers a way to manage risk. It also spreads marketing options, from feed grain to forage: or even protein extraction in the future.

This continuity is important, and whether to intercrop is not a one-season question. It requires testing over multiple years and sites to understand interactions between species, varieties, soils and weather. So, despite promising early findings, there is much still to do. One key area is understanding which traits underpin successful intercrop combinations. For example, what canopy structures allow light sharing rather than restriction? Which rooting patterns allow better soil resource use? How do differences in flowering time and maturity affect competition and harvestability? Without clear answers, it is difficult to guide breeding programmes.

Breeding for intercropping requires a systemic shift in focus for breeding, agronomy and downstream value chains. Varieties bred purely for monocrop performance may not be optimal partners. Traits such as reduced height dominance, complementary life-histories, lodging resistance in mixed stands, and predictable maturity could all be important. The strong performance of certain combinations, such as Mantara with Ketu, hints that these traits are important for

Legume mixes could be harvested as 'grain' or wholecropped. Here, the grain has been crimped and ensiled.

successful combinations, but they need to be identified and selected deliberately.

There is also a need to develop value chains for wholecrop use. While grain markets are well established, wholecrop legume-cereal mixtures require clear routes into livestock rations, dairy systems or potentially biorefining. If wholecrop options are to act as a resilience tool under unpredictable weather conditions, farmers must have on-farm uses or be confident of a viable market.

Finally, robust data on nitrogen budgets and following crop responses are essential. Faster residue turnover and nitrogen-positive outcomes in some intercrops suggest there may be scope to reduce fertiliser inputs to subsequent cereals, but this needs careful measurement to avoid unintended losses.

In summary, early results show that pea-bean and pulse-cereal intercrops can increase protein yield, reduce reliance on synthetic nitrogen and offer yield-resilience in the face of challenging weather conditions. The benefits are real, but conditional. Stand density, variety choice and harvest strategy are all important. The flexibility to harvest as grain or wholecrop may become increasingly valuable as weather patterns become less predictable. However, to move from promising trials to widespread adoption, further work is needed on traits, breeding, nutrient dynamics and market development. Intercropping offers a practical pathway towards more resilient and

home-grown protein systems, and it remains, as most agriculture is, a work in progress, with 'every day a school day'.

Life cycle assessment for cropped systems

Life cycle assessment (LCA) is a way of measuring the environmental footprint of farming systems, from fertiliser use through to greenhouse gas emissions. While widely used in other industries, it is now being applied to arable farming. Using data from a 14-year field experiment (2009–2023) at the Centre for Sustainable Cropping, researchers assessed the value of growing spring field beans ahead of spring barley. The results showed that barley following beans required around 20% less synthetic nitrogen fertiliser (about 30kg/ha, consistent with RB209 guidance), though further reductions are possible and average yields increase. In addition, environmental impacts were reduced by around 25%, and barley yields increased by an average of 1.2t/ha, except in drought years. This highlights both cost-saving and environmental benefits of including beans as part of a rotation.

Building on this field-scale evidence, a new modelling tool called CropGOBLIN is being developed to look at the bigger picture across regions and nationally. The aim is to understand what would happen if pulse crops such as field beans and peas increased from (in England) today's roughly 4% of arable land to 15-20%. Early results suggest this shift could significantly cut agricultural greenhouse gas emission, potentially by up to 50%, while also reducing reliance on imported soya for livestock feed. The model works by first mapping realistic current crop sequences from national cropping data and then testing alternative rotations that increase pulse crops while keeping major cash crops like wheat largely in place. Early simulations suggest the pulse area could increase to around 18% nationally, with only modest reductions in the wheat and barley area. A full environmental assessment of these scenarios is underway, with results expected later this year.

Addendum – on intercropping versus monocropping

All this said, it should be highlighted that intercropping is not automatically better than growing pulses on their own. In some situations, monocropping, especially with field beans, may still be the stronger option. Field beans commonly produce higher protein yields than peas as they have a higher protein percentage and can deliver more tonnes of protein per hectare. If your main aim is to maximise grain protein yield, and you have reliable harvest conditions and a clear market, a well-managed bean monocrop for grain can be hard to beat. Additionally, monocropping also keeps things simpler. Seed rates, weed control, crop protection and harvest are more straightforward. There's no need to balance two crops in the same field or worry about competition between them. For many farms with established bean agronomy, this reliability and ease of management are important advantages. That said,

CropGOBLIN is being used to assess the impact of increasing UK-grown legumes.

intercropping can offer benefits in tougher or more variable seasons. Mixing crops can spread risk, improve resilience and sometimes reduce the need for fertiliser. It may also give the option to harvest as wholecrop if grain fill is poor and grain harvesting perhaps not possible. So, it is not a case of one system replacing the other. The best choice depends on your soils, weather, market options and appetite for risk, or need for risk avoidance.

