

INCREASING USE OF GRAIN LEGUMES IN CROP ROTATIONS



Photo: ORC

PROBLEM

Reliance on manufactured N fertiliser, loss of biodiversity in farmed landscapes in the UK

SOLUTION

Increased use of legumes in crop rotations helps to supply N to the farming system through biological fixation

OUTCOME

Increased use of legumes in crop rotations provides an addition source of income for farm managers whilst supply N to the system from a renewable source (biological fixation). Increased supply of domestic protein can also help to meet animal nutritional requirements in a sustainable manner.

Use of legumes can also help to spread workloads on a farm, improve the yields of crops following the legume in a rotation and provide a disease break for cereals and oilseeds.

APPLICABILITY

Applicable production types



Application time

Legumes can be sown in autumn or spring depending on species

Regulatory compliance

Reduced N inputs can encourage compliance with Nitrogen Vulnerable Zone (NVZ) regulations

Equipment/resource required

Inoculation required on some soil types

Best in

Field beans are the most popular legume crop in UK content due to reliable cropping, low pest and disease susceptibility and versatility in terms of time of establishment (Autumn or Spring)

PRACTICAL RECOMMENDATIONS

IMPLEMENTATION

- Most popular legumes grown in the UK are spring/winter beans and spring peas.
- Winter beans better-suited to heavier land that is difficult to work in the spring.
- The first step in planning a pea crop is to decide upon the intended market.
- Many types of high quality peas and beans are suitable for a range of premium markets, but all types are suitable for animal feeds.
- Production of combining beans/peas for seed is also an option. Soya production also an emerging market. Peas can also be grown alongside oats and other tall-strawed cereals for arable silage.
- A wide variety of combining peas and beans are available for use in the UK (Please see recommended list published by the Processors and Growers Research Organisation (www.pgro.org)).
- Crop rotations should not have more than one occurrence of the following legume crops every five years: field beans, peas, green beans, vetches, broad beans, lupins, in order to avoid build-up of pests and disease (e.g. pea and bean weevil)



- Peas are vulnerable to compaction in soils; recommended to plough land in autumn in order to allow natural soil weathering in the creation of fine tilth. Spring ploughing possible on lighter soil types. Direct drilling or min-till approaches can also be used to establish pea crops.
- No N fertilizer is required for pea crops, although adequate P and K levels should be ensured through soil-analysis. Where P and K fertilizer is required this should be broadcast and ploughed in at a shallow depth to ensure utilisation by the following crop.
- Sulphur deficiency can also affect peas on light soils and should be addressed through application of manure, calcium sulphate, magnesium sulphate, elemental sulphur or potassium sulphate.
- Amounts of phosphate and potash required by peas are suitable for obtaining yields of approximately 4 t ha yr⁻¹ and 3.5 t ha yr⁻¹ for peas and beans respectively
- Pea seed should also be treated with fungicidal protectants such as Thiram to avoid damping-off losses
- Optimum seed rates will depend on seed size and expected losses which can be determined in accordance with the type
- Drilling should occur early for higher yields
- Sowing in rows wider than 20cms apart may result in lower yield
- Most cereal drills are suitable for peas although on most soil types it is necessary to roll after drilling to ensure that stones are compressed into soil and to avoid/reduce damaging combines
- Pea crops are vulnerable to weeds as they are not very competitive; a number of pre- and post-emergence herbicides are available (see sources of further information below)
- Beans do not require a fine seedbed although are still prone to compaction
- Beans ready to combine at 18% MC, peas at 15-17% depending on end-use
- Desiccant can be used to advance maturity and ensure more consistency in pea crops at uneven maturity
- Beans benefit from increased pollination through increased populations of beneficial insects (e.g. bumblebees)
- Care is needed with combining and drying to ensure quality and reduce losses in field (if peas are over dried they may become unsuitable for human consumption) and cracking in bean stores.
- Storage in dark areas recommended for beans destined for human consumption in order to discourage the development of tannins which may cause decolouration
- Rhizobia inoculation may help in the lower yielding fields if it is the limiting factor.

