2014

PGRO PULSE AGRONOMY GUIDE

Advice on agronomy and varieties of combining peas, field beans and lupins including PGRO Recommended Lists

CONTENTS

1 VALUE OF PULSES IN THE ROTATION

Well grown pulse crops are profitable in their own right, but their financial benefits need to be looked at in two ways. Firstly, that of the individual crop and, secondly, that of the whole farm rotation.

Pulses can provide substantial rotational benefits to subsequent crops, particularly cereal or oilseed crops.

- Pulses provide a disease break for cereals and oilseed rape.
- They require no nitrogen fertiliser as sufficient nitrogen is fixed from the atmosphere by naturally occurring Rhizobium bacteria in root nodules.
- Pulses leave a residue of between 25 – 50kg N per hectare which is utilised by a following winter wheat crop.
- European research shows that winter wheat yields increase by 0.84 t/ha after peas compared to wheat.
- Choice of spring or autumn planted pulse crops can spread the workload.
- Peas are suited to medium to light soil types and beans to medium to heavier soils, giving a choice of pulse crops for most situations.
- Spring beans or peas can follow over-wintered stubble allowing adequate time to control problem grass weeds such as blackgrass.
- Over-wintered stubbles can also attract Entry Level Stewardship (ELS) payments.
- Winter beans are suited to heavier soil types where spring planting may be impractical.
- Most pulses are harvested before or after the cereal crop.

2 PULSES GROWN IN THE UK

The development and introduction of new pulse varieties calls for close liaison between growers, processors and plant breeders. PGRO is the prime link between the three parties through independent trialling.

Spring Peas

Spring peas are very versatile, most varieties are semi-leafless with high yields and improved standing ability. However, heavy rainfall and wind in June and July can result in tall crops prone to lodging. Growing peas on lighter soils reduces lodging risk, and the tolerance of peas to drought stress allows good yields in low rainfall areas. Spring peas mature early enough to allow production as far north as central Scotland.

Spring Beans

Spring bean production has fluctuated, the success of the crop linked to early summer rainfall. In dry years, yields can be disappointing, but in wet years much better results can be expected. Vulnerability to drought can be reduced by growing on more moisture-retentive soils and by sowing early. Spring beans are now being successfully produced in arable areas of Northumberland and southern Scotland with good yields. In these higher rainfall areas, the late maturity of spring beans needs to be considered and early maturing types are now available for selection. Premium markets exist for small, round-seeded samples which can be used for pigeon feed, and for pale-seeded beans which can be exported to the Middle East for human consumption.

Winter Beans

This is the classic pulse crop for heavy land that is difficult to work in the spring. Though the preferred method of establishment is by drilling, ploughing-in remains an option as winter beans usually show great vigour during germination. Early crop development reduces their susceptibility to early summer drought.

Lupins

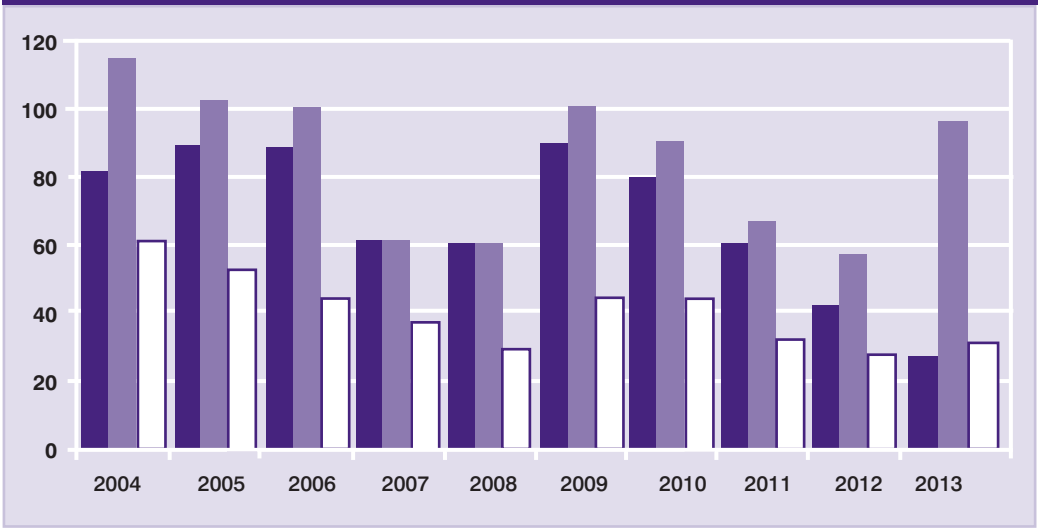
The major advantage of lupins is their high protein content, ranging from 30 to 45%, depending upon species, variety and growing conditions. They also provide a useful level of oil. Lupins therefore present useful possibilities for home grown pulses in animal feeding rations. However, most lupin types are relatively alkaline intolerant and care should be exercised in choosing varieties to suit soil types. Lupins tend to be used as a crimped or ensiled product for animal feed.

Other Pulses

In addition to peas and beans, opportunities now exist for other protein-rich dried pulse crops, e.g. navy beans.

3 UK PULSE CROP AREA

UK Pulse Crop ('000ha)



Source: Defra / PGRO

UK Bean production

	2009/10	2010/11	2011/12	2012/13
Area Winter	79	82	58	41
Area Spring	86	86	67	50
Yield Winter	3.7	2.9	3.1	3.4
Yield Spring	3.6	2.0	3.4	3.4
Production Winter	292	237	179	140
Production Spring	309	249	227	170
TOTAL ('000s tonnes)	**601**	**486**	**406**	**320**

Source: British Edible Pulse Association

4 VALUE OF PULSES FOR ANIMAL FEED

The principal markets for UK peas and beans have been for human consumption where the chief drivers have been appearance characteristics of the whole grain rather than the nutritional value of the legume crop.

However, with the continuing increase in the cost of soya beans, and questions raised about our increasing dependence on imports and their environmental impacts, UK-produced peas and beans are being considered a more viable protein source for animal feed.

The following tables provide a guide to the relative value of peas and beans for feed compared to soya.

Composition

	field beans(%)	combining peas(%)	soya bean(%)
dry matter	86.0	86.0	88.0
oil	1.5	1.0	1.9
starch	37.0	44.6	-
cellulose	8.0	5.2	6.0
minerals	3.5	3.0	6.4
protein	25.0	20.7	45.3

Source: INRA, Arvalis-UNIP

Amino acid composition

	crude protein (%)*	Lysine (%)*	Methionine (%)*	Methionine +cystine (%)*	Threonine (%)*	Tryptophan (%)*	Valine (%)*
peas	20.74	1.51	0.19	0.48	0.79	0.20	0.97
beans	24.74	1.56	0.18	0.48	0.85	0.21	1.11
soya bean	47.78	2.92	0.65	1.35	1.86	0.65	2.27

Figures standardised to a dry matter content of 88%

Source: Green Pig Project – "Increasing the use of home grown pulses in pig nutrition" (SAC, University of Nottingham and NIAB) with industrial partners, BOCM Pauls, BPEX, Evonik-Degussa, Genesis QA, Harbro, Premier Nutrition Products, PGRO, QMS, Soil Association and UNIP, with Defra support (Sustainable Livestock Production LINK).

5 THE MARKET FOR PULSES IN THE UK

The UK produces around 400,000 tonnes of beans each year and these go into UK animal and fish food and are exported for feed and for human consumption.

UK feed buyers use beans to feed to aquaculture as they are an excellent binder in a high protein fish food diet. When beans are a relatively close value to wheat, they are also included into cattle and pig rations.

Beans are an important agricultural export for the UK which supplies over a third of all the human consumption beans consumed in North African countries, with Egypt being a major market.

The UK produces over 100,000 tonnes of dried peas each year. Half of these are for human consumption as processed or marrowfat peas, with the balance being micronised for specialist animal consumption and pet products.

Peas are a profitable crop for the specialist growers who produce marrowfats and blue peas plus a small area of yellow peas. For peas, colour is vital, and the UK can compete due to superior cleaning and traceability.

The outlook for pea marketing is positive, with UK demand for combining peas constant, while market requirements are changing from processed peas to mushy peas and domestically-produced snack foods.

The range of pulse markets serviced by the UK trade is given in the table below.

Use	Special requirements
Animal Feed	Peas, beans and lupins in competition with imported soya meal and other vegetable protein. White or green-seeded peas used and a premium can be paid for lupins because of their high protein content.
Edible Export Beans	Beans must be clean, sound and have low levels of bruchid damage.
Green Peas a) Micronising b) Export	Large blue varieties used almost exclusively.
White Peas	Commercially referred to as yellow peas.
Marrowfat Peas a) Canning b) Packet c) Export (Far East) d) Other Export	Samples must be clean, sound with only low levels of moth damage, and pass soaking and cooking tests.
Small Blues	Samples must be clean, sound and pass cooking tests.
Pigeon Trade a) Maples b) Small blues c) Tic beans	Small grain size peas and beans

Source: British Edible Pulse Association, November 2013.

6 GROWING COMBINING PEAS

Combining peas *(Pisum sativum)* are a valuable break crop. The produce is mostly used for human consumption or as a high protein component of pet and livestock feeds.

The first step in planning a pea crop is to decide upon the intended market. Many types of high quality peas are suitable for a range of premium markets, but all types are suitable for animal feeds. Current marrowfat human consumption varieties are relatively lower yielding and they are often more expensive to produce - but they can command a high premium price. Production for seed is another option.

6.1 CLASSIFICATION AND QUALITY CRITERIA

Combining peas are classified into the following groups by type and quality criteria.

