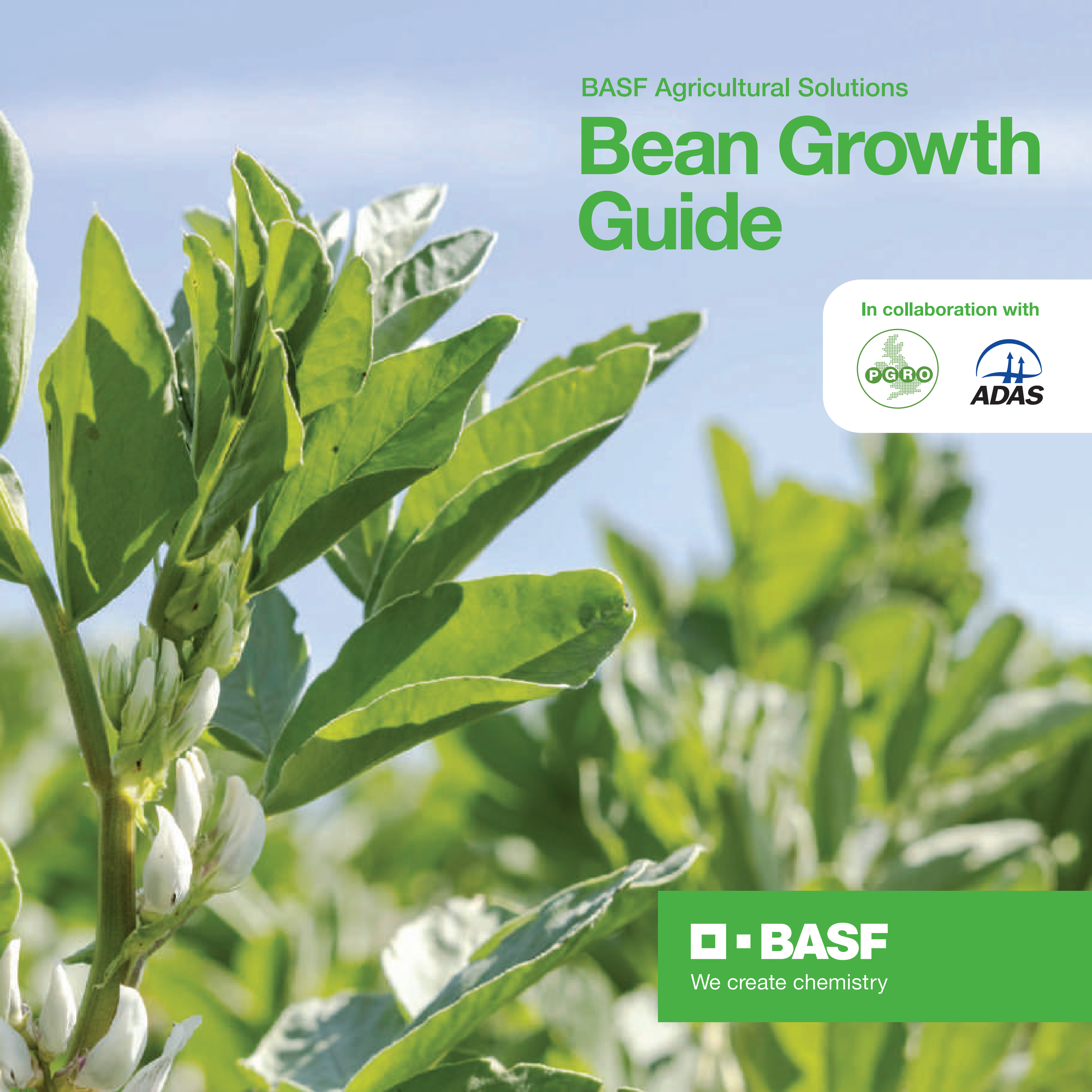
BASF Agricultural Solutions

Bean Growth Guide

In collaboration with

PGRO

ADAS



BASF

We create chemistry

Welcome

Welcome to the ultimate guide to growing field beans! As the demand for plant-based protein increases, the area of field beans has been steadily growing. Not only are they a profitable crop, but they also provide numerous benefits to the following crop and offer an opportunity for grass weed control.

In this comprehensive guide, we will cover everything you need to know to successfully grow field beans, from establishment to harvest. We will start by discussing the ideal conditions for growing beans and the best practices for seed selection and drilling.

We will then move on to cover the various management techniques required throughout the growing season, including pest and disease control and weed management.

Finally, we will delve into the best harvesting practices and provide tips for post-harvest handling and storage. Whether you are a seasoned agronomist or new grower, this guide is designed to provide you with the knowledge and tools you need to successfully grow field beans.

Contents

Understanding yield formation

Yield determination

Crops can be regarded as "Energy Harvesters" – plants convert natural resources (solar energy, carbon dioxide and water) into edible energy. Water is required in proportion to energy captured, so crop yields are best understood as resulting from:

- Available Resources
- Their Capture, and
- Their Conversion to harvestable grain or seed

Yield is calculated differently depending on if the crop was grown in a light or water limiting year:

If light is limiting:

Yield (t/ha) = Light energy (TJ/ha) x Capture (%) x Conversion (t/TJ) x Harvest Index

If water is limiting:

Yield (t/ha) = Available Water* (mm) x Capture (%) x Conversion (t/ha/100mm) x Harvest Index

*The sum of spring and summer rainfall and soil-held water.

Light capture

Depends on the size of the green canopy and its longevity.

Water capture

Depends mainly on rooting depth, which is typically 0.7m for spring beans to 0.9m for winter beans, but could exceed 1m if soil depth allows.

The Harvest Index is the proportion of total crop biomass growth which is harvested as seed.

Average Harvest Index (HI) for winter beans has been measured at 0.54 HI and 0.60 HI for spring beans.

Resource conversion

Rates of energy absorption, carbon dioxide fixation and water transpiration by leaf canopies are inherently linked (Figure 1), so light use, water use and biomass formation are roughly proportional.

Benchmark rates of conversion by bean canopies are 1 tonne biomass per terajoule of light energy intercepted, and about 4 t/ha biomass per 100mm of water captured and transpired.

Nitrogen fixing crops must use some of the energy captured to fix nitrogen, hence their conversion efficiencies are less than non-nitrogen fixing crops.

Resource conversion can be reduced if storage capacity for assimilate is insufficient, e.g. low number of seeds set (sink limitation).

