NCS
NITROGEN CLIMATE SMART

# Peas and beans as a livestock feed

Farmers working with scientists to achieve the best from pulse crops and reduce their carbon emissions.

PRODUCED AS PART OF THE NCS PROJECT

# The NCS Project

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## Contents

# Introduction

**Though peas and beans have long been a trusted part of cropping rotations, it is perhaps only recently that the scope and value of their potential is being realised.**

When grown well, both peas and beans offer an economic alternative plant-based protein source for both human and animal consumption.

At farm level, pulses are competitive and profitable against other arable crops on the farm and have a very positive effect on the whole farm rotation, providing substantial benefits to subsequent crops - particularly cereals or oilseeds.

What's more, compared with alternative protein sources like soyabean, peas and beans are proven to be more environmentally friendly, with the wider carbon benefits of the crops only just beginning to be appreciated.

The NCS Project 'Nitrogen efficient plants for climate smart arable cropping systems' is a four-year innovative project, led by the PGRO in collaboration with 17 industry partners. It explores in more detail the value of pulse crops and aims to enable UK agriculture to bring about a reduction of 1.5Mt $CO_2e$ per annum or 54% of the maximum potential.

The project is funded by the Defra Farming Innovation Programme, delivered by Innovate UK, and will give 200 UK farmers direct support to establish their business' carbon baseline.

The leading innovators among them are being paid to co-design with scientists crop and feeding trials they carry out on their farms.

This guide is designed to be a starting point for livestock farmers who may be looking at ways to reduce the carbon emissions associated with their businesses and see pulse crops as an option to do so.

**The ambition of the project is to increase pulse and legume cropping in arable rotations to 20% across the UK (currently 5%). In addition, up to 50% of imported soya meal used in livestock feed rations can be replaced with home-grown legumes.**

**To get involved with, or simply to keep up to date with the latest project news visit:**

**www.ncsproject.co.uk**

Roger Vickers, PGRO Chief Executive

# Peas and Beans
## for Livestock Feed

**Soyabean meal has been widely used as a protein source in livestock diets for some time. However, with the ever-increasing cost of soya and the harsh environmental penalties associated with imports sourced from countries like Brazil, many livestock farmers are now looking for alternative, home-grown sources.**

Lizz Clarke
Independent Nutritionist, LC Beef Nutriton

This is where pulse crops, such as peas and beans, present an opportunity – offering farmers an alternative high-quality, high-value feed source.

While these crops have been a component of pig and poultry diets for some time, they are also a small, but very important component, of ruminant rations – particularly for the dairy industry.

In ruminant rations, peas and beans offer a 'mid-way' protein source – meaning they are not quite a rumen-degradable source, nor a bypass protein, but somewhere in the middle. They are mid-range in terms of quality too, offering on average 26% crude protein, and serve as an excellent source of starch as well.

In beef diets, the energy-to-protein ratio in pulses lends itself particularly well to finishing stock. For dairy cows, the starchy element of beans specifically is a very important aid for building milk proteins.

What's more, the high energy content of beans and peas can also help boost the overall ration quality when feeding lower nutrient value forages.

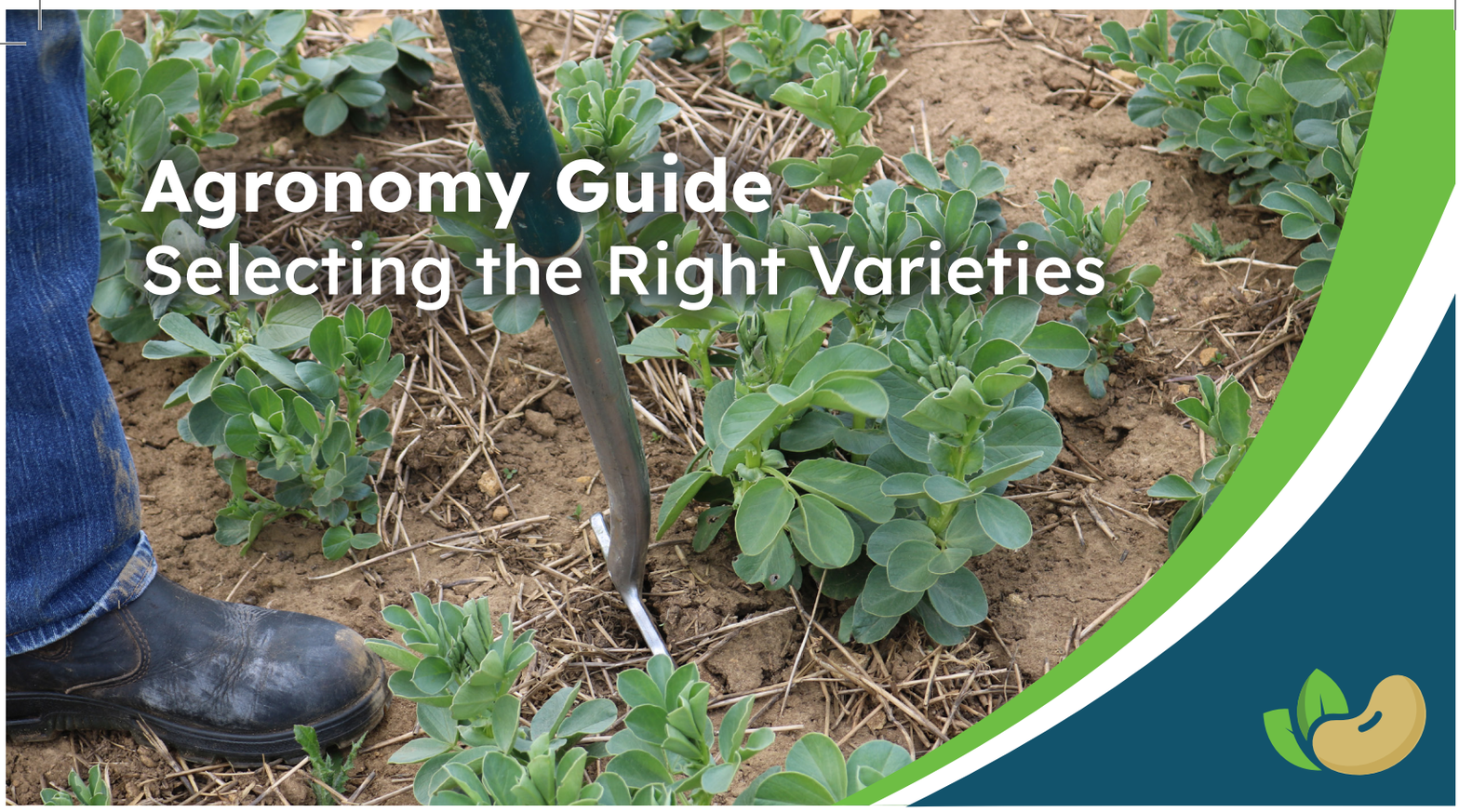
As valuable as these crops are, it is important to remember that pulses are not a direct replacement for soya in rations and in fact, are quite different in terms of protein and energy values.