White flowered varieties

All varieties of white flowered peas are suitable for premium markets but can also be used for animal feed. These are further classified on the current PGRO Recommended List into white (yellow) types, large blues, small blues and marrowfats.

Type	Description	Quality criteria
White peas	Seed coat white/yellow, smooth and round. Primarily of use in animal feeds but small quantities of white peas are used for canning as 'pease pudding' and as split peas in ingredients for soups and prepared meals. Suitable for a wide range of soil types.	Commercially referred to as yellow peas. Samples for the human consumption markets should have smooth skin and a bright, even colour.
Large blues	Seed coat blue/green, smooth, large and round. In addition to the animal compounding market, large blue varieties can be sold for micronising and for human consumption for export or UK packet sales. The micronising process produces a high protein feed for use in certain dried animal rations and pet foods. Breeding programmes are now producing a number of high yielding large blue varieties with different agronomic characteristics suited to a range of soil types.	Sample colour is one of the more important quality criteria for micronising, with the higher premiums being offered for samples of green, large, even-sized seed.
Small blues	Seed coat blue/green, smooth, round and small. Varieties are available for use on a limited scale for canning as small processed peas, or for micronising or for the pigeon trade.	Canning samples must be free from waste and stain, and pass cooking tests. A good even, green colour is necessary for acceptance for the pigeon feed market.
Marrowfats	Seed coat blue/green, large, dimpled seeds. Varieties in this group are the most important for human consumption, being used for both dry packet sale and canning as large processed peas. They are suited to a wide range of soil types and some are relatively late maturing.	The best samples will go for export to the Far East. A good colour, free from blemishes, is also required for packet sales. Samples for canning must be free from waste and stain, and pass soaking and cooking tests.

Coloured flowered (Maple) varieties

A very small area of this type of pea is grown, principally for pigeon feed. Samples for this market are brown-seeded, small, round or dimpled.

Maples	Coloured flowered. Seed coat is brown, often with flecked orange / yellow markings. Principally used in the pigeon trade.	Samples for the pigeon trade should be blemish free, brown-seeded, usually small and sometimes round and smooth.

6.2 PGRO RECOMMENDED LIST OF COMBINING PEAS

The development and introduction of new pulse varieties calls for close liaison between growers, processors and plant breeders. PGRO is the prime link between the three parties through independent trialling.

Table characters

1 - 9 ratings

A high figure indicates that the variety shows the character to a high degree.

Yield

Yields are expressed in percentage terms in relation to the mean (100%) of a number of control varieties. Provisionally recommended varieties may only have been in trials for three years but a statistical adjustment makes their data comparable with fully recommended ratings, for which yield is based on the five year mean.

Earliness of ripening

Differences in maturity dates are greatly influenced by growing conditions and are extended in the north and west of the country. Maturity is expressed on a 1 - 9 scale: 1 = late, 9 = early. A difference of one point represents approximately two days in Eastern England.

Shortness of straw

This is greatly influenced by growing conditions. Shortness of straw length is expressed on a 1 - 9 scale: 1 = tall, 9 = short. A difference of one point represents approximately 7 cm.

Standing ability at harvest

Now incorporates the character for ease of combining, which has been removed. Standing ability has been improved with new varieties but crops often lodge at harvest. Standing ability is expressed on a 1 - 9 scale: 1 = flat, 9 = erect.

Resistance to wilt

This sporadic disease *(Fusarium oxysporum f. sp. pisi)* reduces yields and can only be controlled effectively by genetic resistance. Race 1 is the most common form, the majority of varieties are resistant to this race.

Resistance to downy mildew

Downy mildew *(Peronospora viciae)* is a soil-borne disease, favoured by cool, moist conditions. It can kill young plants and reduce pod-fill in older plants. Varietal resistance should be taken into account when deciding whether to use a seed treatment to control the disease. It is advisable that seed treatment is used where high levels of the disease have occurred before, or where susceptible varieties are grown, since there is no effective method of control after sowing.

Resistance is expressed on a 1 - 9 scale, where 9 indicates a high level of resistance. Generally, seed of any variety with a rating of 6 or below should be treated for downy mildew control.

Downy mildew is a variable fungus, with many different races. Occasionally some races may become more dominant in certain growing areas and some varieties may be more susceptible to these. Therefore, the ratings may change from year to year.

Thousand seed weight

This characteristic is very dependent on growing conditions. Data are presented in grammes and reflect the mean 1000 grain weight recorded in trials over a number of sites and seasons. These data have been established from samples at 15% MC.

PGRO Recommended List of Combining Peas 2014

The control for yield is the mean of Prophet & Mascara.
Yield differences of less than 7.2% should be treated with caution.

Variety / type	White peas			Large blue peas					Maple peas			Marrowfat peas			
	Salamanca	Mascara	Gregor	NEW Campus	Crackerjack	Prophet	Daytona	Stratford	Mantara	Rose	NEW Rainbow	Sakura	Neon	Bibao	Genki
	R	R	R	P1	R	R	R	P2	R	R	P1	R	R	P2	R
Yield as % Control (5.02 t/ha) 5 year mean	101	100	99	103	102	100	100	94	97	91	90	89	85	85	85
Agronomic characters															
Earliness of ripening	5	6	5	5	5	5	6	5	5	6	6	5	5	5	5
Shortness of straw	4	4	4	4	4	4	4	5	6	4	4	4	5	4	4
Standing ability at harvest	7	5	6	8	5	6	6	6	6	6	6	5	4	6	6
Resistance to															
Pea wilt (Race 1)	R	R	R	R	R	R	R	R	R	S	S	R	R	S	R
Downy mildew	6	7	7	6	6	7	7	8	7	7	7	5	6	5	5
Seed characters															
Thousand seed weight (g)(@15%mc)	259	279	304	282	294	291	272	283	231	249	283	383	336	359	412
Protein content (%dry)*	23.9	23.2	25.1	23.4	23.9	22.9	23.9	22.4	23.4	27.4	25.8	24.4	23.3	24.3	24.5
Year first listed	11	07	09	**14**	08	07	10	13	10	06	**14**	08	11	13	07

Recommendation categories: R=Recommended, P1,P2=1st & 2nd year provisional recommendation, O=Outclassed.
A high rating figure indicates that the variety shows the character to a high degree.
Pea wilt *(Fusarium oxysporum f. sp. pisi)*(race 1) R = Resistant; S = Susceptible.
*Protein content: Testing for protein content was reinstated in 2012 and data are limited at this stage.

Supplementary List of Combining Peas
Varieties removed from or not added to the Recommended List for 2014

The control for yield is the mean of Prophet & Mascara.

	Yield as % of Control	Type	Earliness of ripening	Shortness of straw	Standing ability	Pea Wilt	Downy mildew	Thousand seed weight (g)
Kenzzo	96	W	5	4	6	-	7	291
Blueprint	98	LB	5	4	6	R	6	268
Countdown	92	LB	5	3	7	R	8	253
Hawaii	79	SB	6	5	5	R	7	214
Hydra	87	MF	5	5	5	R	4	343
Strada	83	MF	4	5	3	R	8	389

A high figure indicates that the variety shows the character to a high degree.
Pea wilt R = Resistant; S = Susceptible: - = no data
LB=Large blue, W=White, MF=Marrowfat, SB=Small blue

6.2 PGRO RECOMMENDED LIST OF COMBINING PEAS

Key to breeders and UK Agents for combining peas

Variety	Breeder	UK Agent
Blueprint	Limagrain Europe	Limagrain UK Ltd
Campus	NPZ-Lembke	LS Plant Breeding
Countdown	NPZ-Lembke	LS Plant Breeding
Crackerjack	Toft, Den	Dalton seeds
Daytona	Danisco, Den	Agrii
Genki	Toft, Den	Dalton Seeds
Gregor	Serasem, Fr	LS Plant Breeding
Hawaii	Limagrain Europe	Limagrain UK Ltd
Hydra	Limagrain Europe	Limagrain UK Ltd
Kenzzo	SARL Adrien Moment et Fils,Fr	Senova Ltd
Mantara	Limagrain Europe	Limagrain UK Ltd
Mascara	Lochow-Petkus, Ger	Senova Ltd
Neon	Limagrain Europe	Limagrain UK Ltd
Prophet	Limagrain Europe	Limagrain UK Ltd
Rainbow	Toft, Den	IAR Agri
Rose	Toft, Den	Dalton Seeds
Sakura	Toft, Den	Dalton seeds
Salamanca	LS Plant Breeding	LS Plant Breeding
Strada	Limagrain Europe	Limagrain UK Ltd

Additional varieties of combining peas

Jackpot - UK Agent: Dalton Seeds

A white pea that has not been through official trials and is available through the common catalogue. It is semi-leafless, tall with and gives moderate yields. It has good standing ability and ease of combining. Jackpot has good resistance to downy mildew and limited information suggested good tolerance to *Mycosphaerella*. Quality of produce is good for the white pea markets.

Kabuki: UK Agent: Limagrain UK Ltd

This semi-leafless marrowfat variety has found favour for human consumption in all marrowfat market sectors and is reported to have good colour retention. It is only available when grown under contract to Dunns of Long Sutton. It has not been through UK official trials and is available through the common catalogue. Limited data suggests yields and standing ability are similar to Princess. Little information on downy mildew resistance, but as for other marrowfat varieties a multipurpose seed treatment is advised.

Maro

UK Agent: W.A.Church (Bures) Ltd/ Boston Seeds

Is suitable for the whole range of processing markets for human consumption and is favoured for the Japanese export market. Premiums are required to compensate for the very low yield. It is late maturing with very poor standing ability. It is extremely susceptible to downy mildew and a multipurpose seed treatment is required.