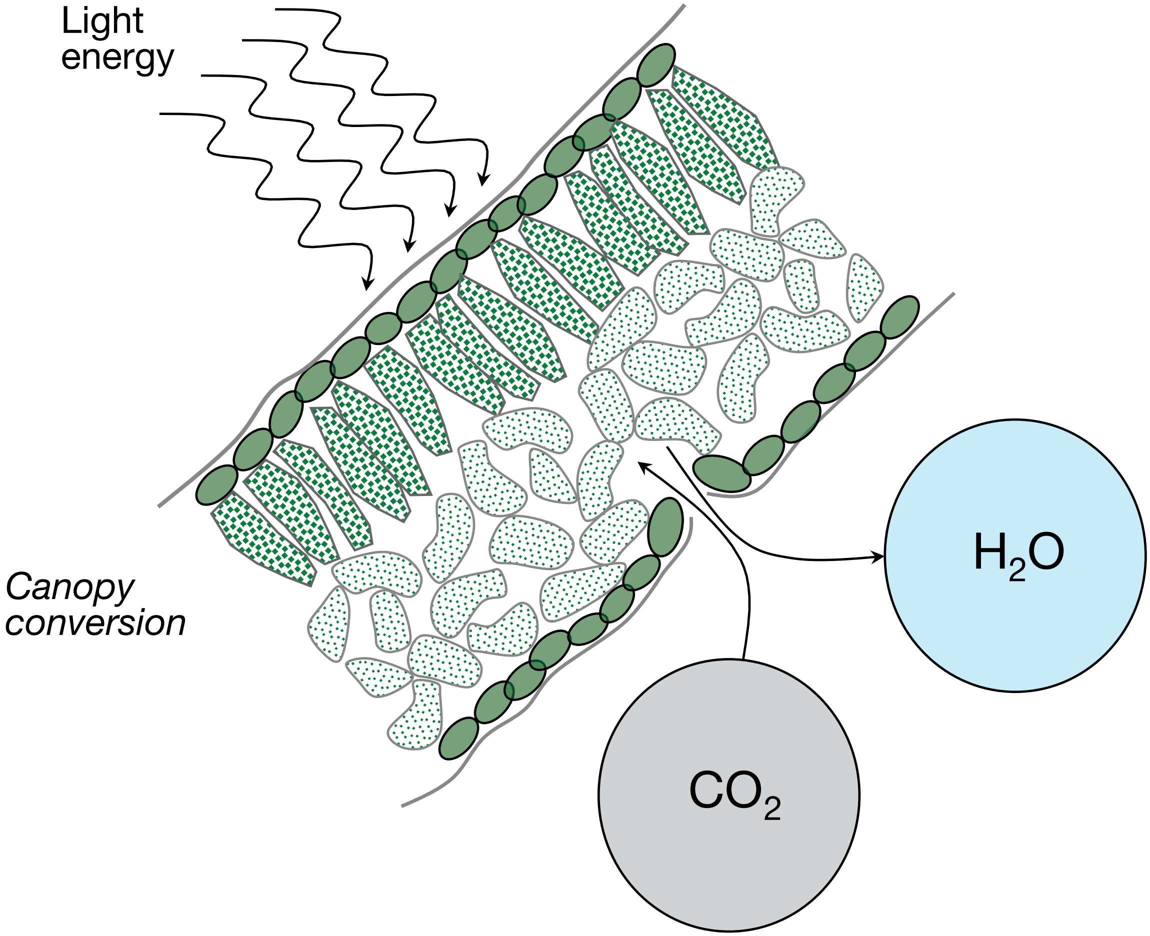


Figure 1. Canopy capture and conversion of natural resources

Yield potential

Enhancing grain yields

Given the average sun and rainfall available in the UK, with solar energy capture at 55% to 60% for spring and winter beans respectively, we can calculate the potential yields for these crops.

The conversion of solar energy as 1t/TJ and a harvest index of 60% would give spring beans a potential of 12t/ha on light soil types* and 14t/ha on water retentive soil**.

*Light soil types assume 160mm available water; Figure 2a

**Water retentive soil assumes 260mm available water; Figure 2b

This is far more than average yields that are currently achieved.

New varieties and new agronomy practices must be developed and combined synergistically, to achieve such yield potentials.

Energy capture can be increased mainly by delaying canopy senescence. Such canopies will often need to capture extra soil water, which will require deeper roots.

Mapping yield potentials

Southern regions receive most solar radiation and western regions receive most summer rainfall, so greatest yield potentials are in the south west whilst smallest potentials are in the north and east.

Local soil variation will often affect potential yields.

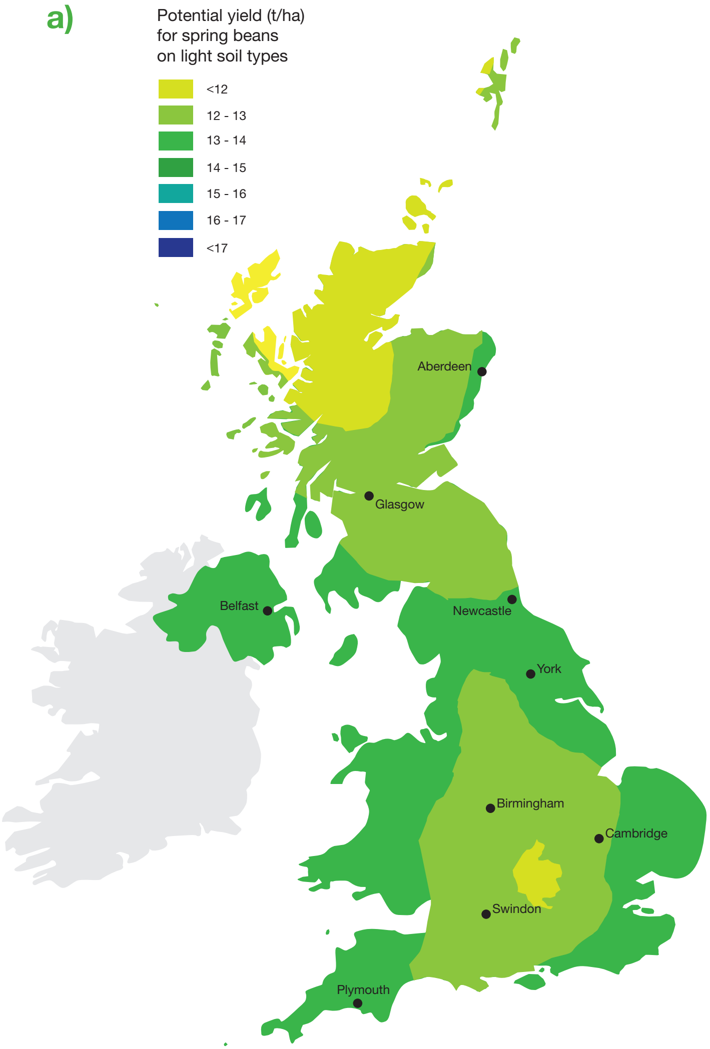


Figure 2. Potential yields of spring beans in a) 160mm and b) 260 mm available soil water environments

Nitrogen fixation

Nitrogen fixation (N) is one of the biggest benefits of growing pulses in rotations. The amount of N fixed by pulses typically ranges between 150 to 240 kg N/ha, but can be as high as 400 kg N/ha. There are many factors which can affect this, some of which can be influenced by management.