The value of peas and beans also varies depending on how the crop is harvested and which class of livestock the diet is intended for. For example, for finishing cattle a crimped grain feed is likely to be optimal. But for a suckler cow, wholecropping beans and peas may be a better option to provide more bulk and less unnecessary protein and energy concentration.

Therefore, to get the best from pulses it is important to think about what outcome is required, whether that be milk production, cattle growth or finishing. Ration formulation should then be done alongside careful advice from a nutritionist to ensure ruminant requirements are being met and performance is not impacted.

When grown and utilised correctly, both beans and peas are an excellent feed source and are currently a very under-utilised product in ruminant diets.

More knowledge and research into their value and the wider benefits they provide to both livestock and soil health and the wider environment will be vital to encourage wider use, but there is no doubt that pulses will continue to grow in importance over the coming years as both beef and dairy diets seek to move further away from a reliance on soya.



# Agronomy Guide
# Selecting the Right Varieties

## PLANNING FOR PEAS

When planning for a pea crop, the first step is to decide on the final market as this will impact decisions on pea type and variety selection. However, for animal feeds all types of peas are suitable.

Pea varieties are categorised firstly by the colour of their flower. White-flowered types are further classified as yellow (referred to as white peas), green (large and small blue) and marrow fats. Coloured-flowered (maple types) are primarily only grown for pigeon feed.

**Yellow peas are often referred to as white.**

## PLANNING FOR BEANS

Similarly to peas, end market will also dominate bean variety choice, however all types are suitable for animal feed.

Beans are categorised as winter or spring types and are further classified by pale or black hilum colour or tic.

Winter beans are generally large-seeded with a thousand seed weight normally above 530g. Spring varieties are generally smaller seeded. Tic bean varieties have small, rounded seeds, which tend to be more suitable for the pigeon feed trade.

When growing pale hilum spring beans for export for human consumption and small-seeded beans for the pigeon trade, it is possible to attract a premium. The available premium will depend upon visual appearance and prevailing market conditions.

## THE PULSE DESCRIPTIVE LIST

In the same way as the Recommended List provides guidance on cereals and oilseed varieties, the PGRO Pulse Descriptive List is a good starting point for variety selection.

Through the Pulse Levy, PGRO conducts Descriptive List trials for combining peas and winter and spring beans.

Yearly trials are conducted with sites located in the major production areas. Summary data in the Descriptive List tables are based on a five-year rolling average to take account of seasonal variations.

The yield control (100%) is taken from the average of all varieties that have been in the trial series for four or more years.

## COMBINING PEAS - PGRO Descriptive List 2023

The control for yield is the mean of 4 and 5 year varieties (3.88 t/ha). Yield differences of less than 13.2% are not statistically different.