Minerva Breeder: W.A. Church (Bures) Ltd

A conventional-leaved coloured flowered, forage variety. Very long strawed and poor standing ability. Seed yield is very low, but having small, brown and smooth seed it is the most preferred variety for the pigeon feed market. It is sensitive to several herbicides

Princess UK Agent: Limagrain UK Ltd

Used to be the preferred variety for canning as 'mushy peas' and for fish and chip shop outlets. It has moderately long straw and average standing ability. Princess is rather susceptible to downy mildew and therefore a multipurpose seed treatment is required.

Progreta Breeder: Progreta Ltd

A tare-leaved marrowfat variety, Progreta has relatively poor standing ability and ease of combining. Samples are usually smaller and more irregular in size than Maro and a good sample is required for canning. It is very susceptible to downy mildew and a multipurpose seed treatment is required.

Zero4 UK Agent: Limagrain UK Ltd

Is semi-leafless small seeded blue variety. In National List (NL) trials it had very early maturity, maturing a week before Nitouche and suitable for northerly or late maturing areas. Straw was relatively short and standing ability very good. In NL trials yields were low, but the Agent recommends sowing at a higher plant density (110 plants/m^2) to achieve higher yields. The variety has good resistance to downy mildew.

Varieties promoted from NL2 to RL1 for 2014

After completion of National List trials in 2013, the varieties below will be further evaluated in Recommended List Trials in 2014.

Variety	Type	UK Agent
Antara	W	Limagrain, UK
Bluetooth	LB	LS Plant Breeding

6.3 CHOICE AND USE OF SEED

In the UK Seed Certification Scheme, seed is graded as Basic (B), Certified Seed of 1st Generation (C1), and Certified Seed of 2nd Generation (C2). Basic and C1 seed is generally grown for the production of further seed crops and C2 seed is used for commercial crop production. Basic seed is the most expensive and C2 the least expensive. Certified seed is required to meet a minimum germination of 80% and to achieve a standard of purity. Leaf and pod spot caused by *Mycosphaerella pinodes* and *Ascochyta pisi*, is a potentially serious seed-borne disease, which can affect both quality and yield. However, growers should note that there are no minimum infection standards specified by the statutory certification scheme for this disease. Seed tests are available from PGRO.

Seed treatment

All pea seed should be treated with a fungicidal seed protectant such as thiram (Flowable Thiram, Thiraflo or Thyram Plus) to avoid seedbed losses caused by damping-off diseases. Seed-borne infection by leaf and pod spot may be controlled effectively by using Wakil XL (cymoxanil + fludioxonil + metalaxyl M) which will also reduce losses caused by downy mildew in susceptible varieties.

Seed size

Seed size is very dependent on growing conditions and variety. The 1000 seed weight data shown in the Recommended List should be taken only as a guide to the relative seed size of varieties.

Seed rate and plant populations

Target populations should be set according to the type of the pea variety being sown. The optimum population depends on seed cost and return of produce per hectare. Adjustments should be made accordingly. The populations given below are an average recommended by PGRO as the most profitable levels for each type. Targets could be lower than these on fertile soils. Higher populations may be beneficial on light, drought prone soils, or where there is a risk of attack from birds.

Typical target plant populations

Type	Varieties	Population plants/m²
Some marrowfats	Maro, Princess, Kahuna, Kabuki.	65-70
Others	Salamanca, Gregor, Mascara, Campus, Crackerjack, Prophet, Daytona, Stratford, Mantara, Rose, Rainbow, Sakura, Neon, Bibao, Genki	70
	Zero4	110

The seed rate can be calculated from the following formula:

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

Use of the seed rate formula, and adjustment for expected field losses, is necessary to achieve the most profitable populations. Expected field losses are given in the table below, and are lower for large-seeded peas. Losses will be higher on heavy, poorly drained soils.

Expected field losses (%)

Sowing time	Marrowfats (large seeds)	Others
Very early (February)	15	18
Early (March)	10	13
Mid-season (April)	5	7

Rotation

It is recommended that the rotation carries no more than a single crop of the following group every five years: peas, field beans, green beans, vetches and lupins. This four-year break is the minimum recommended without increasing the risk of building up persistent, soil-borne pests and diseases. *A predictive test for the presence of soil-borne, root-infecting diseases is available from PGRO and details are available on request.*

Cultivations

Often land is ploughed in the autumn. This allows natural weathering to aid the production of adequate tilth in the spring with minimal cultivations (stale seedbed). Peas are sensitive to compaction. On lighter soils, spring ploughing is an option where over-wintered stubbles are required. Drilling with a cultivator drill on spring ploughed land is popular. In some situations peas can be successfully established by direct drilling or min-till.

Fertiliser

The requirements of peas are small and no N is required. Where P and K fertiliser is required, it should be put deep enough into the seedbed to allow full utilisation by the crop. Broadcast fertiliser should be ploughed shallow or applied over the furrows. It can then be worked in by subsequent cultivations, but the production of too fine a tilth and compaction must be avoided. Peas may suffer from sulphur deficiency on poor, light textured soils away from industrial emissions. Where soil deficiency is suspected, apply 25-35 kg/ha SO_3 as a pre-drilling treatment. This can be in the form of magnesium sulphate, calcium sulphate, potassium sulphate or elemental sulphur.

The fertiliser requirements of peas (kg/ha)

Soil index# N,P or K	N	P_2O_5	K_2O*	MgO
0	0	100	100	100
1	0	70	70	50
2	0	40	40(2-) 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 K_2O should be combine-drilled, otherwise germination may be affected. The rest should be broadcast.

The amounts of phosphate and potash are appropriate to pea yields of 4 t/ha. Where yields are likely to be greater or smaller, phosphate and potash applications should be adjusted accordingly.

Time of drilling

The benefits of early drilling can include higher yield, earlier maturity and some escape from pests. However, it is more important to drill peas when soils are drier and less prone to compaction.

Row width and plant population

Peas sown in rows wider apart than 20 cm may give lower yields. Narrower rows result in higher yields and tend to give more even crops, easier combining and better competition with weeds. An adequate plant population is essential since low populations are more difficult to harvest, later maturing and more prone to bird damage.

Drilling and rolling

Most cereal drills are suitable for peas. The drill should be accurately calibrated for each seed lot before sowing. Seeds should be sown so that they are covered by at least 3 cm of settled soil after rolling. On most soil types it is necessary to roll the field to depress stones in order to avoid damage to the combine, and for effective pre-emergence weed control. Rolling should be done soon after sowing, but prior to the application of pre-emergence herbicide application and well before emergence.

6.5 WEED CONTROL

Peas are uncompetative during their early development

Volunteer oilseed rape can be a problem in peas

High numbers of uncontrolled mayweed in peas

Good weed control is essential in the pea crop, since it is not very competitive and is easily dominated by weeds. Efficient control will ease combining and facilitate rapid drying in addition to increasing yield. A number of pre- and post-emergence herbicides are available and a list of currently approved herbicides can be found in the PGRO Technical Updates *'Choice of Herbicides for Peas'* and *'Checklist of Herbicides for Peas'*. Pre-emergence herbicides are best applied to a rolled, clod free, moist seedbed

Broad-leaved weeds

General control of annual broad-leaved weeds can be achieved pre-emergence with a soil-applied residual herbicide or, when weeds and crop have both emerged, with a foliar-applied post-emergence herbicide.

Where soil type allows, it is advisable to use a pre-emergence herbicide. It removes weed competition early and gives better control of some weeds, for example, knotgrass and annual meadow-grass. However, adequate soil moisture is needed for good efficacy of a residual herbicide. Pre-emergence Stomp Aqua, Cinder etc (pendimethalin), Nirvana (imazamox + pendimethalin) and Lingo (linuron + clomazone) are effective. Afalon (linuron) in the spring crops has a more limited spectrum but is a useful tank mix product especially if mayweeds are a problem. Pre-emergence cleaver control is possible using Lingo or Centium 360CS (clomazone). Although active against a few other weeds, Centium is most likely to be used in tank-mix with a partner product.

Post-emergence sprays of full rate Basagran (bentazone) can be applied from 3 nodes of the crop to well waxed peas (tested with crystal violet dye). It has useful activity on volunteer oilseed rape and small cleavers but less on black-bindweed and fat hen. MCPB controls thistles and docks and effectively stunts large volunteer oilseed rape. Check product

labels for any varietal restrictions. Basagran + MCPB mixes are permitted but past work has shown increased likelihood of crop damage if both are used at permitted full doses.

Volunteer oilseed rape

This can be a serious problem if it is grown in the same rotation. Pre-emergence Nirvana and Stomp are effective. However, control particularly of rape germinating from depth, may be incomplete. To avoid harvesting difficulties, a post-emergence treatment will be required. The least expensive herbicide is MCPB which is effective on small rape however it stunts, rather than controls, larger plants. If infestation is severe, post–emergence application of Basagran should be effective.

Wild oats

Infestations of wild oats can cause severe yield reduction and interfere with harvesting. They must be controlled to avoid re-seeding in the following crop. Post-emergence graminicides such as Fusilade Max (fluazifop-p-butyl), Laser (cycloxidim) + oil, Pilot Ultra (quizalofop-P-ethyl), Aramo (tepraloxydim) and Falcon (propaquizafop) give control. A pre-emergence treatment with Avadex Excel 15G (tri-allate) is also an option.

Couch and perennial broad-leaved weeds

Couch is best controlled with products containing glyphosate pre-harvest of cereals, or in the autumn, or pre-harvest of peas (except for seed crops). Although some graminicides offer control, recommended application rates are uneconomically high.