Soil mineral (N)

Although pulses are known for relying on their symbiosis with Rhizobium for fixed N, they can also utilise on soil mineral N (SMN). Typically, 50-60% of the total N uptake by pulses is from fixed nitrogen, but can reach as high as 70-80% in forage legumes. However, high concentrations of SMN (200-250 kg N/ha) will inhibit N fixation, which can reduce total N uptake from fixed N to 35-50%.

pH

A soil of pH 6.5 is the optimal pH for N fixation to occur. Avoid soils becoming lower than pH 5.5.

Phosphorus (P) and Molybdenum (Mo)

Deficiencies in mineral nutrition can reduce N fixation, especially P and Mo.

Temperature

N fixation is most effective when soil temperatures are between 7°C and 20°C. N fixing nodules develop around 3-5 weeks after plant emergence.

Sunlight

N fixation requires lots of energy, using about 30% of the energy captured by the plant through photosynthesis (Figure 3). It is essential to continue N fixation through flowering to supply enough N required for seed growth. This is dependent on providing enough energy through photosynthesis during grain filling by maintaining green leaf area.

Other factors

Any other factors which limit either root exploration of the soil or nodulation will limit N fixation, such as poor soil structure (i.e. compaction), dry soils, waterlogging and salinity.

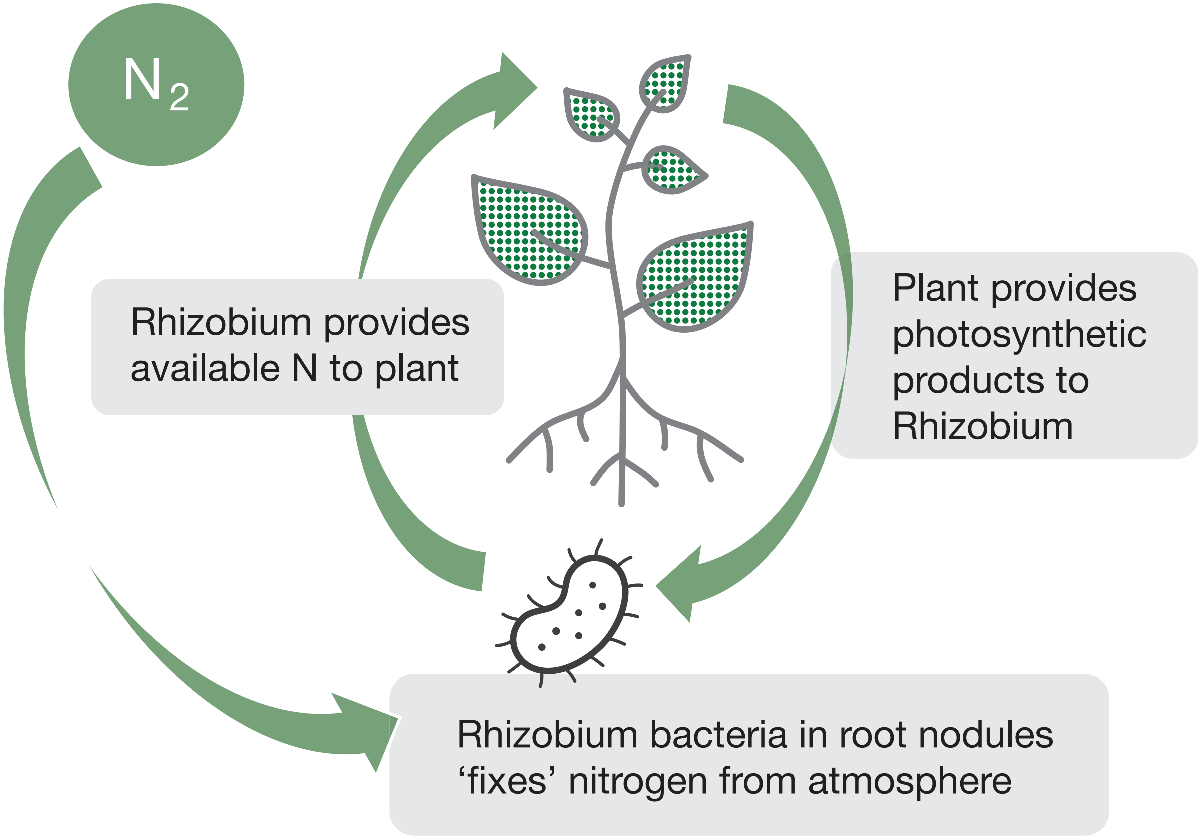


Figure 3. Nitrogen fixation cycle

Canopy expansion and light interception

Canopy size

Canopy size can be expressed as Green Area Index (GAI) – the ratio of total green area (one side only) to the ground area occupied.

The size of the GAI required for light interception depends on how erect the green tissues are. Crops with more erect leaves need a larger GAI to intercept light.

A GAI of 3 to 4 units should be sufficient for a crop to intercept 90 to 95% of incident light (Figure 4). It will be important to reach this canopy size by flowering to help ensure pod numbers and seeds per pod are maximised.

The crop requires approximately 30 kg N/ha to build each unit of canopy, so will require 90 to 120 kg N/ha for light interception.

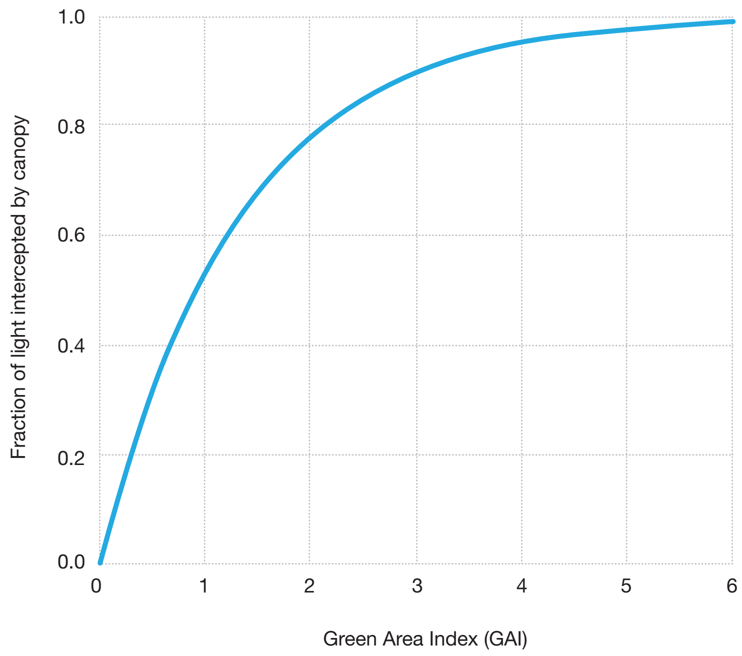


Figure 4. Impact of GAI on light interception

Nitrogen and light capture

During grain filling the growing bean seeds have a high demand for N which comes from current N fixation, uptake of soil mineral N and relocation of N from the canopy.