| | | | Agronomic characters | | | Resistance to | | | Seed characters | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | UK Agent see appendix | Yield as % of Control | Earliness of maturity (1-9) | Straw length (cm) | Standing ability at harvest (1-9) | Pea wilt (Race1) | Downy mildew (1-9) | Powdery mildew * | Thousand seed weight (g) (@15%mc) | Protein content (% dry) | No. Years in matrix | Year first listed |
| **Yellow** | | | | | | | | | | | | |
| Kameleon | Sen | 114 | 6 | 76 | 7 | R | 5 | [S] | 301 | 21.8 | 5 | 20 |
| Orchestra | LSPB | 111 | 6 | 80 | 7 | R | 4 | [S] | 315 | 22.1 | 5 | 20 |
| Glam | Sen | 108 | 3 | 88 | 7 | R | 5 | [S] | 248 | 21.8 | 3 | **23** |
| Manager | KWS | 108 | 6 | 83 | 7 | R | 7 | [MR] | 282 | 22.8 | 5 | 18 |
| LG Ajax | LUK | 103 | 6 | 76 | 7 | R | 7 | [HR] | 265 | 22.1 | 3 | **23** |
| Rivoli | Sen | 102 | 5 | 80 | 7 | [S] | 8 | [S] | 281 | 22.1 | 4 | 22 |
| **Green** | | | | | | | | | | | | |
| Carrington | LSPB | 115 | 5 | 86 | 7 | R | 8 | [S] | 244 | 21.4 | 4 | 22 |
| Butterfly | LSPB | 109 | 7 | 83 | 7 | R | 6 | [S] | 293 | 21.1 | 3 | **23** |
| Greenway | IARA | 107 | 5 | 88 | 7 | R | 7 | [S] | 301 | 22.1 | 5 | 21 |
| Stroma | LSPB | 107 | 6 | 81 | 7 | R | 5 | [S] | 319 | 21.6 | 5 | 21 |
| Mikka | IARA | 107 | 5 | 87 | 7 | R | 7 | [S] | 294 | 22.7 | 5 | 21 |
| Bluetime | LSPB | 107 | 3 | 90 | 6 | R | 8 | [S] | 284 | 21.8 | 5 | 18 |
| KWS Gotham | KWS | 107 | 3 | 86 | 6 | - | 4 | - | 289 | 22.1 | 3 | **23** |
| Kactus | Sen | 106 | 5 | 78 | 7 | R | 7 | [S] | 290 | 21.7 | 5 | 20 |
| Kiravi | Sen | 105 | 4 | 83 | 7 | R | 6 | [S] | 278 | 21.7 | 4 | **23** |
| Karioka | Sen | 104 | 5 | 86 | 7 | R | 7 | [S] | 255 | 22.7 | 5 | 18 |
| LG Aviator | LUK | 101 | 4 | 77 | 7 | R | 8 | [HR] | 284 | 21.8 | 4 | 20 |
| Daytona | Agrii | 98 | 6 | 78 | 7 | R | 7 | [S] | 271 | 22.1 | 5 | 10 |
| Prophet | LUK | 96 | 4 | 77 | 6 | R | 7 | [S] | 300 | 22.0 | 4 | 07 |
| Mankato | KWS | 96 | 4 | 82 | 7 | R | 6 | [S] | 255 | 22.4 | 5 | 19 |
| Greenwood | IARA | 92 | 8 | 70 | 6 | R | 6 | [HR] | 226 | 21.6 | 4 | 17 |
| **Maple** | | | | | | | | | | | | |
| Mantara | LUK | 95 | 6 | 64 | 7 | R | 8 | [S] | 232 | 23.4 | 3 | 10 |
| Rose | Dalt | 92 | 8 | 78 | 6 | S | 9 | [S] | 257 | 24.9 | 3 | 03 |
| **Marrowfat** | | | | | | | | | | | | |
| Takayama | LSPB | 96 | 4 | 87 | 6 | R | 6 | [S] | 350 | 21.5 | 3 | **23** |
| Akooma | LSPB | 95 | 4 | 81 | 5 | R | 5 | [S] | 406 | 22.8 | 5 | 21 |
| Octavia | IARA | 88 | 3 | 79 | 7 | R | 3 | [S] | 399 | 23.0 | 5 | 20 |
| Sakura | Dalt | 86 | 5 | 80 | 6 | R | 4 | [S] | 382 | 23.3 | 5 | 08 |

(1-9) A high rating indicates that the variety shows the character to a high degree. All varieties are semi-leafless. Downy mildew: Varietal resistance may vary in different regions as race structure of the disease changes. Pea wilt (Fusarium oxysporum f. sp. pisi)(race 1)
R = Resistant; S = Susceptible. *Powdery mildew Trials & Breeders information - HR = High resitsance, MR = Moderate resistance, S = Susceptible. 

## SPRING BEANS - PGRO Descriptive List 2023

The control for yield is the mean of 4 and 5 year varieties (4.24 t/ha).Yield differences of less than 7.3% are not significantly different.

| | | | Agronomic characters | | | | Resistance to | | Seed characters | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | UK Agent see appendix | Yield as % of Control | Flower colour | Earliness of maturity (1-9) | Straw length (cm) | Standing ability at harvest (1-9) | Downy mildew (1-9) | Rust* (1-9) | Thousand seed weight (g) (@15%mc) | Protein content (% dry) | No. Years in matrix | Year first listed |
| **Pale Hilum** | | | | | | | | | | | | |
| Genius | LSPB | 110 | C | 6 | 109 | 8 | 5 | 4 | 541 | 27.3 | 3 | **23** |
| Lynx | LSPB | 107 | C | 6 | 108 | 8 | 7 | 4 | 518 | 28.1 | 5 | 16 |
| LG Stego | LUK | 106 | C | 7 | 110 | 8 | 3 | 5 | 562 | 27.7 | 3 | **23** |
| Futura$^{LVC}$ | LSPB | 106 | C | 7 | 111 | 8 | 4 | 4 | 565 | 26.5 | 3 | **23** |
| Ghengis | LSPB | 105 | C | 7 | 113 | 8 | 4 | 5 | 558 | 28.1 | 5 | 20 |
| Stella | SU | 105 | C | 7 | 110 | 8 | 3 | 5 | 537 | 27.8 | 5 | 21 |
| Victus$^{LVC}$ | LSPB | 104 | C | 7 | 104 | 8 | 5 | 4 | 547 | 27.8 | 5 | 19 |
| Macho | LSPB | 104 | C | 5 | 109 | 8 | 4 | 6 | 650 | 26.8 | 5 | 20 |
| Capri | SU | 104 | C | 7 | 109 | 8 | 3 | 4 | 512 | 28.3 | 5 | 21 |
| LG Sphinx | LUK | 102 | C | 6 | 108 | 8 | 4 | 4 | 499 | 28.4 | 5 | 21 |
| Vertigo | LSPB | 101 | C | 7 | 108 | 8 | 4 | 4 | 572 | 27.8 | 5 | 13 |
| LG Raptor | LUK | 100 | C | 7 | 109 | 8 | 4 | 5 | 534 | 28.0 | 5 | 20 |
| LG Viper | LUK | 100 | C | 5 | 99 | 9 | 6 | 7 | 582 | 28.4 | 5 | 21 |
| Fuego | LUK | 95 | C | 7 | 104 | 8 | 4 | 4 | 562 | 28.3 | 4 | 05 |
| Yukon | LSPB | 92 | C | 8 | 101 | 8 | 9 | 5 | 622 | 27.5 | 5 | 20 |
| **Black Hilum, Tic** | | | | | | | | | | | | |
| Maris Bead | WAC | 83 | C | 6 | 115 | 7 | 7 | - | 399 | 29.7 | 3 | 64 |