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Find out more about The James Hutton Institute at *www.hutton.ac.uk*

For links to further reading scan the QR code.

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Wet threat to silage controlled by preservative

Good farming practice and the right choice of additive have turned potentially difficult silage cuts into good quality forage for a high yielding herd.

Like many farmers and growers, the Riding family have chopped and changed silage additives over many years. So, last year, when they were faced with a late, wet cut of grass silage, they were undecided about which product to use. They were concerned about adequately wilting the crop in potentially wet, cool conditions, and they were concerned it could be contaminated with soil. This posed the risk of clostridia entering the forage and continuing to thrive and spoil the silage in the clamp.

Farming together at Goosnargh Lodge near Preston, the three generations – grandfather, Fred, his son, Mark and grandson, Jake – were all well aware of the damage this could cause. With a herd of 180 Holsteins giving 10,522 litres at 4.47% fat and 3.44% protein, they were not prepared to risk the butyric fermentation which could arise in these conditions. This could potentially restrict intakes and hit performance and metabolic health.

So, when the family read about MultiMax, the preservative launched by Kelvin Cave last year specifically for low dry matter (DM) silage, they were keen to find out more (***KnowHow***, Spring 2025).

Clamp management is excellent on the Ridings' farm.

Michael Carpenter, Kelvin Cave's technical director explains: "We brought MultiMax to the market last year specifically to help producers make silage in multi-cut systems.

"Tight weather windows are often a feature of these systems where both soil contamination and slurry residues can be a concern," he says. "There may also be less time for wilting, so low dry matter is a risk when silage is being cut against the clock."

These same dangers prevail in autumn cut grass, which is why the Riding family decided to give MultiMax a try when making their final cut of the year. At that time, low sugars are also a seasonal hazard, risking insufficient substrate for a bacterial inoculant (the alternative to a preservative) to achieve a desirable fermentation.

So, the Ridings tried MultiMax for the first time last autumn, cutting and clamping their ryegrass sward in late September.

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Their silage analysis tells the story of how this preservative fared, most notably, conserving protein at a useful 15.9%. Metabolisable energy (ME) of 10.5MJ/kg DM and a D value of 65.7% were a fair reflection of a fourth cut, autumn sward, while ash at over 10% suggested a little soil may have come in on the crop.

Sugar at just 2.2% gave a clear indication of the challenge being faced, with very little substrate for desirable bacteria to convert into lactic acid.

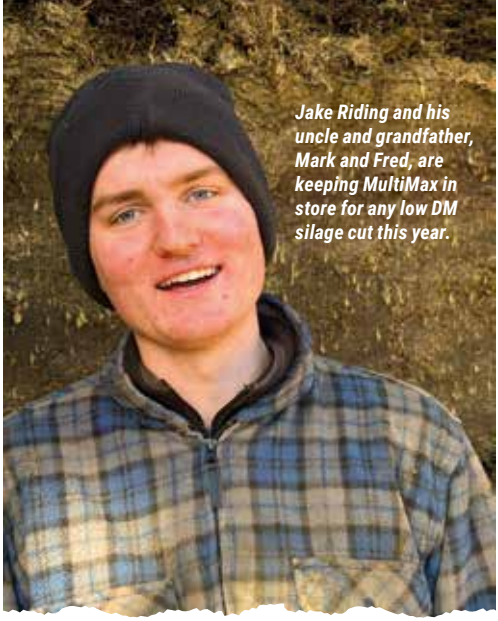
Michael explains: "These low sugars above all demonstrate why we would never recommend a silage inoculant in such challenging conditions. The bacteria in any inoculant would be unable to convert so little sugar to the lactic acid required for a reduced pH and to quickly preserve the crop.

"There would be a risk that clostridia would prevail in these conditions, converting sugars into undesirable butyric acid which would create unfavourable and unpalatable compounds in the silage and lead to dry matter and energy loss and compromise animal health.