Crops with a high yield potential may benefit from growing a larger canopy than is required to intercept 90-95% of light to help meet the N demand of the seed.

During early grain filling, the top two thirds of the canopy intercept 90% of the light, with leaves intercepting almost 60% of total light (Figure 5).

This emphasises the importance of maintaining healthy leaves for as long as possible during grain filling.

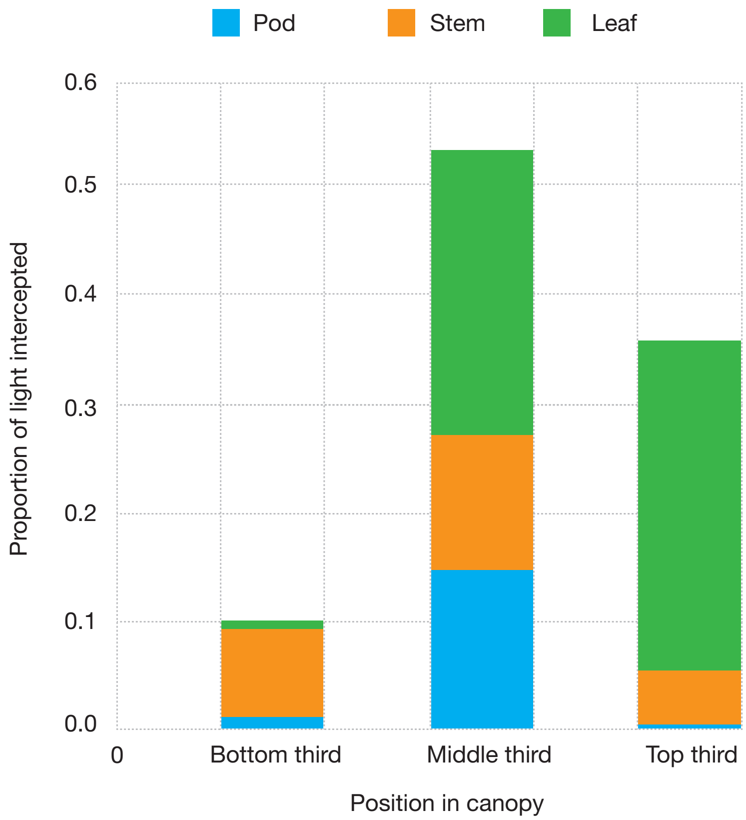


Figure 5. Light interception by canopy levels and plant organs

Beans are semi-determinate and can continue vegetative growth after flowering.

Yield formation

Yield components

The principal components of yield are seeds/m^2 and seed size. Seeds/m^2 results from a combination of plants/m^2, shoots per plants, pods per shoot and seeds per pod.

The development of each yield component occurs during different phases of growth, which means analysis of these characters can indicate when a crop may have been positively or adversely affected by management or conditions.

Unlike cereals, beans are semi-determinate and can continue vegetative growth after flowering. This means there is often substantial overlap and competition between the growth phases of each yield component (Figure 6).

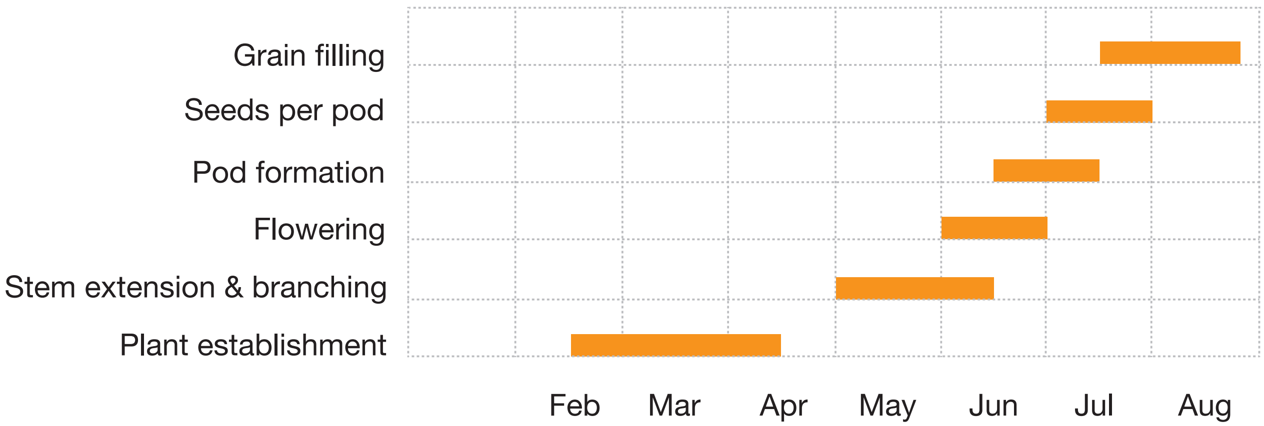


Figure 6. Yield component development of spring beans through time

Yield components

Plant population

Determined by seed rate and establishment.
See page 20 for optimum plant population.

Shoot number per plant

Determined during stem extension and influenced most by plant spacing and water supply. Winter beans often branch more than spring beans.

Pods per shoot

Related to number of nodes per shoot which may be related to plant height and the conditions during stem extension. Flowers from these nodes may be aborted under stressful conditions such as high temperatures, drought or dull conditions.

Variety may affect the importance of self-vs-insect-pollination for pod formation.

Seeds per pod

The potential number of seeds per pod is set following flower fertilisation and is sensitive to the amount of photosynthesis during this period.

Sink size is mainly determined by seeds/m²

With potential seed size also having an effect

Source is the ability to fill the sink

Determined by photosynthesis during grain fill

Seeds/m²

A function of plant number, shoots per plant, pods per shoot and seeds per pod. Seeds/m² determines the sink size of the crop.

Seed size

The potential seed size is set after flowering and is sensitive to photosynthesis during this period. The seed's ability to reach its potential size is determined by the rate and longevity of photosynthesis during grain fill.