The fertiliser requirements of peas and beans (kg/ha)

Soil index # N,P or K	N	P ₂ O ₅	K ₂ O*	MgO
0	0	100	100	100
1	0	70	70	50
2	0	40	40(21) 20(2+)	0
>2	0	0	0	0

KEY:

According to soil analysis on the ADAS classification: 0 = very low, 1= low, 2=medium, >2=high

* Not more than 50 kg/ha K₂O should be combine-drilled otherwise germination may be affected. The rest should be broadcast

Source: PGRO Pulse Agronomy Guide

EASE OF ADOPTION ON NON-ORGANIC FARMS

- Easy adoption in the case of the right equipment being available.
- Seed readily available from a number of suppliers

BENEFITS OF IMPLEMENTATION

- Reduced fertilizer expenditure, increased on-farm biodiversity
- Spread workloads throughout the year through broader range of crop types and harvest periods
- Breaking pest, disease and weed cycles (e.g. presence of wireworms, leatherjackets, fusarium and rust in cereal crops)



DRAWBACKS OF IMPLEMENTATION

- Important to ensure adequate market before sowing crop to avoid wasted investment in equipment/infrastructure
- Increased time required for managing crop with different husbandry requirements compared to 'traditional' cereal crop

BARRIERS AND RISKS

- Significant pest and disease risks associated with the crop, in situations where adequate rotation is not ensured
- Financial risk associated with increased investment (e.g. in bespoke grain storage and/or drying facility) and finding adequate market

FINANCIAL ANALYSIS

No substantial effects are expected following an increased use of grain legumes in rotations, as the cost decrease is likely to be offset by a decrease in financial output, as shown in the table below.

Initial investment	Ongoing costs	Yields	Financial output	Expected effect on margin
~	↓	~	↓	~

Rating approach used to describe the effect and direction of change (increase or decrease): Unknown = ? None = ~ Low = ∨ Moderate = ∨∨ High = ∨∨∨

In the estimate of the financial implications, cost reduction is related with beans providing 30-35 kg/ha of nitrogen to the following crop, reducing N fertiliser costs.

RELEVANT LEGISLATION AND CURRENT INCENTIVES

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FURTHER INFORMATION

Video

- A video highlighting the importance of timing in pea harvesting/delivery for product quality: https://www.youtube.com/watch?v=Foplcu_oW6Q
- Clip of harvesting of vining peas on farm in Lincolnshire: <https://www.youtube.com/watch?v=PgaYkoWEqsw>
- Online report on British Pulses by the Sustainable Food Trust: <https://sustainablefoodtrust.org/articles/rediscovering-british-pulses/>

Further reading and weblinks

- Red Tractor Bean Growing Guide: https://assurance.redtractor.org.uk/contentfiles/Farmers-6580.pdf?_=635969175271376334
- Red Tractor Pea Growing Guide: https://assurance.redtractor.org.uk/contentfiles/Farmers-6603.pdf?_=635971919577556120
- Processors and Growers Research Organisation (PGRO) guide on growing pulses: <http://www.pgro.org/downloads/PGRO-AGRONOMY-GUIDE-2017.pdf>
- SRUC guide to field beans and lupins: https://www.sruc.ac.uk/info/I20582/organic_farming_technical_summaries/I288/field_beans_and_lupins
- A guide to weed control options in pea production: <http://www.pgro.org/weed-control-peas/>
- A guide to arable silage options: <https://www.farmseeds.co.uk/t/categories/forage-crops/other-useful-forages/arable-silage>



CASE STUDY FARMER APPLYING THE PRACTICE: : BENNINGHOLME GRANGE FARM

Location: Yorkshire

Size: 364 hectares

Enterprises: Mixed (pigs and sheep with arable)

Blue peas have provided a useful alternative to vining peas as part of East Yorkshire grower Guy Shelby's battle against blackgrass, and have fitted well into his one-in-six-year rotation.

He grew 16ha of the variety Daytona for the first time in 2016 on a buy-back contract with Glencore to complement his existing vining peas. The crop is followed by wheat in his rotation, which also includes spring barley, oilseed rape, and beans.

Source: <https://www.fwi.co.uk/arable/pulses/pulses-can-attractive-despite-poor-yields-2016>

ABOUT THIS PRACTICE ABSTRACT

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