"Instead, we would always recommend a preservative, and MultiMax is one which would particularly suit this situation.

"It contains sodium nitrite, the most potent inhibitor of undesirable clostridia we can include, which is why this ingredient is commonly used in human food preservation," he adds.

"In silage, it rapidly and selectively kills undesirable clostridia and their spores, and together with other ingredients, reduces pH and ensures the forage is well conserved," he says.



Jake Riding and his uncle and grandfather, Mark and Fred, are keeping MultiMax in store for any low DM silage cut this year.

"In fact, this is the only silage additive we know of which has actually been tested with heavy levels of soil and clostridial contamination, which is why I have such confidence in recommending it when these things may be a risk."

Using it for the first time last autumn, the Ridings say they've been pleased with the outcome and have ordered enough for more cuts this year.

Goosnargh Lodge Farm Facts

- 250 acres (101ha) owned and rented near Preston, Lancs
- 180 Holsteins run by three generations of Riding family
- 10,522kg, 4.47% fat, 3.44% ptn produced through three De Laval robots
- TMR for milking herd for M+25 litres, topped up in robots
- TMR = grass silage, sugar beet pulp, straw, energy and protein blends
- Silage made through multi-cut systems using MultiMax when DM low
- Finish all heifer beef and sell bull beef as calves

Mark says: “Last year, fourth cut was certainly wetter than I’d have liked and we had to make it in three attempts as the weather was so catchy.”

Not expecting a vintage crop, he says he is pleased, not only with the silage analysis, but also in how well it has preserved and fed to his cows.

“Unfortunately, we did have some slippage, which is a risk when the crop is wet, but the silage stayed completely cold when it slipped into a pile from the clamp, even though it was exposed to air and not used up for several days,” he says.

The silage analysis also bears out the favourable fermentation, with ammonium nitrogen (as a proportion of total nitrogen) exceptionally low at 2.7%.

“This reflects an excellent fermentation, very little breakdown of protein and suggests a rapid drop in pH which prevents unwanted bacterial activity,” says Michael.

This was demonstrated in a pH of 4.1 which is considered optimal for this type of silage.

Silage analysis showing key components and challenges in autumn cut grass, Goosnargh, 2025

ME	10.5MJ/kg DM
D-value	65.7%
Sugar	2.2%
Protein	15.9%
NH3-N (% total N)	2.7%
pH	4.1
Ash	10.6%

Well-run farm

The analysis achieved in the Ridings’ fourth cut silage would be considered acceptable even in earlier cuts, and several components – including pH and protein – would be exceptional at any time.

“This isn’t just a reflection of the choice of additive, but demonstrates good silage-making practice from start to finish and tidy clamp management on an exceptionally well-run farm,” says Michael.

Low DM silage was a challenge last year.

Although the Ridings have already purchased MultiMax for 2026, not just to use on late season cuts but on any cut threatened with low dry matter, they have added other products to try in higher DM situations.

“We now have several products on the farm to give us the flexibility we need in Lancashire’s unpredictable weather,” says Mark. “We will try the Activator range of inoculants as conditions dictate, particularly using Activator+CA on higher DM cuts where aerobic spoilage is a risk on clamp shoulders and tops, but will use MultiMax in cuts where fermentation would be challenged by low dry matter.

“We completely understand the importance of having the right product for the conditions, having experienced DM losses when the wrong choices have been made in the past,” he says.

Grass silage is the main forage in the herd's TMR which is formulated for maintenance plus 25 litres.

Feeding wholecrop beans in a TMR for calves

An on-farm trial investigates the impact of a beans-based ration on growth rates, performance and profits in calves.

In a previous edition of *KnowHow* (Autumn 2024), we featured Yorkshire beef and arable producer, Richard Barker, and described how he had transformed his farm by ditching soya and palm kernel and using home-grown ingredients in their place. In particular, he'd started growing beans and using them wholecropped for beef.

In this edition, we report on some on-farm trials he subsequently carried out at his North Lingy Moor Farm near Richmond. In these trials – undertaken as part of the Nitrogen Climate Smart (NCS) Project – he used wholecrop beans as part of a total mixed ration and fed it to calves from about four months of age. This was an age group which hadn't previously been fed wholecrop beans. Their performance was compared with a group fed a ration based on herbal ley silage.