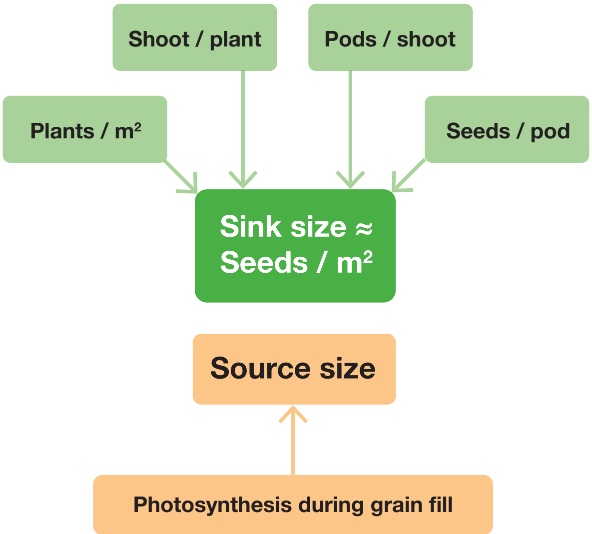
Variety affects most yield components.

Both the number of seeds set (the sink size) and the ability to fill these seeds (the source size) are important factors in determining final yields.

Source vs sink limitation

Analysis of BASF trials and the Bean YEN dataset have both found associations with the number of seeds set per metre squared and thousand seed weight (TSW) with yield.

Therefore, both the number of seeds set (the **sink size**) and the ability to fill these seeds (the **source size**) are important factors in determining final yields that crop managers must focus on.



Nutrient uptake

Proportion of nutrients

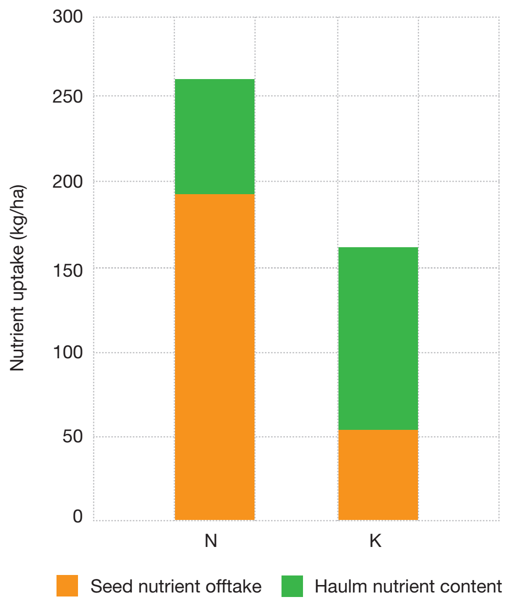
The proportion of nutrients partitioned between the seed and the haulm varies considerably by nutrient. The plant partitions a greater proportion of nutrient uptake to the seed for phosphorus, nitrogen, zinc and sulphur, with less portioned to the seed for calcium, boron, potassium and iron.

The amount of nutrients taken up by a bean crop yielding 5 t/ha are about 250 kg/ha for N, 150 kg/ha for K, 30 kg/ha for P and 14 kg/ha for S (Figure 7).

Nutrient offtake (kg/ha)
=
Average nutrient concentration (%)
x
Average yield (t/ha)

Diagnosing nutrient deficiencies

The nutrient concentrations in the grain are important to consider at the end of a growing season to help assess if the supply of nutrients was deficient (either due to inadequate supply or inability of the root system to access nutrients) or a nutrient surplus – and therefore whether there could have been environmental and financial benefits from applying fewer nutrients.



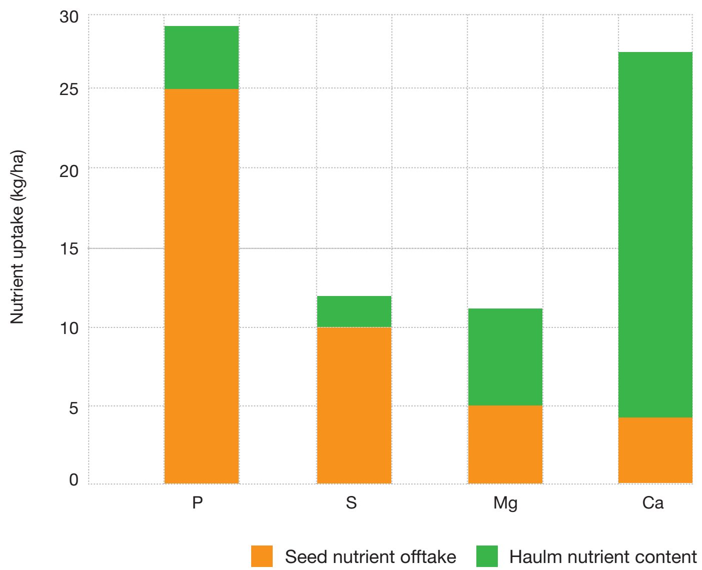


Figure 7. Nutrient uptake for a bean crop yielding 5 t/ha (15% moisture)

Ideal traits for a high-yielding bean crop

The dataset collected from the Bean Yield Enhancement Network (YEN) (2019-2021) has highlighted that there are specific plant characteristics that are likely to be needed to achieve high yield.

High yielding ideotype

From this, a new high yielding ‘ideotype’ has been designed for beans. An ideotype is a combination of morphological and/or physiological traits that can be targeted to enhance crop yields.

Analysis of the Bean YEN dataset demonstrates that high yields in both winter and spring beans relate positively to:

- **Later senescence**
- **Greater plant height, total biomass and shoot number**
- **More seeds/pods, thousand seed weight**
- **Greater harvest index - ratio of grain to total biomass**

Multi-noded, tall stems, are likely to prolong the flowering and pod-setting periods, improving resilience against conditions that reduce flowering and pod set.

Our new Bean YEN ideotype has:

- **Tall, multi-noded stems**
- **Prolonged canopy survival**
- **Deep roots**

Having multi-noded stems with more pods will prolong the period of flowering, helping to insure against adverse conditions.

Influential husbandry and environmental factors on bean yields

The following environmental and husbandry factors have been identified as being influential on the production of multi-noded, late maturing ideotypes, which lead to higher yields:

Adverse weather

Temperature, light and rainfall are critical in the four days following flowering for flower retention and pod set. High temperatures at fertilisation can reduce self-pollination and cause flower abortion.

Having multi-noded stems with more pods will prolong the period of flowering, helping to insure against adverse conditions.

Pollination and fertility

Although bean crops can self-pollinate, fertilisation is improved by a greater abundance of pollinators. It is also possible that there are varietal differences in fertility.

Maximise water capture

Water limitations can have negative implications on many aspects of yield formation. Encouraging deep rooting is key to good water capture, which can be aided by limiting soil compaction, good seed bed conditions and maintaining a good soil structure throughout the soil profile.