(1-9) A high rating indicates that the variety shows the character to a high degree. The scales of characters of spring beans do not necessarily correspond with those for winter beans.The export market for human consumption usually requires pale hilum types. LVC = Low Vicine & Low Convicine (LVC). *Rust data influenced mostly by 4 trials in 2020. The lsd is approx 1 rating point. 

## WINTER BEANS - PGRO Descriptive List 2023

The control for yield is the mean of 4 & 5 year varieties (4.50t/ha). Yield differences of less than 8.0% are not statistically different.

| | | | Agronomic characters | | | | Resistance to | | Seed characters | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | UK Agent see appendix | Yield as % of Control | Flower colour | Earliness of maturity (1-9) | Straw length (cm) | Standing ability at harvest (1-9) | Downy mildew (1-9) | Rust* (1-9) | Thousand seed weight (g) (@15%mc) | Protein content (% dry) | No. Years in matrix | Year first listed |
| **Pale Hilum** | | | | | | | | | | | | |
| Vespa | Sen | 111 | C | 5 | 115 | 8 | 5 | 5 | 667 | 25.7 | 5 | 18 |
| Vincent | Sen | 108 | C | 5 | 117 | 8 | 7 | 4 | 768 | 26.9 | 5 | 21 |
| Bumble | Sen | 104 | C | 5 | 121 | 8 | 5 | 5 | 665 | 25.3 | 5 | 16 |
| Bonneville | Sen | 102 | C | 6 | 115 | 8 | 5 | 4 | 692 | 26.5 | 3 | **23** |
| Norton | Sen | 102 | C | 7 | 112 | 8 | 6 | 5 | 659 | 25.8 | 5 | 21 |
| Pantani | LSPB | 96 | C | 8 | 90 | 8 | 5 | 5 | 610 | 23.3 | 4 | 22 |
| Honey | Sen | 94 | C | 7 | 105 | 9 | 5 | 4 | 673 | 25.9 | 5 | 12 |
| Tundra | LUK | 94 | C | 6 | 105 | 8 | 5 | 5 | 607 | 25.7 | 5 | 14 |

(1-9) A high rating indicates that the variety shows the character to a high degree. The scales of characters of winter beans do not necessarily correspond with those for spring beans. 

## SELECTING THE RIGHT VARIETY - THE PRIORITIES

- What is your end market?
- What is the realistic yield potential?
- Are there any particular disease pressures on your farm?
- Does your rotation suit winter or spring types better?

## Key to source of varieties

| Agent code on DL | UK agent |
|---|---|
| Agrii | Agrii |
| Dalt | Dalton Seeds |
| IARA | IAR Agri |
| KWS | KWS UK Ltd |
| LSPB | LS Plant Breeding |
| LUK | Limagrain UK Ltd |
| SU | Saaten Union (UK) Ltd |
| Sen | Senova Ltd |
| WAC | WA Church (Bures) Ltd |

# Agronomy Guide
## Weeds to Watch For

**Good weed control in both peas and beans is vital as young crops are not very competitive and can find themselves easily dominated by weeds. This can have a detrimental effect on pulse yields, as well as causing issues in the following crop.**

### CLEAVERS

Cleavers are extremely competitive annual weeds, characterised by whorls of six to eight long, slender green leaves and hollow, square stems covered in prickly hairs. They also feature white flowers. They grow particularly well on highly fertile loam and clay soils.

### CHICKWEED

Chickweed is an annual weed characterised by long – usually more than 8mm – oval leaves and tiny white flowers. It grows particularly well on fertile, high-nitrogen soils and can do so even at low temperatures.

### KNOTGRASS

Knotgrass is an annual weed which spreads low to the ground, sometimes creeping up the plant. Leaves are narrow and spear-shaped and the stem on the young plant is crimson. It is found most commonly on bare, fertile soils.

### SHEPHERD'S PURSE

Shepherd's purse is a very prolific annual weed which can grow up to 60cm in height. Most leaves grow as a rosette at the base of the plant and flowers are characterised as tiny and white-petalled which develop into a heart-shaped seed head. Weed seeds are sticky, making them easily transported between farms. Shepherd's purse prefers sandy, nitrate-rich soils and avoids wetter areas.