Lizz Clarke
LC Beef Nutrition

Richard Barker
Beef and arable producer

Balancing the ration

Both groups were fed one of two total mixed rations, with the two rations balanced for protein and energy. They were each formulated by independent beef nutritionist, Lizz Clarke (LC Beef Nutrition), who is a partner in the NCS Project and oversaw these trials. They were formulated to have a metabolisable energy (ME) as close to 11MJ/kg DM and protein as close to 15.5% as practicable, with the ingredients available on the farm. This resulted in the ration in Table 1.

As Lizz explains: "The energy and protein are the important components to balance in cattle rations when comparing one with another. Inevitably, one ration was higher in starch, partly thanks to the high starch content of the wholecrop beans [see Table 2 for analysis of wholecrop beans and herbal ley silage], and partly because extra cereals were needed to make up the energy of the wholecrop-based ration."

Table 1: Two total mixed rations for the two groups of calves

Kg freshweight fed per head per day	TMR based on wholecrop beans	TMR based on herbal ley
Wholecrop beans	4.25	
Herbal ley		11.5
Crimped barley	2	
Crimped wheat	2	2
Protein blend	0.3	1.1
Diet specification		
Starting Dry Matter Intake (kg/day)	5.2	5.2
ME (MJ/kg/day)	11.1	11.1
Protein %	15.4	15.5
Starch %	37.5	14.8
Sugar %	6	6

The diet was pre-mixed through a mixer wagon and fed to appetite. 140 Angus cross calves were randomly split into two groups of 70 and the average age at the start was 118 days (156.2kg) for the herbal ley-fed group and 120 days (149.2kg) for the bean-fed group. The calves were on the trial for 83 days, weighed before the trial and had three further weights taken during the trial. Any animal with health issues was removed from its group, housed separately and treated if necessary, in accordance with good husbandry and to avoid bullying. However, their data remained part of the trial.

Table 2: Analysis of wholecrop beans and herbal ley silage used in the TMR

	Wholecrop beans	Herbal ley silage
Dry matter %	**59.4**	**27.4**
ME (MJ/kg DM)	**9.4**	**10.0**
Crude protein %	**17.3**	**9.5**
Starch %	**18.7**	**1.8**
Sugar %	**0.90**	**6.71**

Results

Despite commercial challenges along the way – most notably a part-way change in composition of the herbal ley silage – results showed a clear pattern of performance, with calves in the bean-fed group having a daily liveweight gain (LWG) of 1.2kg, compared with 0.92kg for the herbal ley-fed group. This resulted in a weight gain during the trail of 67% and 49% respectively, with final weights coming in some 22.8kg more in the bean-fed group than those fed the herbal TMR.

Treatment group	Age at start (days)	Pre-trial weight (kg)	End weight (kg)	Weight gained (kg)	DLWG (kg)	% gain from start weight
Herbal ley TMR	118	156.2	233.1	76.6	0.92	49%
Wholecrop bean TMR	120	149.2	248.6	99.4	1.20	67%

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However, Lizz observes: "There are several factors to explain this difference besides the beans themselves, including the higher quantity of crimped grain in the beans-based diet and the lower dry matter of the herbal ley ration."

This lower DM meant the calves had to consume a freshweight of 14.6kg/day to achieve adequate dry matter intake of the herbal ley diet compared with 8.55kg/day for the beans-based group.

Emphasising the importance of continued research, she says: "Further trials are required to assess wholecrop beans, as with all forages, it very much relies on the season and clamp management for the nutrient quality of the forage."

Costs

With performance clearly improved in this trial on the beans-based diet, it was important to assess its cost implications. Using ingredient costs calculated on farm by Richard Barker (see Table 3), the cost per tonne freshweight of the TMR was calculated. This showed the beans-based diet to be more expensive at £125 per tonne, compared with £82 per tonne for the herbal ley (freshweights). However, combining this information with estimated average intake figures for a 150kg calf and the actual liveweight gains achieved in the trial, showed the cost per kilogram of LWG was more favourable for the beans-based group at 62p, compared with 89p (see Table 4).

Carbon footprint

The improved growth rates also impacted carbon footprint which, although calculated to be very similar in total for each group, was better (lower) per kilo of liveweight gain for the beans-based group thanks to the calves' improved growth rates. Carbon footprint was calculated as 3.89 CO2e/kg LWG for the bean TMR group and 5.10 CO2e/kg LWG for the herbal ley group.