Glyphosate applied 7 days pre-harvest will eradicate perennial broad-leaved and grass weeds. It must be applied when moisture content of the peas is 30% or less, at this stage the crop is overall yellow and senescent. It must not be applied to seed crops.

Other grass weeds

The post-emergence graminicides can control volunteer cereals and offer some reduction of blackgrass and other grass weeds however resistant grass weed populations will cause problems. Aramo has activity on both target site and enhanced metabolism resistant blackgrass as well as annual meadow grass. Laser has activity on only enhanced metabolism resistant blackgrass populations. Falcon achieves some suppression of annual meadow grass. Control with the graminicides, particularly of high populations of blackgrass can be disappointing. Where blackgrass is anticipated to be a problem, it is recommended that populations are depleted as much as possible by ploughing and the use of stale seedbeds prior to drilling.

6.6 DISEASES

Pea downy mildew

Pod botrytis in peas

Pea leaf and pod spot

Many factors can affect growth of the pea crop, and the notes below describe the main diseases which reduce yield and quality. Further information, and colour photographs of symptoms and damage may be obtained from the publication *Peas and Beans; Pests, Diseases and Disorders* and a list of currently approved pesticides can be found in PGRO Technical Update *'Checklist of Fungicides and Insecticides for Peas'.*

Pea wilt *(Fusarium oxysporum f. sp. pisi)*

Wilt is a soil-borne disease which can occur in any pea growing area, but is generally confined to fields with a very long history of peas. It can cause substantial reductions in yield, but is effectively controlled by genetic resistance. Race 1 appears to be the most common form; the majority of varieties are resistant to this race and although it has not been seen for many years, growers using land in known high risk areas should select these.

Downy mildew *(Peronospora viciae)*

This disease produces resting spores, which persist in the soil and initiate primary infections in young pea plants. Though secondary infections can develop, particularly in cool, damp conditions, they are rarely as damaging as primary infections, which can kill plants before flowering. Fungicide seed treatment should be combined with varietal resistance to avoid serious losses. There are no foliar fungicides which give effective control.

Leaf and pod spots

Leaf and pod spots are caused by three fungi, *Ascochyta pisi, Mycosphaerella pinodes* and *Phoma medicaginis,* which may be spread by seed infection, soil or plant debris. The most frequent is *M. pinodes,* which can cause losses in both yield and quality in wet conditions. The use of disease-free seed will help to reduce the incidence of disease. There are

no minimum standards specified by the statutory seed certification scheme for *M. pinodes* but seed, especially farm-saved, should be tested. Seed treatments are recommended for the control of disease at certain levels of infection. Fungicides such as azoxystrobin, metconazole, boscalid + pyraclostrobin (Signum), chlorothalonil + cyproconazole (Alto Elite) or chlorothalonil + pyrimethanil (Walabi) give useful control of the disease in the crop and can give yield increases when applied during flowering and pod set

Botrytis, or grey mould

This can affect stems and pods during wet weather, and is initiated when petals adhere to plant parts after pod set. One or two applications of fungicides at pod set and at the flat pod stage may be required to prevent *Botrytis* infection when wet or damp weather occurs during flowering. It may be necessary to select products which combine control of *Botrytis* and *Mycosphaerella*. However, in dry conditions, sprays during flowering are unnecessary. Suitable products include Alto Elite, Walabi, Signum, cyprodinil + fludioxinil (Switch) and azoxystrobin.

Powdery mildew *(Erysiphe pisi)*

Occasionally late maturing crops may become covered with a grey-white film of powdery mildew. The disease can delay maturity. Alto Elite, applied for leaf and pod spot control will reduce powdery mildew. Sulphur formulations with Extensions of Authorisation for Minor Use (EAMU) for peas can be used to control powdery mildew.

Foot and root rots

Several species of fungi cause foot and root rots. The effects of these diseases are particularly common on heavy land with a history of frequent pea cropping. Good drainage and avoidance of compaction can help to minimise losses. A soil test, which predicts the likelihood of soil-borne disease causing serious yield loss in future crops, is available. There are no means of controlling foot rots satisfactorily once they become established in a field, other than extended cropping with species other than legumes. *Sclerotinia sclerotiorum* causes a stem rot rather than a foot rot, but affects peas, spring beans, oilseed rape, linseed, and sometimes potatoes and certain field vegetables. This should be remembered when planning rotations in areas where *Sclerotinia* has occurred. Switch or azoxystrobin applied at first pod can give useful control.

Bacterial blight *(Pseudomonas syringae pv. pisi)*

This is a potentially serious seed-borne disease, which can occur on all types of peas. Symptoms consist of water-soaked brown lesions on the lower leaves, stems and stipules, and become noticeable following periods of heavy rain, hail or frost. The lesions may coalesce and show a fan shape on the leaf, following between the lines of the veins. Some pod spotting may occur. Severe infections have not occurred in spring-sown peas and effect on yield has been negligible.

6.7 PESTS

Pea and bean weevil leaf damage

Thrip damage in peas

Marsh Spot in peas

Pea aphid

Many factors can affect growth of the pea crop, and the notes below describe the main pests which reduce yield and quality. Further information, and colour photographs of symptoms and damage may be obtained from the publication *Peas and Beans; Pests, Diseases and Disorders* and a list of currently approved pesticides can be found in PGRO Technical Update *'Checklist of Fungicides and Insecticides for Peas'.*

Pea weevil *(Sitona lineatus)*

Weevil may cause damage if large numbers appear when plants are small and in particular in cloddy seedbeds and in conditions of slow growth. Leaves of attacked plants show characteristic 'U' shaped notches around the edges, but the main damage occurs as a result of the larvae feeding on the root nodules. Sprays may be applied at the first sign of leaf damage and repeated after 7 - 10 days.

A monitoring system is available from Agralan Ltd (The Old Brickyard, Ashton Keynes, Swindon SN6 6QR) to predict the likely severity of attack.

Field thrips *(Thrips angusticeps)*

Field thrips feed on the leaf surface of emerging seedlings which results in a thickening and puckering of the tissue. Seedlings may appear pale in colour. Although further damage can be checked by spraying, in the majority of cases the peas will outgrow the effects of thrips, and yield improvement may not be achieved following treatment.

Pea aphid *(Acyrthosiphon pisum)*

Aphids can cause severe yield loss when present in large numbers, and early infestations can result in crops becoming infected with pea enation mosaic virus. Aphids should be controlled as soon as colonies can be found on 20% of plants, particularly where crops have commenced flowering. Yield can be improved by controlling aphids at any stage up to the time when four trusses of pods have been set.

Pea moth larvae *(Cydia nigricana)*

These feed upon the developing seeds within the pod. Yield loss is minimal, but the effect on quality can be dramatic. Damage to the seed reduces the value of the produce.

The Oecos pheromone pea moth trapping system should be used to assess the need for treatment and to forecast the date on which insecticides should be applied. To further assist growers in the use of their own traps, information is provided on optimum spray dates. Growers achieving a threshold catch in their traps can obtain a predicted date for spraying in the area concerned by means of an automatic telephone information service provided on 01780 783099, or by going to the PGRO web site at www.pgro.org.

Pea moth traps are available from Oecos at 11A High Street, Kimpton, Hertfordshire SG4 8RA.

Pea cyst nematode *(Heterodera gottingiana)*

Pea cyst nematode is a very persistent soil-borne pest, often causing severe yield loss. Frequent cropping of peas and *Vicia faba* beans favours the build-up of infestations, and an adequate rotation is essential to minimise the risk of occurrence. Affected plants are stunted and pale, and the root systems do not develop nitrogen-fixing nodules, but become studded with white, lemon-shaped cysts. Correct diagnosis is essential as subsequent pea crops grown in infested fields are subject to complete failure.

Marsh spot

Marsh spot is a disorder of peas, which is due to deficiency or unavailability of manganese. The deficiency causes the formation of a brown spot in the centre of many of the peas produced, and the produce is spoilt for human consumption and for use as seed. It is particularly associated with organic and alkaline soils. When symptoms appear in a crop, 5 kg/ha of manganese sulphate with a wetter, or an equivalent application of a manganese spray, should be applied at once in a high volume of water. Similar treatment must also be carried out when an affected crop is at first pod stage, and repeated 10 - 14 days later, in order to prevent the formation of marsh spot. In some seasons flowering is prolonged and a third manganese application will be necessary. The amount of manganese in some formulations (e.g. chelated manganese) may be too low to be effective at the rate recommended.

6.8 HARVESTING

Care must be taken in harvesting peas as a premium is often available for high quality produce. Quality can be affected by wet weather at harvest causing staining in a lodged crop, and if destined for the packet trade, chip shop or export value is reduced if pea seed becomes bleached.

If peas are left in the field too long until moisture content is 12% MC (or if they are over-dried), the crop may be unsuitable for human consumption, the percentage of 'non-soakers' increases and the seed may split and crack. Peas for micronising for pet food must also have a good blue/green colour.

Yield is lost if peas are left too long in the field when shelling out and pod shatter occurs, therefore timely harvesting is essential.

Peas for animal feed should be dry (about 15% MC) and free from moulds. Split or stained peas do not adversely affect the crop value.

If the crop is very weedy or uneven in maturity a desiccant will aid combining by killing the weeds and hastening the drying out of the less mature haulm. A desiccant will not advance seed maturity. Treatment must be delayed until the peas on the least mature plants have reached the 'starchy' stage and can be marked by a finger nail and do not readily split. The top pods at this stage will be pitted and wrinkled while the lower pods will be at the parchment stage, and the foliage beginning to turn yellow. Reglone (diquat) has been widely used for many years. The addition of Agral or other wetter may be needed to kill volunteer rape. It is rain fast 15 minutes after spraying. The crop will be ready for combining 7-10 days after Reglone application. Challenge/Harvest (glufosinate-ammonium) is an alternative desiccant used at the same crop stage and it is rainfast 6 hours after spraying. It is slower to act than Reglone, with harvesting 10-14 days after application and it must not be used on pea seed crops.