### RED DEAD-NETTLE

Red dead-nettle is a bushy annual weed, characterised by heart-shaped, toothed leaves with round edges and pink flowers. It is particularly common in arable rotations and grows well on fertile, sandy soils.

## CONTROL STRATEGIES

General control can be employed either via pre-emergence with a soil-applied residual herbicide or with a foliar-applied product, post-emergence.

Cultural control is often not enough and so chemical options are usually required. A number of products are available to growers and should be selected based on conditions, soil type and weed spectrum.

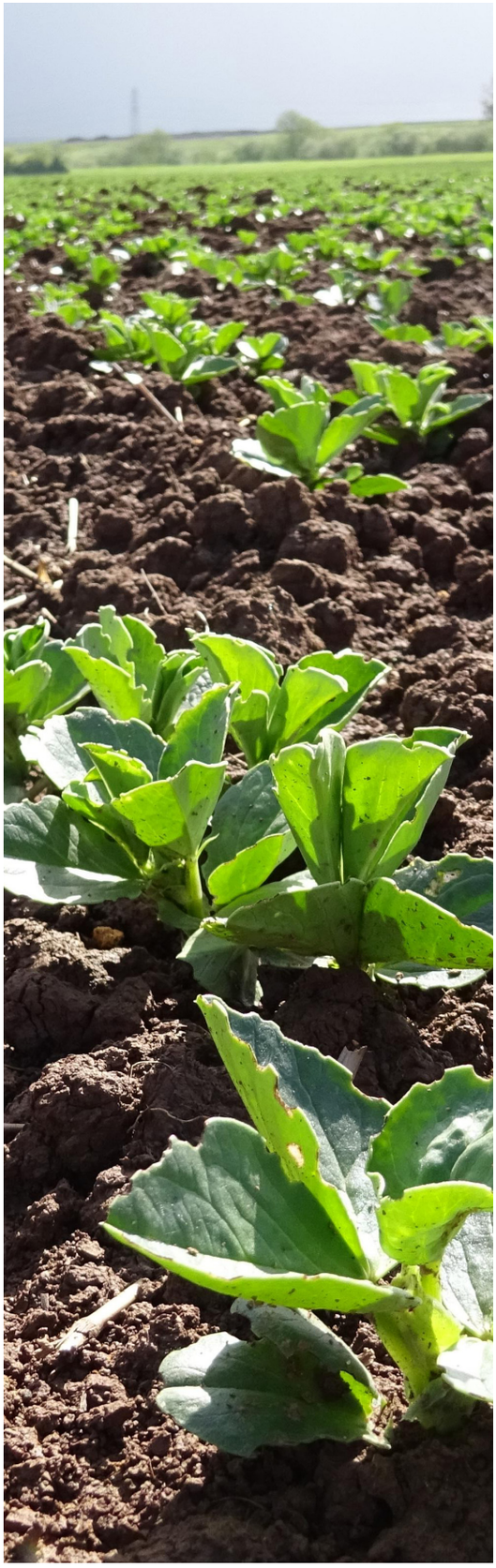
## VOLUNTEER CHALLENGES

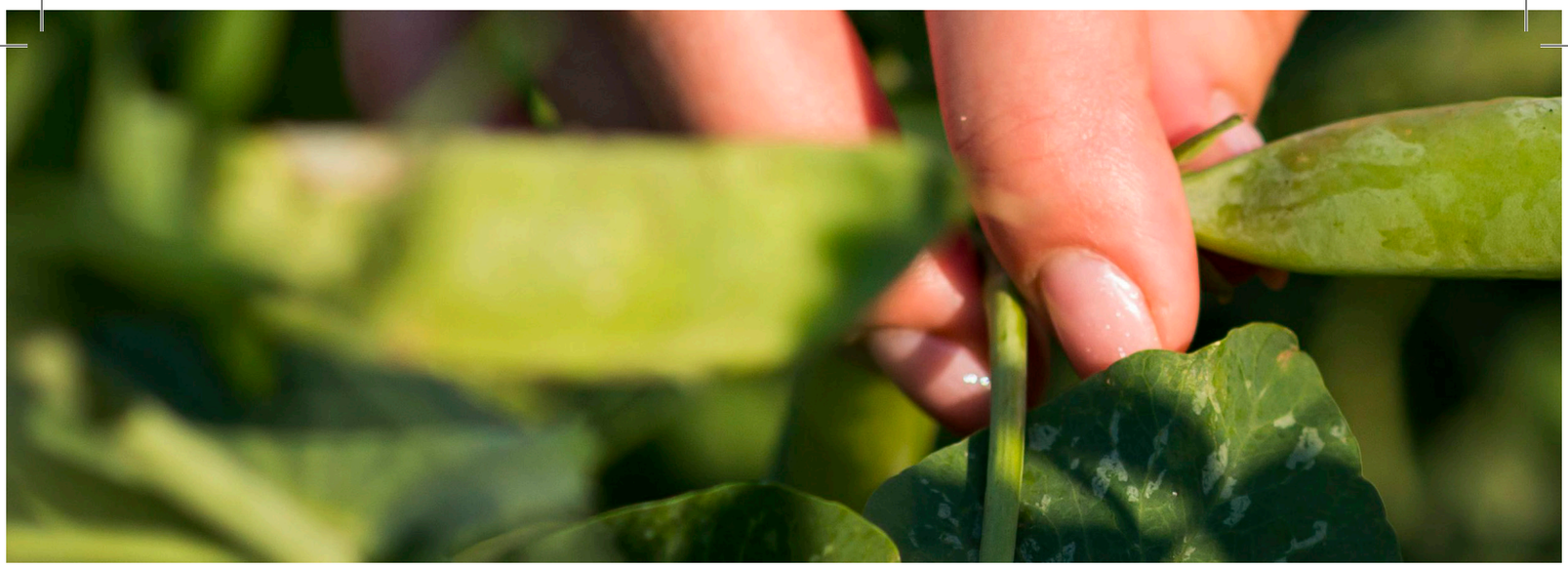
**Volunteer oilseed rape and cereals can also cause issues for growers, with volunteer OSR a serious problem if it is grown in the same rotation.**