Table 3: Ingredient costs for the total mixed rations

Feed ingredients	Cost per tonne of freshweight
Herbal ley	£35
Wholecrop beans	£48
Crimped wheat	£200
Crimped barley	£180
Protein concentrate	£360

Richard Barker grew beans as part of an NCS trial and will be keeping them as a permanent part of his crop rotation.

Table 4: Total mixed ration cost

Ration	Diet cost/t FW	FW intake/h/d (kg)	DLWG (kg)	Cost/kg LWG
Herbal ley-based TMR	£82.09	10.08	0.92	89.13p
Wholecrop beans-based TMR	£125.38	5.94	1.20	62.05p

Observations
Overall, it was observed that the group fed beans looked fuller and showed improvements in skin health and dung. Manure samples suggested more efficient nitrogen use with slightly lower ammonium nitrogen levels, in turn suggesting better protein digestion.

Pleased with their performance, Richard says: "Beans will continue to be part of the diet for all our beef animals now. We like growing them, and alongside the herbal leys they have given us options to improve the performance and sustainability of the farm."

He also notes they don't need nitrogen fertiliser and little in the way of agrochemicals compared with other crops, and that their nitrogen fixing properties are a bonus for the following cereal crop.

They also provide the opportunity for the control of grass weeds which are hard to tackle in cereals.

He says: "We've been working with Kelvin Cave for many years and their suggestion to try wholecrop beans was the best advice we've had. It has allowed us to expand our crop rotation while cutting our growing costs; to drop oilseed rape as a break crop and try to reduce blackgrass and herbicide-resistant ryegrass issues. And it's drastically improved the health of the soil."

The beans are generally drilled in March, depending on season, and despite their lower yields than a winter-sown crop, spring beans are cheaper to grow and, if conditions allow, a cover-crop can be over-wintered before them.

"We might also grow beans with a companion crop," he adds. "We've tried peas but found oats work particularly well. You encourage more biodiversity with a second crop and there may be an element of disease prevention.

"It's very low cost as we just mix the beans and oats on the floor and drill them together from one hopper," he says. "We may try peas again as they spread and cover the ground, which helps with weed suppression early in the season, and then they climb up the scaffold provided by the beans, which keeps them standing later on."

The trial involved feeding bean silage to calves - the youngest group fed this forage on Richard Barker's farm.

The NCS Project
The NCS Project brings together research organisations and commercial companies who are working together to increase awareness of the use of pulse crops and cut the UK's tonnage of imported soya. Kelvin Cave Ltd is one of 16 partners in the Innovate UK funded project and is involved in investigating preservatives for both wholecrop and crimped pulses. Several articles featuring farmers taking part have been published in previous issues of KnowHow including a farm feature on Richard Barker as well as features on Luke Gardner and Luke Medd. All can be found by searching the Kelvin Cave website.










When conditions are tough

chemical preservatives get going

Last autumn, Kelvin Cave brought MultiMax to the market, at a time when silages were being made in challenging conditions. This additive – based on sodium nitrite and sodium formate – prevents clostridial fermentations in low dry matter, potentially soil-contaminated, grass silage. In this issue of KnowHow, Dr Horst Auerbach (pictured right) from Germany's International Silage Consultancy (ISC), explains the MultiMax mode of action and how it should be safely used.

Mode of action and fate in the silage

Sodium nitrite-based silage additives have been widely used in Europe for decades. But their use has attracted particular attention recently as empirical evidence from farms has shown that silage inoculants (additives based on lactic acid bacteria), regardless of their composition, cannot safeguard a proper fermentation process under challenging conditions.

During the early stages of the fermentation process, sodium nitrite ($NaNO_2$), which is used as a food preservative in cured ham and bacon and salami, actively and selectively kills clostridia (and their spores coming from the soil). Thereafter, the substance is degraded into the gases nitrous/nitric oxide, and ammonia. Some of the gaseous compounds will leave the silo as yellowish-brown gas. This is a process which naturally occurs whenever the forage contains nitrate (NO_3^-) at the time of ensiling. During fermentation, nitrate is converted into nitrite, which follows the fate of added nitrite. So, one could even consider nitrite a natural chemical silage additive.

As nitrite is and must be degraded during fermentation, a second substance must be used that is not degraded and remains in the silage to make sure any clostridia that may have escaped the attack by nitrite can not germinate and grow. The patented formulation of MultiMax therefore includes the very well-known compound sodium formate (a salt of formic acid).