If the crop is free from weeds and is dying back evenly it can be left until it is dry enough to direct combine. Efficient lifters are helpful with badly lodged crops and it may be necessary to combine in one direction only.

It is possible for peas to pass through most combines without damage when the seed moisture content is about 20% and early harvesting at 18% avoids bleaching, shelling out losses and splitting or the deterioration in quality of human consumption or seed crops during wet weather. For animal feed peas harvesting later, when they are about 16% MC will reduce drying costs.

6.9 DRYING AND STORAGE

The quality standard for peas, ex farm is usually 14% MC (moisture content) and 2% impurities, or a combination of both, which should not exceed 16%. The relatively large seed-size of peas makes drying more difficult than with cereals.

Whilst damaged peas are still acceptable for compounding, mouldy produce is not. Considerable care must be taken not to over-dry peas for human consumption or seed. The drying temperature should not exceed 49°C for human consumption peas; at higher temperatures, a tougher texture or splitting of the grain may result. The drying temperature of peas for seed purposes should not exceed 43°C if the moisture content is below 24%, and if the moisture content is higher, 37°C should be considered the maximum temperature for seed peas and 43°C for human consumption peas. When the moisture content is high, two dryings may be necessary. At least two days should be left between them to enable the moisture to spread evenly throughout the bulk.

Any type of dryer may be used for peas, but those operating at low temperatures are safer. Floor-ventilated bins are easy and relatively safe to operate. When the initial moisture content is high, the transfer of the peas 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 peas. On-floor drying using ambient or warmed air can be used and provided there is sufficient volume of air and adequate ventilation, peas of relatively high moisture content can be dried using this method. Continuous flow driers designed to work on a short period/high temperature basis need more careful operation than other systems. The maximum moisture content of peas for safe storage depends upon the method and the length of time they are to be stored. Peas may be safely stored for up to 4 weeks at 17% MC, but if they are to be stored until the following spring the moisture content should not be above 15%. If the peas are in bulk with forced ventilation or frequently moved the moisture content can be 1% higher.

7 GROWING FIELD BEANS

Field beans *(Vicia faba)* are used for inclusion in animal feed, aquaculture, export for human consumption or pigeon feed, for which suitable winter and spring varieties are available.

They provide a useful break to reduce cereal pests and diseases and an opportunity to control grass weeds in an arable rotation. In wet years and on heavy soils, beans perform better than peas. Beans also suffer less from pigeon damage, they are easier to combine, and growing costs can sometimes be lower.

Beans, however, are harvested later than peas, and time of harvest is very dependent on seasonal weather in the August/September period.

7.1 CLASSIFICATION, CHOICE OF CROP AND QUALITY CRITERIA

Classification

Beans are classified by type and quality criteria as winter and spring beans 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 530 grammes. Spring varieties are generally smaller seeded than this. Tic varieties have small, rounded seeds, which may be suitable for the pigeon trade.

Choice of crop

Winter beans do not have a vernalisation requirement, although they are more winter hardy than spring types. In moisture retentive and fertile fields that produce tall, lush crops, short-strawed varieties could be an asset. *Ascochyta fabae* is most likely to be a problem in wet conditions and varieties with good resistance are available.

Pale hilum spring beans for export for human consumption and small-seeded beans for the pigeon trade attract a premium. Downy mildew can cause yield loss in some seasons, but varieties with good resistance are available. Early maturing spring beans can mature before winter beans. Early maturing beans have enabled the crop to be grown in Northern Britain.

A separate table of results from Scottish variety trials is included this publication.

Quality criteria

Quality standards for export to the Middle East for human consumption are high. Varieties with a smooth and pale skin and pale hilum are suitable for this market. It is important that samples are clean, sound and have low levels of bruchid beetle damage.

Samples for the pigeon feed trade should be small, round and have consistent colour.

Beans for compounding for animal feed must be free from moulds.

7.2 PGRO RECOMMENDED LIST OF SPRING BEANS

Table characters

1 - 9 ratings

A high figure indicates that the variety shows the character to a high degree.

Yield

Yields are expressed in percentage terms in relation to the mean (100%) of a number of control varieties. Provisionally recommended varieties may only have been in trials for three years, but a statistical adjustment makes their data comparable with fully recommended ratings for which yield is based on a seven-year mean.

Standing ability at harvest

Expressed on a 1-9 scale from lodging data recorded within trials.

Shortness of straw

A difference of one point on the 1-9 scale represents approximately 8 cm for winter beans and 10 cm for spring beans. Differences are greatly influenced by growing conditions

Earliness of ripening

A difference of one point on the 1-9 scale represents approximately two days for winter beans and three days for spring beans. Differences are greatly influenced by growing conditions and are usually extended in the north and west compared to the south and east.

Resistance to downy mildew

Downy mildew *(Peronospora viciae)* can sometimes be severe on spring beans. Varieties differ in their resistance to the disease and this is expressed on a 1 - 9 scale, a high figure indicating a high level of resistance.

Resistance to leaf and pod spot

In some conditions, leaf and pod spot *(Ascochyta fabae)* can be severe on winter beans. Varieties differ in their resistance to the disease and this is expressed on a 1 - 9 scale, a high figure indicating a high level of resistance.

Thousand seed weight

This characteristic is very dependent on growing conditions. Data are presented in grammes and reflect the mean 1000 grain weight recorded in trials over a number of sites and seasons. These data have been established from samples at 15% MC.

PGRO Recommended List of Spring Beans 2014

The control for yield comparisons is the mean of Fuego and Fury.
Yield differences of less than 6.1% should be treated with caution.

Variety / type	Pale hilum							Black hilum Tic
	Vertigo	Fanfare	Boxer	Fury	Pyramid	Fuego	Babylon	Maris Bead
	P2	P2	R	R	R	R	R	R
Yield as % control (4.34 t/ha) 5 year mean	109	105	103	102	100	98	96	88
Agronomic characters								
Flower colour	C	C	C	C	C	C	C	C
Earliness of ripening	7	7	7	7	8	7	8	6
Shortness of straw	6	6	6	7	6	6	7	5
Standing ability at harvest	6	7	8	7	8	8	8	5
Resistance to								
Downy mildew	4	4	4	6	6	5	7	7
Seed characters								
Thousand seed weight (g)(@15%mc)	545	511	533	496	533	537	513	37
Protein content (%dry)*	27.6	28.6	27.5	28.2	27.1	27.8	27.1	29.4
Year first listed	2013	2013	2012	2010	2010	2005	2011	1964

Recommendation categories: R=Recommended, P1,P2=1st & 2nd year provisional recommendation
A high figure indicates that the variety shows the character to a high degree. ( ) = limited data
The scales of characters of spring beans do not necessarily correspond with those for winter beans.
Hilum colour. The export market usually requires pale hilum types
*Protein content: Testing for protein content was reinstated in 2012 and data are limited at this stage.

Supplementary List of Spring Beans.
Varieties removed from or not added to the Recommended List for 2014

The control for yield comparisons is the mean of Fuego and Fury.

	Yield as % of Control	Type	Earliness of ripening	Shortness of straw	Standing ability	Downy mildew	Thousand seed weight (g)
Tattoo	90	PH/LT	7	7	6	6	546

A high figure indicates that the variety shows the character to a high degree
PH= pale hilum, BH= black hilum, LT=Low Tannin

7.3 PGRO / SAC SPRING BEAN VARIETY TRIAL RESULTS 2011–13

Variety (n) = no. of trials	Yield as % control	Maturity 1 = Late 9 = Early	Chocolate spot 1 = susceptible 9 = resistant	Plant Height 1 = short 9 = tall	Brackling 1 = poor 9 = good
Babylon	108	6.7	8.0	7	7
Boxer	103	6.8	7.5	7	7
Fuego	100	6.5	6.5	6	5
Fury	100	6.7	8.0	6	6
Maris Bead	99	6.3	6.0	8	5
Pyramid	103	7.0	7.0	7	7
Fanfare	98(2)	7.0	7.0	6	*
Vertigo	104(2)	6.9	6.5	6	*

* Insufficient data

The control for yield comparison is the mean of Fuego and Fury in 2011, 2012 and 2013. 100% = 4.78 t/ha.

Unless indicated, variety means are over 3 years

There was no lodging / brackling at the Perth site in 2012/2013. The brackling figures are based at 2011 figures.

The SAC spring bean variety trials, funded by the PGRO voluntary pulse levy have been carried out in the Perthshire area.

Spring Bean Varieties: Breeders and UK Agents

Variety	Breeder	UK Agent
Babylon	Limagrain Europe	Limagrain UK Ltd
Ben	Limagrain Europe	Limagrain UK Ltd
Boxer	Lantmännen SW Seed Hadmersleben GmbH	Senova Ltd
Fanfare	NPZ-Lembke, Germany	LS Plant Breeding
Fuego	NPZ-Lembke, Germany	Limagrain UK Ltd
Fury	NPZ-Lembke, Germany	LS Plant Breeding
Maris Bead	PBIC, UK	WA Church (Bures) Ltd
Pyramid	Limagrain Europe	Limagrain UK Ltd
Tattoo	NPZ-Lembke, Germany	LS Plant Breeding
Vertigo	NPZ-Lembke, Germany	LS Plant Breeding

Varieties Promoted from NL2 to RL1 for 2014

After completion of National List trials in 2013 no new varieties were taken through to Recommended List Trials in 2014

7.4 PGRO RECOMMENDED LIST OF WINTER BEANS 2014

The control for yield comparisons is the mean of Arthur and Wizard.
Yield differences of less than 6.5% should be treated with caution.