Maximise green canopy duration

Maximising green canopy duration is key to maximise the capture of sunlight.

- Achieve full ground cover by early May through good crop establishment (e.g. good seedbed, appropriate sowing date, depth and seed rate)
- Provide sufficient nutrients, especially P and S, to allow the canopy to expand and fix N
- Make use of resistant varieties and fungicides to prevent early canopy senescence commonly caused by chocolate spot development
- Make use of fungicides, such as Signum®, that provide physiological greening effects to prolong canopy life

Cultivations and establishment techniques

Cultivations

Unlike other combinable crops, beans do not necessarily require a fine seedbed; slightly cloddy conditions will be tolerated. However, to get the best efficacy out of any residual herbicides, a well consolidated seed bed will be advantageous.

Beans are large seeded and require adequate moisture to germinate, so good seed to soil contact is essential. Although less sensitive to compaction than peas, PGRO suggest that soil compaction can reduce yields by up to 40%. Compaction results in poor root development and if there is a high soil moisture deficit, this can exacerbate plant stress.

Rotation

To avoid soil borne diseases, it is advised that legumes are grown no more than 1 in 5 years.

Drilling depth

Drilling depth seems to have a significant correlation on establishment and overall yield. PGRO recommend that drilling to a depth of 7.5-12.5cm provides the best establishment. This is supported by three years of BASF survey data, which showed a yield uplift of 0.4t/ha above the average for growers who drilled to a depth of 10-13cm.

Have patience

It is important that beans go into the right conditions, so have patience to wait 'til the time is right. Spring beans forced into poor conditions such as cold and damp seed beds will not thrive. Ensuring there is adequate moisture and the seed is well covered, with good soil to seed contact will give it the best start.

Seed quality

Seed should be tested for germination, pests and diseases. For germination, you are targeting 80% or above and for pests, you are looking for seed completely free of stem nematode.

Seed should have no more than 1% *Ascochyta fabae* as this seed borne disease can be extremely damaging to the crop. It is also worth noting the moisture content and any physical damage to the seed as this may also affect establishment. Seed tests are available from PGRO.

Seed rate

For winter beans, the target plant population is between 18 – 28 plants/m^2, depending on variety. For spring beans, the recommended seed rate is 50-55 plants/m^2 or 40 plants/m^2 on very fertile land.

The seed rate can be calculated from the following formula:

$$\text{Seed rate (kg/ha)} = \frac{\text{thousand seed weight x target population plants/m}^2}{\%\text{ germination}} \times \frac{100}{(100\text{-field loss})}$$

Establishment diseases

Keeping the crop clean and free from disease throughout its growing period is the best way to ensure maximum yield is maintained. Below are a few of the key early-stage diseases to look out for.

Downy mildew

Downy mildew is predominantly an issue on spring beans, where it causes greyish-brown, felty growth on the under-surface of the leaves. The disease favours cool, humid conditions which are often felt in late spring. It is important to look at the disease rating on the PGRO Descriptive List of Varieties, which ranges from 1-9, with some varieties having high resistance to the disease.

Photo credit: Simon Goodger, University of Lincoln

Leaf & pod spot (*Ascochyta fabae*)

Leaf and pod spot is primarily a seed borne disease, so using certified or tested seed is the best way to prevent infection. Whilst the disease is seed borne, air borne spores can also cause infection, so if growing winter beans in close proximity to the previous year's crop then it is important to look out for early signs of infection.

Lesions are greyish-brown, circular to oval in shape and often develop a lighter grey centre. Small, pin-prick sized dark pycnidia form in the centre of the lesion. As the name suggests, lesions can spread from the leaf onto the stem and pod surface, where they appear sunken and dark in colour. This type of infection can also blemish seeds inside the pod.

Establishment pests

Pea and bean weevil

Pea and bean weevils are active in early spring when they migrate in from grassy, uncultivated field edges of fields previously cropped with legumes.

They begin feeding on plants, leaving characteristic 'u' shaped notching around leaf edges. Whilst feeding, eggs laid by the female weevil are washed into the soil around the stem base and produce larvae.

It is these larvae which begin feeding on the root nodules which can be particularly damaging. Insecticide sprays can be applied at the first sign of leaf damage and repeated after 7 – 10 days.

Stem & bulb nematode

The stem & bulb nematode has become a major pest in field beans, causing severe problems in wet seasons particularly where infected farm-saved seed has been used. The pest can be seed or soil-borne, therefore ensuring seed is tested and a long rotation is maintained are important IPM techniques to reduce the risk of infection.

Damage from the stem & bulb nematode is not initially apparent, usually becoming most noticeable around the flowering stage. Plants may appear stunted with thickened and twisted stems. Leaves can be thickened and brittle with a bronze discolouration in the leaf petioles. Later, stems may turn a browny red colour and swell, twist and break. Pods tend to fill unevenly and seeds are poorly developed, becoming black and shrivelled as they mature.

Affected plants may be isolated or in larger patches of the field. Isolated occurrences are more indicative of an infested seed source whereas patches throughout the field are more likely to suggest a soil infestation.

Seed and soil testing for stem & bulb nematode are now available from PGRO.

Weed control

Pre-emergence weed control

Crops sown into fields with a high weed burden will struggle with competition for light and moisture. For this reason, early weed control is important to maximise yield.

Post-emergence options for weed control in beans are very limited, therefore it is important to make the most of the armoury available at the earlier pre-emergence timing.

Product (active)	Winter Beans	Spring Beans
Nirvana® (imazamox + pendimethalin)	On-label approval	On-label approval

Work has shown that the full 4.5 l/ha rate can effectively reduce cleaver numbers and control a wide spectrum of weeds.

Nirvana® shows excellent activity against polygonums, black-bindweed, redshank and knotgrass. Charlock is also effectively controlled as is chickweed.

Nirvana® also gives excellent control of early emerging volunteer oilseed rape. Seed should be drilled to a depth of 25 mm and fields prone to water logging should be avoided.