There is a large body of evidence in scientific literature which shows that nitrite degradation is rapid and complete (Table 1). However, it is recommended to leave the silo closed for at least four, better six weeks. This period includes a safety margin to account for all possible variation.

Table 1: Fate of nitrite (NO_2^-) during the fermentation process

Fermentation length (days after ensiling)	Nitrite (NO_2^-) (g/t fresh matter)	
	Early-cut rye (27% DM)	Grass (40% DM)
At ensiling*	600	600
3	235.5	7.5
14	1.2	0.7
28	0.8	0.6
42	0.7	0.3
90	1.0	1.1

*Equivalent of 900g sodium nitrite/kg fresh matter applied, equivalent to an application rate of 2.8l/t MultiMax

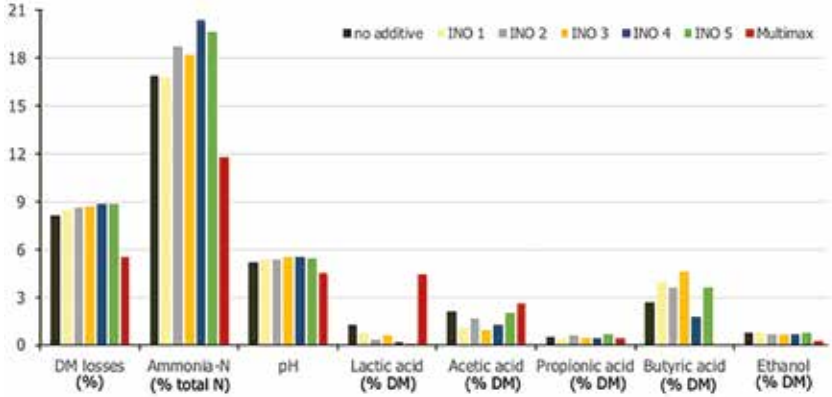
Trials in Germany demonstrated:

- ***MultiMax*** is safe and non-corrosive
- ***MultiMax*** sustainably suppresses clostridia development in low DM/ high ash forages
- ***MultiMax*** outperforms inoculants under challenging conditions regardless of their composition and inoculation rate

Comparison between MultiMax and several commercial inoculants

There is a large body of data which demonstrates the efficacy of MultiMax in comparison with no additive used. However, as inoculants have become important silage additives across the world, not least because of lower costs and lower application volume to use, it is important to know how each additive type performs under challenging conditions. For that reason, a trial using grass (26% DM, 16% crude protein, 14% crude ash) was carried out at the University of Applied Sciences in Bernburg, Germany. The results in Figure 1 clearly show that MultiMax outperformed any of the different inoculant formulations. It was the only additive that could sustainably suppress clostridia development. None of the tested inoculants – regardless of the number of strains, the type of strain, the inoculation rate – ensured a normal, lactic acid-dominated fermentation process. In fact, concentrations of this acid were even lower in all the inoculant-treated silages than in the untreated control. With the exception of MultiMax-treated silages, all silages had high pH and ammonia concentrations and contained butyric acid at very high concentrations, whereas MultiMax could prevent clostridial activity completely. As a result, due to an efficient fermentation process, DM losses during fermentation were reduced by 32% when compared with untreated silage.

Figure 1: Effects of different additive types on the fermentation of low DM/high ash grass silage stored for 123 days



Ino 1: homofermentative inoculant, 300,000 cfu/g forage; Ino 2: hetero-/homofermentative, 350,000 cfu/g forage; Ino 3: homo-/heterofermentative, 200,000 cfu/g forage; Ino 4: homo-/heterofermentative, 200,000 cfu/g; Ino 5: homo-/heterofermentative, 300,000 cfu/g forage; MultiMax, 2 l/t; butyric acid=sum of n- and i-butyric acids + n- and i-valeric acids + n-caproic acid. *Source: University of Applied Sciences, Bernburg, Germany*

High moisture hay stacks up as fuel and wrap costs rise

Single-use plastic has been central to forage-making for many years. But environmental concerns and rapidly increasing prices are turning attention to alternatives. Using new preservatives, baled forage can now be made with fewer passes, less fuel and sometimes without wrapping.

As the drive to reduce single-use plastic continues apace, farmers are increasingly seeking alternatives to wrapping their baled forage.