Variety / type	Pale hilum				Black hilum		
	NEW Tundra P1	Wizard R	Honey R	Sultan O	Clipper R	Arthur R	NEW Buzz P1
Yield as % Control (4.15 t/ha) 5 year mean	102	97	93	87	104	103	101
Agronomic characters							
Earliness of ripening	8	8	9	9	6	8	7
Shortness of straw	8	8	9	9	6	8	7
Standing ability at harvest	8	7	9	8	5	5	7
Resistance to							
Leaf and pod spot *(Ascochyta fabae)*	-	9	-	-	9	9	-
Seed characters							
Thousand seed weight (g)(@15%mc)	615	676	673	585	661	632	710
Protein content (%dry)*	26.5	27.3	26.2	26.5	25.4	26.1	26.0
Year first listed	**2014**	2003	2012	2009	1998	2007	**2014**

Recommendation categories: R=Recommended, P1,P2=1st & 2nd year provisional recommendation.
A high figure indicates that the variety shows the character to a high degree. - =no data currently available.
The scales of characters of winter beans do not necessarily correspond with those for spring beans.
All current varieties are coloured flowered, high tannin types
Hilum colour. The export market usually requires pale hilum types.
*Protein content: Testing for protein content was reinstated in 2012 and data are limited at this stage.

Winter Bean Varieties: Breeders and UK Agents

Variety	Breeder	UK Agent
Arthur	Wherry & Sons	Wherry & Sons
Buzz	Wherry & Sons	Wherry & Sons
Clipper	Wherry & Sons	Wherry & Sons
Honey	Wherry & Sons	Wherry & Sons
Sultan	Wherry & Sons	Wherry & Sons
Tundra	Limagrain UK Ltd	Limagrain UK Ltd
Wizard	Wherry & Sons	Wherry & Sons

Varieties promoted from NL2 to RL1 for 2014

After completion of National List trials in 2013 the varieties below will be further evaluated in Recommended List Trials in 2014.

Variety	Type	UK Agent
LGWB1901	Pale hilum	Limagrain, UK
LGWB2401	Pale hilum	Limagrain, UK

7.5 CHOICE AND USE OF SEED

Field beans *(Vicia faba)* are used for inclusion in animal feed, aquaculture, export for human consumption or pigeon feed, for which suitable winter and spring varieties are available.

Seed quality

In the UK Seed Certification Scheme, seed is graded as Pre-Basic (PB), Basic (B), Certified Seed of 1st Generation (C1) and Certified Seed of 2nd Generation (C2). Basic and C1 seed is generally grown for the production of further seed crops and C2 seed is used for commercial crop production. Pre-Basic seed is generally not available for sale, Basic seed is the most expensive seed and C2 the least expensive. Certified seed has a minimum germination of 80% and is required to meet standards for purity. Seed-borne leaf and pod spot *(Ascochyta fabae)* and stem nematode *(Ditylenchus dipsaci)* can be very damaging to field beans. It is strongly recommended that seed is tested for *Ascochyta*. It is advised that Basic seed should not contain more than 0.2% infection, C1 seed should not contain more than 0.4% and C2 seed should not contain more than 1% infection where a fungicide seed treatment is not used. It is also strongly recommended that seed is tested for the presence of stem nematode and only clean seed should be used. Tests for germination and the presence of *Ascochyta fabae* and stem nematode are available at PGRO.

Seed treatments

Seed treatments are sometimes used on winter beans although they seldom produce a significant improvement in seedling establishment. Some control of seed-borne *Ascochyta fabae* is provided by Wakil XL which has an EAMU in beans, but the level of control is not considered to be good enough to be recommended for seed with more than 3% infection. Seed treatments are not often used on spring beans although Wakil XL will help to control primary downy mildew. Thiram can be used to control damping off.

Sowing

There is growing interest in direct drilling or minimum tillage drilling of both winter and spring beans. There is an advantage in the min-till system for spring beans where over-wintered stubble is part of the farm management scheme. Spring beans are best drilled as early as possible provided soil conditions are satisfactory. Later sowing delays harvest and may subject beans to summer drought stress at flowering.

Winter beans can be broadcast or drilled onto the soil surface and then covered by shallow ploughing. However, both seed distribution and seedling emergence can be very uneven. More than half the area of winter beans is now drilled.

The ploughing-in method is less successful for spring beans, and better yields are achieved where they are drilled conventionally. Sowing depth is important and the seed should be covered by a minimum of 3cm of settled soil where pre-emergence herbicides are used.

Winter beans should not be sown too early; i.e. not before the second week of October. Crops which are too forward are more prone to disease and to the effects of severe winter weather. Sowing from mid-October to early November is usually the optimum time but acceptable crops have been produced from early December drilling.

Seed rate and plant population

Dense crops of winter beans are more likely to suffer from disease and early lodging. As a general recommendation a final target of 18 to 20 plants/m^2 is the optimum for winter beans, which produce several stems. Recent work by Wherry & Sons has indicated there may be a varietal yield response to population and these are shown in the table below. A 15 to 20% field loss is assumed when planting beans in the autumn depending on early or later sowing.

For spring-sown beans a final population of around 40 plants/m^2 is required because spring beans produce few stems. About 5 to 15% seedbed loss can occur, depending on soil type, conditions and sowing time, is assumed.

Typical final target plant populations

Type	Varieties	Population plants/m^2
Winter Beans	General	18-20
	Clipper	22
	Wizard, Arthur	23-26
	Honey, Sultan	28
Spring beans	All	35-45

The seed rate can be calculated from the following formula:

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

Rotations

To reduce the risk of a build-up of persistent soil-borne diseases such as foot rots caused by *Fusarium solani* and *Phoma medicaginis var. pinodella,* field beans, broad beans, peas and green beans should be considered as forming a single crop group and, from the point of view of rotation, no more than one of these crops should be grown on any field every five years.

Cultivations

Beans do not require a fine seedbed and will tolerate cloddy conditions (although weed control may be poor) and over-cultivation should be avoided. Beans are sensitive to soil compaction, but are more tolerant of consolidation and waterlogging than peas.

Fertiliser

The requirements of beans are small and no N is required. Where P and K fertiliser is required, it is essential that it is put deep enough into the seedbed to allow full utilisation by the crop. Broadcast fertiliser should be ploughed shallow or applied over the furrows. It can then be worked in by subsequent cultivations, but the production of too fine a tilth and compaction must be avoided.

The fertiliser requirements of peas (kg/ha)

Soil index# N,P or K	N	$P_2 0_5$	$K_2 0$*	MgO
0	0	100	100	100
1	0	70	70	50
2	0	40	40(2-) 20(2+)	0
>2	0	0	0	0

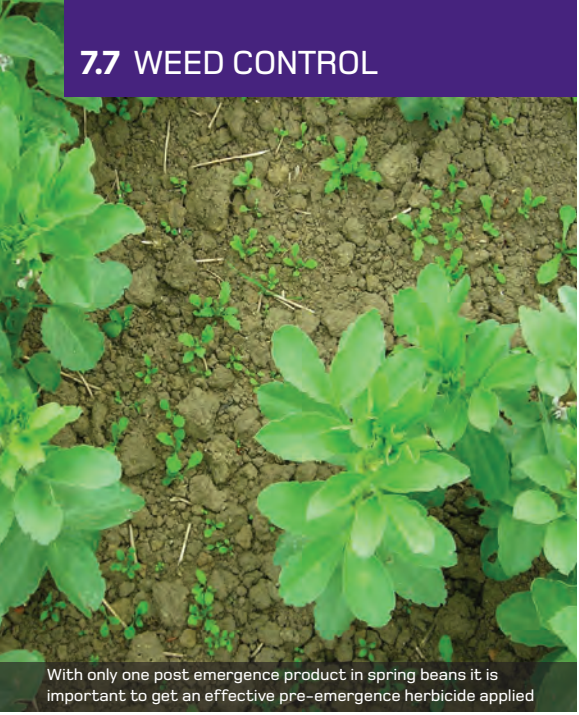
KEY

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

* Not more than 50 kg/ha $K_2 0$ should be combine-drilled, otherwise germination may be affected. The rest should be broadcast

The amounts of phosphate and potash are appropriate to bean yields of 3.5 t/ha. Where yields are likely to be greater or smaller, phosphate and potash applications should be adjusted accordingly.

7.7 WEED CONTROL



With only one post emergence product in spring beans it is important to get an effective pre-emergence herbicide applied

Otherwise we could have problems later

Weed infestations will reduce yield, and climbing species such as black-bindweed and cleavers can cause lodging. Effective weed control will ease combining. A checklist of the approved herbicides and timings for various weed problems is given for winter and spring beans in PGRO Technical Update *'Checklist of Herbicides for Beans'*, and further information on choice of herbicide is given in PGRO Technical Update *'Choice of Herbicides for Field and Broad Beans'*.

Broad-leaved weeds

It is essential that pre-emergence residual herbicides are used, since there is only one approved post-emergence herbicide which controls some emerged broad-leaved weeds. There are no herbicides to control thistles and docks - products containing MCPB, MCPA or clopyralid are damaging to beans. Most pre-emergence products have a minimum planting depth requirement and dose rate may be influenced by soil type. If cleavers are expected to be a particular problem in winter or spring beans Lingo (linuron + clomazone) alone or Centium 360 CS (clomazone) in a suitable tank-mix will be effective pre-emergence. Nirvana (imazamox + pendimethalin) is approved in both spring and winter beans and various pendimethalin formulations have EAMU's (Extension of Authorisation for Minor Use). Defy (prosulfocarb) has EAMU's for pre-emergence use in both winter and spring beans. Afalon (linuron) has approval for use in the spring crop.

