GROWING PEAS FOR OVER 200 YEARS

Wherry & Sons Ltd.
Specialists in pulses for human consumption

A Growers Guide to Peas

- Crop Husbandry
- Weed Control
- Pests & Diseases
- Harvesting, Drying & Storage
- Quality Standards
- Yield Enhancement Network
- The PGRO Website

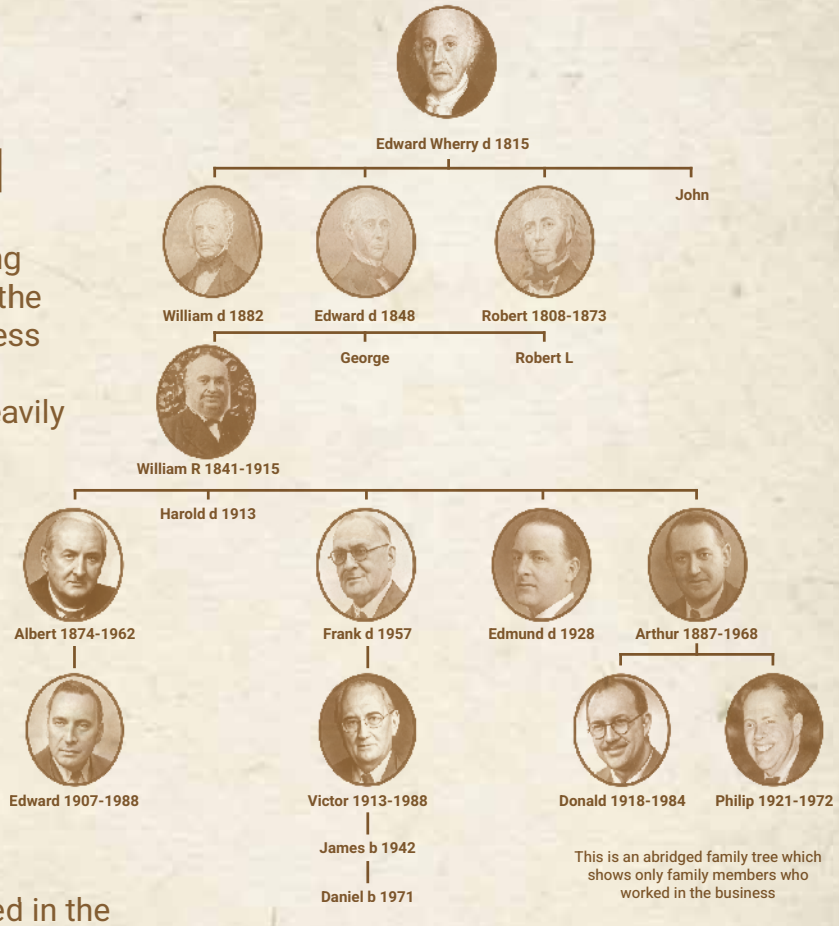
Produced in collaboration with...

PGRO

A Brief History of Wherry & Sons Ltd

Wherry and Sons first began trading in 1806, starting out as grocers in the market town of Bourne. Our business has been based in the area for it's entire trading history and is still heavily linked to agriculture in the region.

Our current Managing Director, Dan Wherry, is the seventh generation of the Wherry family to be involved in the business. Our long history continues to shape everything we do and we pride ourselves on building and maintaining many long lasting relationships with customers and suppliers a like.



This is an abridged family tree which shows only family members who worked in the business

Despite our main office being based in the same locality for nearly 220 years, we now have a presence in many different regions around the world, from Egypt to China, allowing us to service our existing customers around the world whilst also giving us the opportunity to seek new markets for our products.

Our Products

Marrowfat and green peas are the main stay of our business; we supply peas to dozens of customers both domestically and abroad to fulfil many different requirements, be it mushy peas for fish and chip shops here in the UK, soup makers in Germany or snack-food manufacturers in the Far East.

We also export UK grown spring and winter faba beans to the Middle East and North Africa, where they are used for making ful medames.

Wherry's import chickpeas for domestic the canning and houmous trade; unfortunately we have yet to master the art of growing chickpeas here in the UK!

Introduction

Wherry & Sons are very proud to have been trading peas for 200 years and we are an established presence in both domestic and export pulse markets. One constant over this time is the need to produce a quality crop, suitable for the consumer. We hope that this guide will help you to achieve this quality, not only ensuring you receive the best price for your produce but also maintain our access to both global and domestic markets for the future.

Demand for UK peas continues to grow and we believe there is a very bright future ahead. Wherry and Sons continues to invest in all aspects of the supply chain; from new varieties to new forms of processing and manufacturing which will allow a greater number of customers to benefit from UK peas. Ultimately success begins in the field and we hope that with this guide and our experience and support, you can continue producing a market-leading product.