Growing numbers are turning to high moisture hay, which can be now treated with the modern preservative, BaleSafe, at the time of baling. This treatment ensures hay at moisture contents of up to 25% can be stored without wrapping, and will retain its quality during storage. Treated bales can then be stored undercover, either in sheds or with suitable stack covers (see opposite).

The preservatives in BaleSafe include propionic acid and ammonium propionate which stop the activity of undesirable microorganisms including yeasts and moulds.

Using the product achieves cost savings through the wrap not used, but also saves the escalating cost of fuel for the wrapping process. Added to this is the cost of wrap disposal.

As well as being a popular option in place of baled silage, high moisture hay has further attractions over traditional dry hay.

Michael Carpenter, technical director for Kelvin Cave Ltd explains: "Farmers have increasingly moved away from traditional hay due to the length of time taken and the weather dependency of the process.

"Many producers have taken up the BaleSafe option, which means they can bale much sooner after cutting, which is particularly important in catchy weather.

"They're also likely to find they will save one pass with the hay bob, and the resulting high moisture hay is less dusty and has a higher nutritional quality than the dried

Preserving grass at different moisture contents:

Forage type	Moisture content (or DM)	Wrap needed	Preservative recommended
Hay and straw	15% moisture and below	No	Not essential but BaleSafe will reduce dust and assist preservation if grass is diseased
High moisture hay	15-25% moisture	No	BaleSafe essential for unwrapped bales
Haylage (medium DM)	25-50% moisture (or 50-75% DM)	Yes	BaleSafe will improve fermentation and reduce DM loss
Baled silage (lower DM)	More than 50% moisture (under 50% DM)	Yes	Use Safesil to kill yeasts, moulds and undesirable bacteria from soil contamination

product," he says. "That's because there's less leaf shatter, which means a greater percentage of the more nutritious leaf is retained. This lifts feed value and palatability, while reducing dry matter losses."

Furthermore, he says that those who don't have dry storage for unwrapped hay, can cover their stacks with a long-life reusable product.

BaleShield 160

"We introduced BaleShield 160 to cover baled forage outside, where undercover storage is in short supply," he says. "The cover is made from reusable, water-repellent, polypropylene fleece, with ultraviolet stability and outstanding tear resistance, offering protection for up to four years."

This allows forage or bedding to be safely stored in the open, close to where it's needed, and minimises the risk of losses or spoilage.

Used on stacked bales, ideally in a pyramid formation and on pallets to provide all-round air circulation, BaleShield 160 can be secured using one of a range of accessories, designed for easy access at feedout. These include hook and loop tape to join two or more covers together and plastic screws for securing the fleece to the ends of the stack.

Kelvin Cave Ltd supply a range of preservatives to keep forage stable, whatever its dry matter or the conditions in which it is made (see table). As well as supplying preservatives, the company also offers a simple-to-use moisture meter and a range of applicators to fit conventional, round and big square balers, which ensure easy and effective application. Please contact your area manager for advice and to discuss the best product to suit your particular needs.

BaleShield 160 is saving single-use plastic on Luke Gardner's Lancashire farm.

Purple reigns

Same great quality, just a different colour!

You may not know it, but Murska and Korte mills are actually made by the same company. In fact, the Korte name and the green colour were only ever used in the UK, initially to differentiate between the smaller belt-driven machines aimed at farmers and the larger, heavy duty, gear-driven machines which were more often bought by contractors.

However, with farm size increasing and the Murska 350 now being the only belt-driven machine, more farmers have been opting for Korte mills. So, we took the logical decision to follow the rest of the world and phase out the green Korte machines.

With the Murska machines' output ranging from 6-80t/hr alongside a complementary range of equipment from Rivakka, we can offer an unrivalled range of crimpers, rollers, structure mills and hammer mills to satisfy all your grain processing needs and provide ongoing backup and support from our workshops. But we just can't sell you a green one any more!

MURSKA

Come and see us at these 2026 events ...

Warrendale Wagyu Conference 13-14 May *Border Events Centre, Kelso*

Cereals 10-11 June *Diddly Squat Farm, Chadlington, Chipping Norton*

Royal Highland Show 18-21 June *Ingliston, Edinburgh*

Groundswell Festival 1-2 July *Lannock Farm, Hertfordshire*

Royal Welsh Show 20-23 July *Llanelwedd, Builth Wells, Powys*

KELVIN CAVE

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