In winter beans, residual herbicides Kerb (propyzamaide) and Crawler (carbetamide) offer limited control of broad-leaved weeds. They are chiefly used when blackgrass, volunteer cereals, wild-oats and other annual grasses are expected to be a problem. There are no reports of blackgrass resistance to either of these products and both are important tools in its control.

Basagran (bentazone) is the only herbicide approved for post-emergence weed control. However it is expensive, has a limited weed spectrum and will not control annual meadow-grass, large fat-hen or black-bindweed. It is useful for control of small cleavers and oilseed rape volunteers which may not be controlled by pre-emergence materials. To avoid crop damage, it should be applied before 7 leaf pairs (winter beans) and before 6 leaf pairs (spring beans).

Grass weeds, wild oats and blackgrass

Pre-emergence Avadex Excel 15G (tri-allate, spring and winter beans) can give good control of wild oats and remove the requirement for a post-emergence graminicide spray. Kerb and Crawler are for use only in winter beans and will control volunteer cereals, various grass weeds and are useful where blackgrass is a problem especially if there are resistance issues. Fusilade Max (fluazifop-p-butyl), Laser (cycloxidim) + oil, Pilot Ultra (quizalofop-p-ethyl, Falcon (propaquizafop) or Aramo (tepraloxydim) post-emergence, all have some activity on wild-oats, blackgrass, and volunteer cereals. Aramo and Falcon give some control of annual meadow-grass.

Couch and perennial broad-leaved weeds

As far as possible perennial weed problems should be tackled in the previous crop pre-harvest using glyphosate products. In the crop the rates required to achieve couch control with graminicides is uneconomic. Glyphosate applied pre-harvest on beans provides an excellent opportunity for eradication of couch and problem perennial broad-leaved species, but must not be used in crops for seed. It should be applied when all the pods are dry and black, and the seed is hard, with moisture content 30% or less, although the stems may still be green.

7.8 POLLINATION

Field beans usually benefit from the activity of pollinating insects, so care should be taken when applying insecticides. However, plants can be about 60% self-fertile and a high level of flower/pod abortion is inevitable with both winter and spring crops.

7.9 DISEASES


Bean rust

Downy mildew in beans

Leaf and pod spot

Chocolate spot

Chocolate spot *(Botrytis fabae)*

Symptoms appear as reddish-brown spots, which eventually enlarge to give a more damaging aggressive phase in cool, wet or damp weather. Winter beans are more likely to suffer yield losses, especially where the plant population is high and the crop becomes tall. Early fungicide treatment is essential if the crop shows symptoms at first bud or early flower. A second spray may be required 3 to 4 weeks later if damp conditions persist. Additional sprays are unlikely to be economic unless prolonged rain is experienced, and losses due to damage caused by the sprayer may be significant. Tebuconazole, azoxystrobin, metconazole, chlorothalonil + cyproconazole, Signum and Walabi are effective.

Leaf and pod spot *(Ascochyta fabae)*

This also produces brown spots but these contain distinctive black fruiting bodies (pycnidia). Winter beans are more prone to serious attacks which can develop in wet conditions but, since the disease is almost entirely seed-borne, it is advised that farm-saved seed should be tested by PGRO. Some winter varieties which are very susceptible to the disease may develop severe symptoms in wet years, particularly if growing near to previous years' bean fields where infection can be transmitted from bean volunteers. Resistant varieties are available and information is given in the main variety table. Some fungicides will give partial control of the disease.

Downy mildew *(Peronospora viciae)*

Mildew is prevalent on spring beans, where it causes greyish-brown, felty growth on the under-surface of the leaves. Some varieties have resistance to the disease and 1 - 9 ratings are given in the Recommended List of Varieties. However, metalaxyl M (SL567A EAMU 0917/13) mixed with another active ingredient may be necessary on the more susceptible types if infection begins at early flowering. There is an EAMU for Wakil XL as a seed treatment for field beans which can give some useful early control of mildew on newly emerged seedlings.

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. Fungicides such as tebuconazole, cyproconazole, azoxystrobin, metconazole and boscalid + pyraclostrobin may improve yield 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.

Sclerotinia *(Sclerotinia trifoliorum)*

This disease occasionally infects winter beans in damp autumn weather, and infections may be associated with preceding crops containing red clover. Plants develop a watery stem rot, which can spread from plant to plant in dense stands. The related fungus, *Sclerotinia sclerotiorum* infects spring beans and also peas, rape, linseed, lupins and a range of field vegetables. Infection in spring beans is, however, very rare, but the risk should be borne in mind when planning rotations with other host crops.

Foot and root rots

These can occur on seedlings and on more mature plants, causing browning of the stem base and wilting of the leaves. Foot and root rots in beans appear to be more sporadic than those which occur in peas, and the bean crop in general appears less sensitive to root rots than peas. Nevertheless, growers should avoid over-cropping land with beans.

Black bean aphid

Pea and bean weevil *(Sitona lineatus)*

The pest can cause damage to spring beans if large numbers appear when plants are small. Leaves of attacked plants show characteristic 'U' shaped notches around the edges, but the main damage occurs as a result of the larvae feeding on the root nodules. Sprays may be applied at the first sign of leaf damage and repeated after 7 - 10 days. A monitoring system for pea and bean weevil is available from Agralan Ltd., The Old Brickyard, Ashton Keynes, Swindon, Wilts, SN6 6QR. Winter beans, although still prone to attack are usually too advanced in growth for the weevil or the larvae to have any appreciable affect on yield, and spray treatment is justified only when pest pressure is very high and winter beans show retarded growth.

Black bean aphid *(Aphis fabae)* and Pea aphid *(Acyrthosiphon pisum)*

Black bean aphid can be very damaging to field beans if colonies develop just prior to flowering. Spring-sown crops are usually more likely to suffer damaging attacks than winter beans. As well as forming dense, smothering colonies on the upper part of the stem these and the less obvious pea aphid are able to transmit several viruses which add to the yield loss. Aphids can be controlled using pirimicarb as soon as 5% of the plants have been colonised. Care must be taken if using other insecticides, especially when flowers are present on the crop, as there is a serious risk to bees.

Stem nematode *(Ditylenchus gigas)*

The nematode has become a major pest in field beans and can cause severe problems in wet seasons, particularly where farm-saved seed from an infested stock has been multiplied for several generations. The pest is seed-borne and can also infest soils, thereby becoming a problem for future crops of beans. Seed should be tested for nematode, and only clean stocks should be sown.

Bean seed beetle *(Bruchus rufimanus)*

Bruchid beetle can affect both winter and spring varieties. Adults emerge from the seed leaving a circular hole. The beetles do not breed in grain stores, but damaged produce may not be accepted for quality markets. Adults fly to beans during flowering and lay eggs on developing pods. The larvae bore through the pod and into the seed, where they feed until mature. A pyrethroid insecticide approved for use during flowering should be applied using angled nozzles at early pod set following 2 consecutive days when the maximum daily temperature has reached 20°C and repeated 7-10 days later. For further details see PGRO Technical Update 'Bean seed beetle *(Bruchus rufimanus)*'.

7.11 HARVESTING

Bean harvesting dates will depend upon weather, variety and crop location, but spring sown crops are often earlier to mature than winter ones. Harvesting usually follows winter wheat. The bean crop is less affected by wet weather at harvest than peas.

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. 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. The pods will be easily threshed and the seed fit for combining at 18% 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, however, 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.

7.12 DRYING AND STORAGE

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. Radial 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 1 m.

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

8 GROWING LUPINS

Lupins offer growers a pulse crop with significantly higher protein content than peas or beans. However, certain varieties can be later maturing or sensitive to alkaline soils.

There are currently three species of the *Lupinus* family available in the UK: the white lupin *(L. albus)*, the narrow leaved or blue lupin *(L. angustifolius)* and the yellow lupin *(L. luteus)*.

Different species and varieties have contrasting characteristics. Yields in trials have ranged from 1-5 t/ha. High protein content (30-45%) and oil enhances the grain feeding value to livestock.

Spring varieties are available of all three types, but the plant architecture varies between types and varieties.

A number of blue and yellow lupins are sensitive to alkaline soils, a pH of 7.0 or less is ideal. White lupins are more tolerant of alkaline conditions, growing well at pH 7.5.

In the UK, most lupins are used as a crimped or ensiled product

8.1 DESCRIPTIONS OF LUPIN VARIETIES

Dieta UK Agent: Lyle Morrison & Partners, UK marketing agent: Soya UK

Type - white / branching / semi-determinate / pale mauve flower colour

A tall, large-leaved and large-seeded variety, with a lower standing ability and later maturity than the narrow-leaved and yellow lupins. It has a higher seed oil and protein content than the narrow-leaved varieties. Dieta can be grown successfully on soils up to pH 7.8 and is suitable for grain production in the drier, warmer south east of the UK, and for forage in other areas.

Pootallong UK Agent: Soya UK

Type – yellow / branching / indeterminate / yellow flower colour

The highest yielding yellow variety. Plant architecture varies with soil type being less branched on heavier soils. Soil pH should not exceed 7.0

Iris UK Agent: Soya UK

Type – blue / narrow -leaved / branching / semi-determinate / white flower colour

A medium height variety with a semi-determinate branching habit. It is suitable for all combining in the Southern half of the UK, but also for crimping or whole cropping in other areas.