We look forward to working with you.

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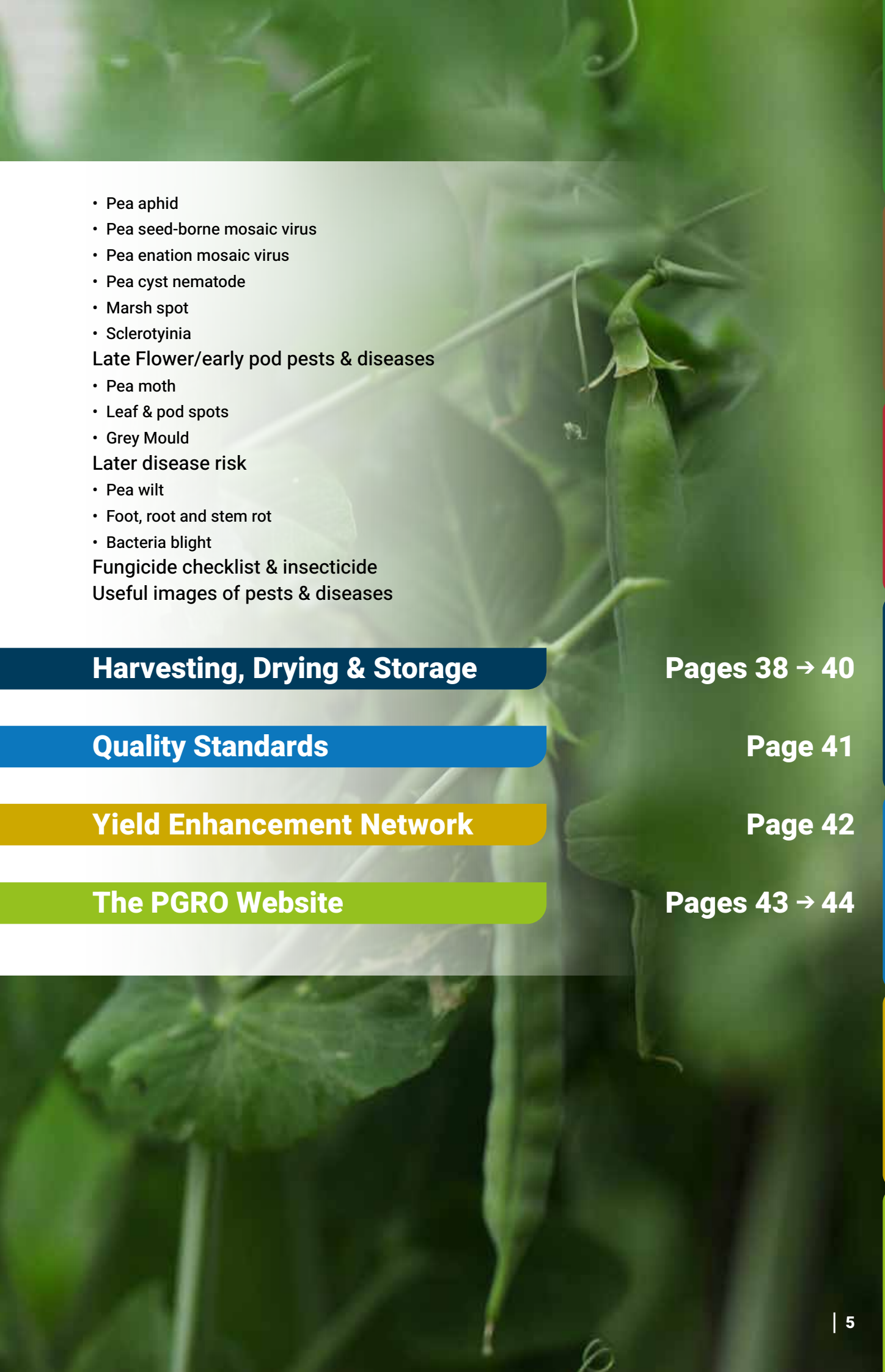


- Pea aphid
- Pea seed-borne mosaic virus
- Pea enation mosaic virus
- Pea cyst nematode
- Marsh spot
- Sclerotyinia

Late Flower/early pod pests & diseases

- Pea moth
- Leaf & pod spots
- Grey Mould

Later disease risk

- Pea wilt
- Foot, root and stem rot
- Bacteria blight

Fungicide checklist & insecticide

Useful images of pests & diseases

Crop Husbandry

Rotation

To reduce the risk of a build-up of persistent soil-borne diseases such as foot rots caused by Fusarium solani, Aphanomyces euteiches and Didymella pinodella, peas should be grown in no more than one year in five on the same field. There is limited information on whether the same pathogen strains can infect other legume crops. Recent cover crop work has shown that winter vetches and Berseem clover do not increase the risk of foot rot infection when grown as cover crops preceding vining peas. Published reports suggest that pathogen strains might be host plant specific but not enough information is available to advise whether field beans and green beans can be grown in closer rotation with peas. As a precaution, it is recommended to leave five years between field beans, broad beans, green beans and peas. (Details of Pea Foot Rots and associated soil tests can be found at the end of this section).