Product (active)	Winter Beans	Spring Beans
Emerger® (aclonifen)	On-label approval	On-label approval

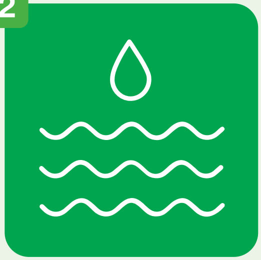
Product (active)	Winter Beans	Spring Beans
Centium® 360CS (clomazone)	On-label approval	On-label approval

Product (active)	Winter Beans	Spring Beans
Kerb® (propyzamide)	On-label approval	Not approved

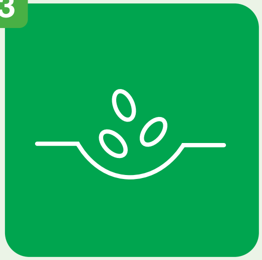
Application advice for pre-emergence weed control

1 

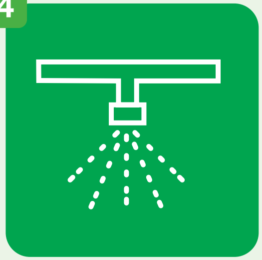
Good seedbeds and soil structure benefit both crop establishment and the performance of pre-em herbicides

2 

Don’t use on water-logged soil or soils prone to waterlogging

3 

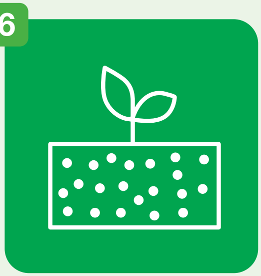
Fine, firm seedbeds improve seed to soil contact which improves germination and establishment

4 

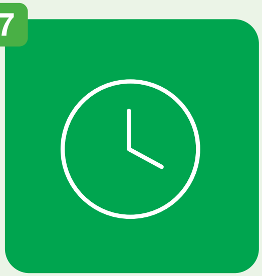
Level and consolidate loose, cloddy or open tilth before spraying pre-em herbicides

5 

Do not apply where the seedbed is stony, rough, cloddy or open, or when heavy rain is forecast

6 

Clod-free seedbeds also aid efficacy and crop safety of pre-em herbicides

7 

Ideally apply within 48 hours of drilling

8 

Drill to a minimum depth of 25mm and ensure seed is fully covered with settled soil

Post-emergence weed control

Post-emergence weed control options in both winter and spring beans are limited. Bentazone is the only approved active ingredient which can come in a range of products such as Basagran® SG.

Bentazone offers useful follow-up weed control for cleavers and volunteer OSR. For maximum efficacy, apply when weeds are small. Water stewardship should take high priority when applying Bentazone due to its water solubility.

Know your Bentazone risk

At present, bentazone is the only post-emergence herbicide for broad-leaved weed control in beans and one of the few post-emergence herbicides in peas to control some challenging weeds such as black nightshade.

Basagran® SG

BASF's Basagran® SG offers broad leaved weed control with bentazone.

Key benefits

- Reliable R&D manufacturer
- Full technical support
- Single or split-dose recommendations

Water stewardship

Bentazone is a highly soluble compound in water and is very mobile in soil which has resulted in it being detected in both ground and surface water. Securing the future of bentazone has to come from improved farm and field practice.

Every person who is applying bentazone, irrespective of the area, has a responsibility to maintain high levels of stewardship and help improve water quality.

Top tips to reduce the risk of bentazone entering surface and groundwater

1 Ensure the field is suitable before planting the crops
Check your soil type to see if you are at a high risk of chemistry leaching through the soil.

2 Avoid high risk areas
Use our mapping & planning tool to help you choose the best site to avoid high risk areas.

3 Keep chemistry on the surface
Avoid spraying your crop on wet days or when there is significant water sat in the field.

4 No spray zone
Having a 6m buffer zone/5m no spray zone around the edges of the field will help where there are high risk areas.

5 Consider how and where you fill the sprayer
Take care when handling the product, filling and cleaning the sprayer to avoid leaks or spills.

A handy tool in your pocket

A new, free tool has been developed by BASF, Nufarm & Sharda Cropchem to help make bentazone stewardship easy.

The tool helps to easily identify high risk areas for bentazone, allowing you to easily plan where and when your bentazone applications should be made.

Scan the QR code below, or visit **www.agricentre.basf.co.uk/sustainability** to try the new Mapping & Planning tool.

Scan QR code for more information

Flowering pests

Black Bean Aphid

The black bean aphid can be very damaging to field beans if colonies develop prior to flowering. Spring-sown crops are usually more likely to suffer damaging attacks than winter beans. Damage is usually as a result of direct feeding; plants fail to develop and pods do not fill normally.

The honeydew produced from the aphid feeding can also result in secondary moulds and diseases infecting the plant, including chocolate spot. The black bean aphid can also act as a vector for viruses such as the bean leaf roll virus.

The winged aphids migrate into the crop in early summer and once established in the crop, can produce several wingless nyphs each day.

Whilst easy to control with aphicides, due to their concurance with the crop flowering, it is important to consider options which are not harmful to pollinating insects. Applications made at early flowering or when 5% of plants are infested reduces infections of aphid-transmitted viruses.

Flowering viruses

Bean Leaf Roll Virus (BLRV)

BLRV is aphid-transmitted and both the black bean aphid and pea aphid are vectors. Usually infection is more obvious where aphids infest the crop before flowering. The pea aphid is more likely to move into beans at this time. Control of early invading aphids is essential to prevent virus infection.

Bean Yellow Mosaic Virus (BYMV)

BYMV develops in beans at any time before flowering. Leaves are crinkled and may become pointed. Vein clearing can develop and the plant is slightly stunted.

It is similar to Pea Enation Mosaic Virus (PEMV) but without the translucent spotting and streaking on the leaf surface.

The virus is aphid transmitted and common in field beans. Infection may be on individual plants or groups of plants and, depending on severity, yield can be severely reduced.

Pea aphid is the principal vector, although black bean aphid can also transmit the virus. Early control of aphids in flowering bean crops is the most effective means of preventing virus infection.

Flowering diseases

Chocolate Spot (*Botrytis fabae*)

Chocolate Spot can be an extremely yield robbing disease. It is estimated to commonly cause yield losses of 25%, but in conducive conditions yield losses can reach 90 – 100%.

Thriving in long periods of overcast and humid weather conditions, the disease can spread rampantly, especially where plant populations are high. ADAS research suggests that temperatures of 15 - 22ºC and high relative humidity of >80% are most favourable for the disease, with rainfall and wind also helping spore dispersal and disease spread. Winter beans are most susceptible, however spring beans can also develop Chocolate Spot during humid conditions.

The disease develops as small, circular, chocolate coloured spots on infected leaves. These become larger and may coalesce to form a greyer coloured lesion extending over the leaf surface. Stems and pods can also develop a covering of spots or flecks. Severe infections can result in defoliation.

Protectant fungicides should be applied as soon as the first lesions appear in the crop or by mid-flowering at the latest. A second spray should be applied 3-4 weeks later if spotting continues to develop on the upper parts of the plant. A third spray is seldom required as sprayer damage can cause more yield loss than late infection of Chocolate Spot.

Bean Rust (*Uromyces fabae*)

The disease is characterised by numerous reddish-brown pustules on the leaves. It is more serious on spring beans and all varieties are susceptible. Most damage occurs if infection begins during flowering and pod set.