Iris UK Agent: Soya UK

Type – blue / narrow -leaved / branching / semi-determinate / white flower colour

A medium height variety with a semi-determinate branching habit. It is suitable for all combining in the Southern half of the UK, but also for crimping or whole cropping in other areas.

Viol UK Agents: Soya UK

Type - narrow-leaved / spike / determinate / very pale mauve flower colour

An early maturing, reduced branching and determinate variety. It has good standing ability. The variety may be grown for combining in all parts of the UK. It is not recommended for whole cropping because of its reduced branching nature. It is claimed by the breeder to be an ultra low alkaloid variety and to have Fusarium resistance.

Volos UK Agent: Lyle Morrison & Partners, UK marketing agent: Soya UK

Type - white / branching / semi-determinate / pale mauve flower colour

The earliest maturing white lupin variety in trials. A tighter growth habit than Dieta.

Seed treatment

Thiram seed treatment is available as an EAMU, but where there is a risk of seed-borne infection by anthracnose *(Colletotrichum acutatum)*, the use of tested, healthy seed is strongly advised. Wakil XL has an EAMU for use on lupin seed and may give some control of *Anthracnose.*

Inoculant

Seed is usually supplied with an inoculant containing *Rhizobium* bacteria *(Bradyrhizobium lupini)*, for nodulation. Most commercial seed suppliers supply the seed with inoculant which offers greater convenience. However, it is sometimes supplied separately and is mixed with the seed immediately before drilling. Growers are advised to use a separate inoculant if the seed is not pre-inoculated. Failure to use an inoculant can mean a very significant reduction in the amount of nitrogen fixed by the crop.

Fertiliser

No additional nitrogen is required and normal levels of P and K are sufficient.

Sowing dates

Spring varieties should be sown as early as conditions allow, with an optimum time of mid to late March.

Seed rate and population

The seed size of varieties varies considerably, as do the target populations, with white lupins having target populations of around 35 plants/m^2, yellow and narrow-leaved lupins target populations of 60-75 plants/m^2 for the branching varieties and up to 100 plants/m^2 for the non-branching varieties.

Rotation

There are some diseases and pests common to lupins, peas and field beans, but are only likely to build up to damaging levels where close rotations with peas or beans are followed.

Cultivations and drilling

Lupins require a similar seedbed to peas and over-cultivation and compaction should be avoided. Seed should be sown to a depth of 3-5cm and usually rolled after drilling.

8.3 WEED CONTROL

All herbicides for lupins are available through EAMUs. Weed control is heavily reliant on pre-emergence herbicides, various pendimethalin products, and Gamit (clomazone). Gamit can cause bleaching particularly in narrow-leaved lupins.

Pre-emergence Avadex Excel 15G (tri-allate) can be used to control wild oats. General grass weed control can be achieved with graminicides such as Fusilade Max (fluazifop-p-butyl), Laser (cycloxydim), Aramo (tepraloxydim) and Falcon (propaquizafop).

8.4 DISEASES

Lupins are susceptible to anthracnose *(Colletotrichum acutatum)* and seed should be tested. Foliar diseases, including rust and *Stemphylium* occur occasionally and early infection should be treated with metconazole, azoxystrobin, Switch, or Bravo Xtra (chlorothalonil + cyproconazole) which have an EAMU for lupins.

8.5 PESTS

Lupin aphid *(Macrosiphum albifrons)* can be damaging and peach potato aphid (Myzus persicae) can transmit bean yellow mosaic virus.

8.6 HARVESTING

A desiccant such as diquat (Reglone) can be used in crops that are weedy or uneven in maturity. Glyphosate may be used in non-seed crops where perennial weeds have become established. Lupins may lodge during the pod filling stage but generally, this does not significantly affect the ability to combine harvest. Recent experiences have suggested that harvesting is generally very easy and little pod shattering has occurred, except where the crop has over-dried in the field.

APPENDIX 1. PEA *(PISUM SATIVUM)* GROWTH STAGE DEFINITIONS

	CODE	DEFINITION	DESCRIPTION
Germination and	000	Dry seed	
Emergence	001	Imbibed seed	
	002	Radicle apparent	
	003	Plumule and radicle apparent	
	100	Full emergence	
	101	First node	leaf fully unfolded, with one pair leaflets, no tendril present
	102	Second node	leaf fully unfolded, with one pair leaflets, simple tendril
	103	Third node	leaf fully unfolded, with one pair leaflets, complex tendril
	10x	x node	leaf fully unfolded, with more than one pair of leaflets, complex tendril
	1n	last recorded node	any number of nodes on the main stem with fully unfolded leaves according to cultivar
Reproductive Stage (Refers to main stem, and first flower or pod apparent.)			
	201	Enclosed buds	small flower buds enclosed in terminal shoot
	202	Visible buds	
	203	First open flower	
	204	Pod set	a small immature pod
	205	Flat pod	
	206	Pod swell	pods swollen, but still with small immature seeds
	207	Pod fill	green seeds fill the pod cavity
	208	Green wrinkled pod	
	209	Yellow wrinkled pod	seed 'rubbery'
	210	Dry seed	pods dry and brown, seed dry and hard
Ripening Stage (Refers to lower, middle and upper pods on whole plant)			
	301	Lower pods dry and brown, seed dry, middle pods yellow and wrinkled, seed 'rubbery'. Upper pods green and wrinkled. Desiccant application stage.	
	302	Lower and middle pods dry and brown, seed dry, upper pods yellow and wrinkled, seed 'rubbery'. Pre-harvest stage.	
	303	All pods dry and brown, seed dry. Dry harvest stage.	

APPENDIX 2. BEAN *(VICIA FABA)* GROWTH STAGE DEFINITIONS

	CODE	DEFINITION	DESCRIPTION
Germination	000	Dry seed	
and	001	Imbibed seed	
Emergence	002	Radicle apparent	
	003	Plumule and radicle apparent	
	004	Emergence	
	005	First leaf unfolding	
	006	First leaf unfolded	
Vegetative Stage	refers to main stem. Two small scale leaves appear first but the nodes where these occur are not recorded; only nodes where leaf has unfolded are recorded.		
	101	First node	
	102	Second node	
	103	Third node	
	10x	x node	
	1n	n, last recorded node	
Reproductive	refers to main stem and first flower or first pod apparent at first fertile node(1). Stage For determinate cultivars there is an inflorescence at the terminal position as well as other racemes on the stem.		
(Node)	201(1)	Flower buds visible	(first buds visible and still green)
	203(1)	First open flowers	(first open flower on first racemes)
	204(1)	First pod set	(first pods visible at first fertile node)
	205(1)	Pods fully formed, pods green	(pods fully formed but with small immature seed within)
	207(1)	Pods fill, pods green	(seeds at maximum size fill the pod cavity)
	209(1)	Seed rubbery, pods still pliable, turning black	
	210(1)	Seed dry and hard, pods dry & black	
Pod Senescence & Seed Ripening refers to whole plant			
Senescence	301	10% pods dry and black	
	305	50% pods dry and black 80% pods dry and black, some upper pods green	
	308	80% pods dry and black, some upper pods green	
	309	90% pods dry and black, most seed dry	
	310	All pods dry and black and seed hard	
Stem Senescence		refers to whole plant	
	401	10% stem brown/black (or most stem green)	
	405	50% stem brown/black (or 50% stem green)	
	409	90% stem brown/black (or 10% stem green)	
	410	All stems brown/black; all pods dry & black; seed dry	

APPENDIX 3. PGRO PULSE TECHNICAL UPDATES

NUMBER	DESCRIPTION
117	Manganese Deficiency & Marsh Spot
137	Seed Treatments for Peas and Beans
138	Optional Extra Services
143	Pea Leaf Wax Assessment
147	Pea and Bean Seed Quality
149	Pea Moth
150	Harvesting Combining Peas
158	Fungicides for Peas
162	Check-list of Fungicides and Insecticides for Peas
163	Field Thrips *(Thrips angusticeps)* in peas and beans
164	Pea & Bean Weevil *(Sitona lineatus)*
167	Fungicides for Beans
168	Stem & Bulb Nematode in Field Beans
173	Checklist of Fungicides & Insecticides for Field Beans
177	The Choice of Herbicides for Spring Combining Peas
178	The Choice of Herbicides for Field Beans
180	Checklist of Herbicides for Combining Peas
183	Checklist of Herbicides for Field Beans
184	Notes for Growing Organic Pulses
185	Bean seed beetle *(Bruchus rufimanus)*
187	Pea aphid
188	Black bean aphid
189	Bean broomrape

PGRO is a non statutory levy body which is the UK's centre of excellence for peas and beans. It has a long history and a well-earned reputation for stability and consistency - along with a track record of providing authoritative, up to date information and project work based on solid, reliable research.

In recent years, there has been considerable change in the way the PGRO operates, and the PGRO of today is considerably different to that of even ten years ago. Many of these changes have been internal, and perhaps not immediately apparent to our levy paying members and the agricultural world at large.

The new PGRO logo has been launched, accompanied by a refresh and standardisation of our presentation Our new logo makes the organisation more immediately visible. It is a redesign of the old image that retains its general familiarity, yet delivers a more up to date impression, making it more modern and useable with electronic media.

The redesign of this Agronomy Guide and the Vining Pea Growers Guide - along with the recent launch of our more vibrant, modern and user friendly web site - are examples of PGRO's refreshed external image.

The PGRO aims to maintain its valued stability and consistency and, for the future, to project a modern organisation of continuing relevance for research partners, collaborators and commercial clients, as well as maintaining the confidence of staff and levy payers alike.

For the latest PGRO crop updates, technical updates and other information visit our web site at www.pgro.org

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