**Wild oats can lead to severe yield reductions, as well as challenges at harvest, and must be controlled to avoid re-seeding in a following crop.**

**Post-emergence graminicides offer control of volunteer cereals, as well as the reduction of blackgrass and grassweeds.**

More information on weed challenges and control strategies can be found online in the PGRO Online Pulse Agronomy Guide





# Agronomy Guide
## Pests and Diseases

**Suboptimal management of pests and diseases can reduce both yield and quality in peas and beans. Here are just a few key pests and diseases to look out for.**

## PESTS

### Pea and bean weevil

**What is it?**

A beetle-like pest about 4-5mm in length as an adult. Typically light grey to brown in colour, with faint striping along the length of wing cases. Large numbers of weevils can cause significant foliar damage to young crops, and yield loss may be caused by larval feeding in root nodules.

**Which crop is affected?**

Peas and beans

### Black bean aphid

**What is it?**

A black aphid – about 1-2mm in size – with very small white spots on the upper surface of the body. Damage occurs mainly as the direct effect of aphids feeding, which causes suboptimal development of crops and lack of pod fill. If colonies develop prior to flowering, they can cause a huge amount of damage to yield in field beans.

**Which crop is affected?**

Beans and occasionally peas

### Pea moth

**What is it?**

One of the most damaging pea pests in the UK which causes losses as a result of the larvae feeding on peas within the pod. Damage is not as significant in peas grown for animal feed, and can be controlled via insecticides – alongside cultural strategies such as pheromone trapping and pest monitoring.

PGRO has a monitoring and prediction tool online to help understand risk factor and advise on predicted spray dates.

**Which crop is affected?**

Peas

More information on weed challenges and control strategies can be found online in the PGRO Online Pulse Agronomy Guide

## DISEASES

### Chocolate spot

**What is it?**

An early season disease characterised by the presence of small, circular, chocolate-coloured spots on the lower leaves. Disease risk is greater during periods of overcast and humid weather conditions, and yield loss depends on the severity of infection.

**Which crop is affected?**

Beans

### Bean rust

**What is it?**

A later infection characterised by red-brown pustules on bean leaves. It is more serious in spring beans and all varieties are susceptible. Most damage occurs if the infection begins during flowering and pod set.

**Which crop is affected?**

Beans

### Downy mildew

**What is it?**

A pathogen which produces soil-borne resting spores and targets young plants as a primary host of infection. Infected seedlings have a greyish brown, felty mycelial growth on the underside of the leaf, suffer from stunted growth and often die before flowering. These young plants are the source for secondary infection of older plants as they produce air-borne spores. Many pea and spring bean varieties are resistant to downy mildew and variety selection can assist in disease management.

**Which crop is affected?**

Peas and beans

# Agronomy Guide
## Harvesting and Storage

**Peas and beans are usually harvested dry, but hitting the optimum moisture content (14%-16%) at harvest for dry storage is not always easy in the UK climate and drying down to this level can be fuel-hungry and expensive.**

There are a number of alternatives and practices recommended by livestock feed preservation specialists, Kelvin Cave, depending on the moisture content of the crop, the storage facilities available, existing feed stocks, available harvesting or contractors' equipment, and personal preference.

**Propionic acid** has long been a popular choice and avoids the need to dry pulses at up to 25% moisture. Modern propionic acid products, such as Propcorn NC, avoid the corrosive and unpleasant handling effects of earlier products, and have contributed to a rise in use.

**Wholecropping protein crops** is growing in popularity and can offset a large percentage of bought-in protein or even eliminate its use in ruminant diets. In general terms, the crop is simply cut and ensiled in the same was as any other wholecrop but generally at a higher dry matter (DM) than cereals. Hitting DMs of 55%-70% will maximise protein and starch levels. However, the later harvest and high DM can make effective fermentation a challenge, so a chemical salts-based preservative, such as Safesil Pro, is recommended. This will protect against the development of yeasts, moulds and contaminants from the soil and give prolonged storage stability.

For organic systems, when salts-based preservatives are not permitted, it is advisable to harvest the crop at a lower DM (35%-50%). A homo-fermentative bacterial inoculant combined with citric acid is recommended in this situation, such as Activator + CA which achieves aerobic stability while minimising DM loss, according to Kelvin Cave.

**Crimping legume 'grains'** to create a nutritious concentrate feed is another popular practice and the same principles apply to pulses as to cereal crops. The process involves the rolling of the moist pulse through a crimping machine and the application of a preservative. Compaction and storage in an airtight clamp ensures a controlled fermentation and maximises nutrient retention. However, crimping beans on their own has always been problematic as the large grain size makes it difficult to remove air and achieve the required anaerobic conditions. But a growing number of farmers have overcome this issue by crimping a mix of peas and beans or even crimping beans with brewers' grains or draff, although careful planning is needed to ensure the co-product is available at the time of harvest. The target moisture content for the pea/bean mix is 30-35% at harvest and a chemical salts-based preservative is recommended.