Various fungicides are effective for Rust management and may improve yield etc. in either winter or spring beans, but treatment is unlikely to be worthwhile if infection begins when pod fill is complete and the crop is beginning to senesce.

Disease control and Signum®

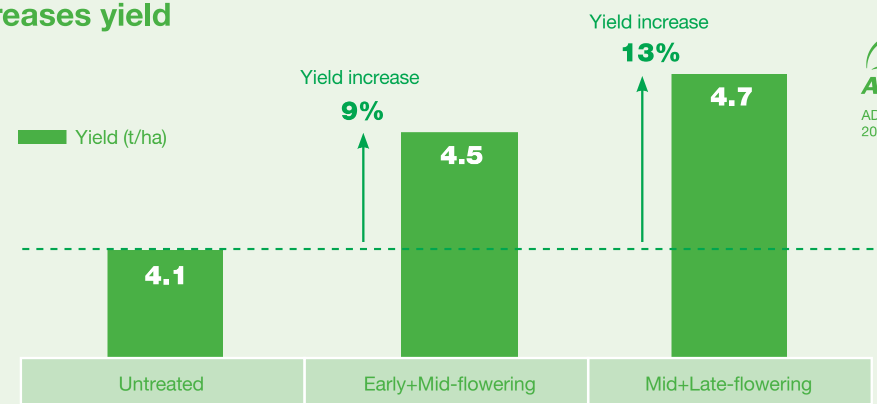
Widely recognised as the best product for Chocolate Spot control, Signum® maximises pulse yields by stopping Chocolate Spot and Rust in their tracks, whilst also prolonging green leaf area, and providing the best return on investment compared to alternatives.

Signum® maximises yield potential and crop quality

Signum® maximises yield, even in the absence of disease. PGRO and ADAS trials show how Signum® gives a significant yield uplift.

In the ADAS trials shown below, Signum® provided a 14% yield uplift on an already high yielding crop and there was evidence it increased photosynthesis.

Signum® increases yield



ADAS Bean Physiology Studies 2020-2022, N=3, winter & spring beans

Key benefits

- Provides the best return on investment
- Builds yield potential and crop quality
- Delivers excellent control of Chocolate Spot, Grey Mould and good preventative activity against Rust
- Provides physiological benefits from both boscalid and pyraclostrobin, resulting in increased green leaf retention throughout the season and reduction of stress

> “In our trials, Signum® kept winter beans greener for longer, with up to 17% uplift in yield”

Dr Becky Howard - PGRO

Signum®

Rate and timing recommendations

Field beans

Situation	T1: Early flowering	T2: Mid-late flowering
High or moderate disease risk situations	Signum® 0.5 - 0.75 kg/ha	Repeat Signum® application after 2-3 weeks if disease pressure high
No early disease pressure - delay 1st spray		Signum® 0.5 kg/ha Add Sunorg® Pro if rust is active
Moderate-high early disease risk, 2nd spray after 3-4 weeks if rust active but low risk of chocolate spot	Signum® 0.5 - 0.75 kg/ha	Sunorg® Pro 0.6 - 0.8 l/ha

Signum® controls all the key diseases in beans

Field beans

Product	Chocolate spot	Bean rust	Ascochyta
Signum®	*****	****(*)	***
Sunorg® Pro	**(*)	*****	*
Azoxystrobin + tebuconazole	****	*****	****
Elatus™ Era	****	*****	-

Very good control: *****
Poor control: *
No information available: -

Signum®

The T1 product
of choice for beans.

Scan QR code for
more information

agricentre.basf.co.uk/signum

Harvest and storage

Harvest

Bean harvesting dates will depend upon weather, variety and crop location, but spring-sown crops are often earlier to mature than winter ones.

Desiccant usage

Bean leaves usually fall during ripening and a desiccant has little effect on stems, so weed-free crops are not normally desiccated. If the crop is very weedy or has a few small late-set pods which are still green, a desiccant can aid harvesting.

Glyphosate is the only fully approved product for pre-harvest weed control, but is not a true desiccant. It should not be used on crops destined for seed production.

It should be applied when at least 90% of pods are dry and black and most seed is dry. Bean pods blacken and seed becomes dry and hard first, but stems usually remain green for longer.

Combining

The pods will be easily threshed and the seed fit for combining at 18% moisture content (MC) but, to avoid combine blockages, it is best to wait until only a small percentage of green stem remains.

If the seed is very dry, it may be damaged and seed crop quality may be reduced. If the crop is likely to shell out, losses can be reduced if the beans are combined when slightly damp in the early morning or evening.

Storage

Storage in dark areas is recommended for beans destined for the human consumption market in order to delay the development of tannins which cause beans to discolour.

Drying

The quality standard ex-farm is usually 14% MC and 2% impurities, or a combination of the two should not exceed 16%. Merchants may accept beans at 16% MC. Beans must be dried down to 14% MC for long-term storage in bulk. This is important since beans are often stored for some time before they are sold.

The large seed size of beans makes drying difficult as beans have a low resistance to air flow. It takes time to move moisture from the inside to the outside and slow, gentle drying with ambient air is best. Mouldy produce is unacceptable for animal feed or other markets.

Where high quality is important, high temperatures in continuous flow driers should be avoided since they may cause cracking.

Floor ventilated bins are also suitable. When the initial moisture content is high, transfer of beans from bin to bin and the use of warmed air together with adequate ventilation may be necessary to avoid mould developing in the upper layers.

Radially ventilated bins allow faster drying than floor ventilated bins but care must be taken not to overheat the beans.

On-floor drying using ambient or warmed air is also successful, but care must be taken not to load beans too deep if moisture content is high and if lateral ducts are spaced wider than 1m.

Notes

Further information:

Thank you for reading the BASF Bean Guide, produced in collaboration with PGRO & ADAS. Please see below for further information.

BASF: www.agricentre.basf.co.uk
@BASFCropUK

PGRO: www.pgro.org
@pgroresearch

ADAS: https://adas.co.uk
@ADASgroup

Disclaimer

Amistar® contains azoxystrobin. Basagran® SG contains bentazone. Centium® 360CS contains clomazone. Elatus™ Era contains benzovindiflupyr and prothioconazole. Emerger® contains aclonifen. Nirvana® contains imazamox and pendimethalin. Kerb® contains propyzamide. Sigum® contains boscalid and pyraclostrobin. Sunorg® Pro contains metconazole.

Use plant protection products safely. Always read the label and product information before use. For further product information including warning phrases and symbols refer to **www.agricentre.basf.co.uk**. For further information, please do not hesitate to contact your local BASF Agronomy Manager or the BASF **Technical Services Hotline: 0845 602 2553.**

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We create chemistry