## Tempering

There are also options which improve the feed value of pulses which have become too dry, such as if over-dried or harvested in drought conditions. Such crops have numerous disadvantages, but their problems can be rectified by tempering, or treating with a blend of surfactants, preservatives and water to improve the feed's qualities for milling and animal digestion.

# Views from the field Case Studies

# Peas and beans mix replace bought-in feed in Pembrokeshire

Pembrokeshire farmer Eurig Jones has cut feed costs by over £10,000 by replacing bought-in feed with crimped peas and beans.

Mr Jones grew 8ha of bicropped beans and peas in 2021 as part of a Farming Connect trial, funded by the Welsh government and the European Agricultural Fund for Rural Development, to use as an alternative feed source for his 400-head beef herd at Panyderi Farm in Boncath. Bicropping was opted for over single crops due to the perceived greater yield potential.

Prior to the trial, Mr Jones had been feeding a bought-in 36% protein, maize distillers, and rapeseed blend to the herd, but says it has long been his ambition to become self-sufficient in protein.

The trial plot was drilled in April, sowing beans first at a rate of 308kg/ha and a depth of 60mm, followed by peas at 225kg and a depth of 30mm. The crop received a pre-emergence herbicide application at drilling and two sprays for chocolate spot. No artificial fertiliser was applied.

The crop was harvested in September, using Mr Jones' own kit, giving an average yield of 5.25t/ha. Quality wise, it was analysed at 26% crude protein, 13.6MJ/kg DM of metabolisable energy and a D-value of 93.4%, providing the farm with a high-quality concentrate feed for grower and finisher rations.

The crop was crimped, and a preservative was applied, before storing in a clamp ahead of winter feeding.

Haulm from the crop was also chopped and baled to produce a high-quality straw to replace barley straw in the ration.

The total cost of production of the crop was calculated as £117/t.

Independent nutritionist, Hefin Richards, formulated the rations with the new pea and bean mix to ensure energy and protein levels remained the same as the previous concentrate that was fed.

Cost was quickly revealed as a big benefit of the legume mix, which came in at a daily ration cost of £1.29 a head for the growing ration and £2.18 a head for the finishing ration, compared with £1.35 and £2.39, respectively.

This equated to a saving of £5,588 per 200 head of cattle – more than £10,000 over his 400-head herd.

As well as the cost benefit, feeding peas and beans has helped improve daily liveweight gain (DLWG). Growing cattle are now averaging 1.19kg a head/day, compared with 1.15kg DLWG previously, and finishing cattle now achieve 1.44kg a day, compared with 1.43kg.

The advantages of the legumes also lasted well beyond the crop itself - a large amount of residual nitrogen was left in the soil, which benefited the following crop of wheat. So much so that nitrogen was not required until the following April.

Pleased with the results, Mr Jones increased his cropping area to 12ha in 2022 and hopes to grow even more this year.


"The aim at Pantyderi was to increase self-sufficiency, maintain performance and reduce costs, and all of those boxes have been ticked."

## Beans cut finishing costs in Northumberland

Northumberland beef and sheep farmer Steven Smith has cut lamb finishing costs by two-thirds since switching from feeding purchased concentrates to whole cropped beans.

High costs across his 5,000 head flock were a challenge for Mr Smith, who farms 1,820ha with his son William, near Hexham.

Ewes are run as three flocks – one of Swaledales, one of Mules and one of Texel crosses. Lambs from each flock are finished in different ways according to season and lambing date, but all are sold deadweight, with a target average of 21kg. Lambs from the Texels and Mules mostly achieve this either straight from their mothers or on autumn grass, while ewe lambs from the Mules, sired by a Texel tup, are either sold for breeding or retained for the flock.

Meanwhile, wether lambs out of the Swaledales, which are not finished off autumn grass, are brought inside to fatten on bought-in cake, which has proved very costly over time and did not always guarantee producing in-spec lambs.

In a bid to change this, Mr Smith believed there was scope to use more home-grown feeds and sought specialist advice from Kelvin Cave's Michael Carpenter.

The decision was made to buy 24ha of a standing crop of spring beans from a neighbour, which was cut and ensiled by a local contractor, as it was not feasible to grow them on farm as part of the current rotation.

The crop was harvested in late summer to capture the highest starch levels, but without leaving it too late that harvest could be hampered by wet weather and unfavourable site conditions.

The wholecropped beans analysed at 20.9% crude protein and 17.1% starch and formed part of the final lamb ration which comprised 2t of grass silage, 500kg of wholecrop beans and 500kg of oats – completely replacing bought-in cake.

Because of the improved structural fibre supplied through the more mature crop at harvest, straw – which was previously fed with the pellets – could also be removed from the ration.

Preservation and ensiling of the wholecrop had to be done with care due to its high dry matter (53%). This meant putting extra effort into compaction to achieve anaerobic conditions and treating the wholecrop beans with a salts-based preservative to guard against yeasts, moulds and spoilage bacteria associated with aerobic conditions.

The clamp was also covered with a double-layered silage sheet to create an airtight seal.

The cost benefit has been to reduce weekly fattening costs from £2.25 to just 78p per head. "We are over the moon with the lambs' performance on the beans," says Mr Smith. "Since we have been on the mix, we have not had a single lamb out of spec, and when you go to the shed, they are really content – they just eat when they want rather than gorging on the concentrate and shouting when they want more."

**"Now we feel we are treating the stock like ruminants – we will not go back to cake."**

## Soya swapped for homegrown pulses in Durham

Replacing bought-in soya with homegrown peas, beans and lupins has helped mixed farmer Rob Crowe cut feed bills and move towards a more self-sufficient system.

The decision to grow pulses came about after a conversation with Kelvin Cave's Michael Carpenter – originally about the purchase of a mill to roll barley in 2019.

Mr Crowe had grown peas and beans before, drying to 14% moisture and selling commercially, however Mr Carpenter suggested he could try growing them again for livestock feed to improve the farm's self-sufficiency.

At the time, there was also the opportunity to use pulse crops to satisfy the farm's compliance with the BPS greening rules as an ecological focus area (EFA).

Realising the opportunity, Mr Crowe drilled 6ha of peas and beans on 1 April using a combination drill. A power harrow was used in front of the drill and the field was harrowed behind to give a fine tilth. With the conditions of the EFA meaning sprays could not be used, the decision was taken to grow the beans and peas together to improve competitiveness against weeds.

Trials data from PGRO has shown that mixed crops regularly produce more than the crops grown individually, and because the beans support the peas, the whole crop should remain standing for harvest.

The crop was harvested on 1 October and rolled through the same mill Mr Crowe purchased for his barley. He also applied a non-corrosive propionic acid-based preservative at the same time to safeguard against the formation of yeasts, moulds and mycotoxins.

As well as the beans and peas, Mr Crowe planted 4ha of lupins, grown as a single crop, and together the pulses formed a mix used in all livestock rations – including his 400 in-lamb ewes and their offspring and the 60-head of beef he sells as stores or fat cattle.

With the quality analysis showing over 30% crude protein for lupins and in the high 20s for the peas and beans mix, the pulses together have provided enough protein to allow Mr Crowe to remove soya from the diets – the equivalent of 10t a year, at a cost of £360/tonne (based on 2019 prices). This is in comparison with an estimated feed cost for growing and harvesting peas and beans of £123.50/t.

Although more of the protein in the home-grown crops is rumen degradable compared with the soya, the lupins have a more favourable amino acid profile than peas or beans and help lift the level of digestible undegradable protein.

A typical 1t ewe mix now comprises 200kg whole oats, 50kg rolled lupins, 150kg rolled pea and bean mix, 20 litres of molasses and the remainder rolled barley.

**"I appreciate the system might not be for every farmer, but for our mixed farm it seems to work really well. It is important to me in the current climate that we aim to be self-sufficient, and this is helping us achieve that goal.**

**"Now we have taken on extra land, we plan to grow more pulses in the years ahead which will hopefully mean there's little need for bought-in feed at all."**

# Beans for feed help alleviate drought pressures in Yorkshire

Switching from harvesting beans for human consumption to whole cropping for livestock feed has provided a new income stream for Yorkshire farmer Tom Bayston.

The decision came after mounting pressures on livestock farmers during the drought of 2018 saw many begin to run out of feedstocks.

Mr Bayston farms 405ha of arable land near Goole and has grown spring beans at Pollington Grange for many years. In this particular year, beans were looking their worst ever due to the drought, so he saw an opportunity to change tack to get the most from the crop and to help provide livestock farmers with high quality forage.

The whole 36ha was harvested and wholecropped by 15 August, giving an average yield of 7.4t/ha. Knowing wholecrop beans can be difficult to ensile, he consulted feed and forage preservation specialists, Kelvin Cave, who advised on the best approach to achieve a good fermentation. “In this instance, it was particularly important to ensure the forage would be stable after opening as it’s quite possible livestock producers buying the silage could keep it exposed to air for several days before feeding,” says the firm’s Michael Carpenter.

To help this, he used a preservative which is claimed to aid quick fermentation and eliminate the activity of fungi and moulds.

The bean silage was then bagged in polythene tubes and sold on to livestock farmers.

Including bean silage in livestock diets brings a beneficial combination of bulk feed with good protein and starch qualities – potentially displacing expensive and often imported protein sources, such as soyabean.

From an arable perspective, harvesting the crop early for the feed market also allowed Mr Bayston to begin cultivations for the next crop in good time. He adds that crops following beans always do particularly well too due to the nitrogen left in the soil.

**Tom Bayston (right) wholecropped his beans and bagged it in polythene tubes.**

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**www.ncsproject.co.uk**

## About NCS

**Nitrogen Efficient Plants for Climate Smart Arable Cropping Systems (NCS) is a four-year £5.9M research programme involving 200 UK farms and 17 partners.**

The main aim is to enable UK agriculture to bring about a reduction of 1.5Mt $CO_2e$ per annum or 54% of the maximum potential for the industry.

The ambitions of the project are to increase pulse and legume cropping in arable rotations to 20% across the UK and to develop and test new feed rations. This will help livestock farmers to substitute up to 50% of imported soya meal used in feed with more climate-friendly home-grown pulses and legumes.

These twin aims will be steered by science and proven by real farm enterprises, with significant benefits for both crop and livestock productivity, including cost savings of over £1bn/year.

The NCS Project is funded by the Farming Futures R&D Fund: Climate smart farming, part of Defra's Farming Innovation Programme. Defra are working in partnership with Innovate UK who are delivering the programme.
Project number: 10043778.