Cultivations

Land is often ploughed in the autumn allowing natural weathering to aid in 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. Here, 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 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 soils with low organic matter content, and poor, light-textured soils. High winter rainfall will lead to increased S leaching, and compaction or cool weather may limit root development and restrict S uptake. Tissue analysis should be combined with soil analysis to predict S deficiency as soil analysis alone is not sufficient. 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 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.

The Fertiliser requirements of peas (kg/ha)				
Soil Index# N, P or K	N	P_2 05	K_2 0*	Mg0
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 K20 should be combine-drilled, otherwise germination may be affected. The rest should be broadcast.

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.

Pea Foot Rots and Associated Soil Tests

Foot rot diseases in peas are caused by a complex of soil borne pathogens. The most common pathogens are Fusarium solani, Didymella pinodella and Aphanomyces euteiches. These pathogens can occur individually or in combination, and yield losses can be severe. Development of foot rot diseases is encouraged by poor soil structure, compaction and water logging. All three pathogens produce long-lasting resting spores which survive in soils for more than ten years. Frequent legume cropping leads to the build-up of pathogen levels in soils. Work has shown that some degree of yield loss can even occur where relatively low levels of pathogens are present, and the above ground symptoms of the disease may not be obvious. Soil tests are available at PGRO to assess pathogen loadings in soil of the three major pea foot rot pathogens, Aphanomyces euteiches, Fusarium solani and Didymella pinodella (formerly Phoma medicaginis var. pinodella). These levels are linked

to the risk of foot rot developing when conditions are favourable for disease development. In high risk fields, considerable yield losses are likely to occur and test results allow growers to avoid planting peas in fields which show a high risk of foot rot development. All pathogens are reported separately. Scores and associated risk levels (likelihood of disease development) can be found in the table below.

Pathogen	Low Risk	Medium Risk	High Risk
Aphanomyces euteiches	0 - 1.8	1.81 - 3.2	3.21 – 5
Fusarium solani	0 -1	1.01 - 1.99	>2
Didymella pinodella	0 -1	1.01 - 1.99	>2

An **overall risk level** for the field considering **all three pathogen loadings** is also provided.

Soil samples should be collected at the latest in autumn before pea planting. Test results will also be valid for soils tested up to 2 years in advance of planting peas due to the long-lasting nature of the pathogen spores. Occasionally, soil samples may have to be taken from fields containing standing crops such as sugar beet. In these cases, soil from the surface should be discarded as some residual herbicides can affect the result.

Test results will be provided 4 weeks after receiving of soils.

Further details of the soil sampling services offered by the PGRO and associated pricing is available on the PGRO website - https://www.pgro.org/soil-testing/

Soil Sampling guidelines

Soils are heterogeneous and populations of soil microbes vary with soil depth and type so it is important to realise that a single sample is unlikely to be representative of the whole site. Soil pathogens, in particular, can occur in patches across a field. Whilst separately testing each sample collected is the ideal method of checking it, the cost is prohibitive, so representative composite samples are created by collecting a number of smaller samples from the area and combining them.

Sampling Strategy

The frequency and distribution of soil collection for the composite sample is important. The more sub samples the better. If a specific issue is occurring in a restricted area, then samples might be collected from that area alone. If the entire site is to be assessed, then a sample representative of the entire site should be collated.

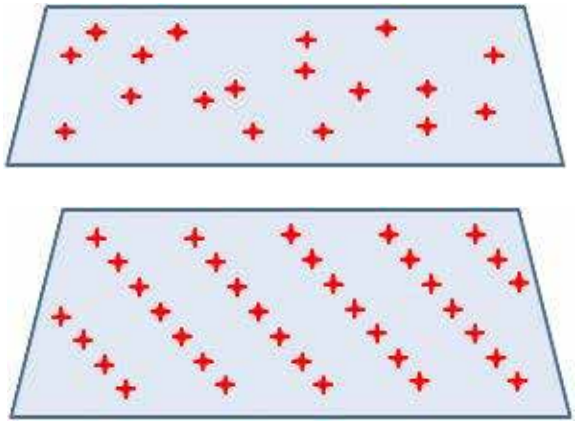
Soil should be taken from the rhizosphere (the root zone), the area within the soil profile that will have the most microbes. This means discarding the top 5 cm of soil, generally sampling to a depth of 25 cm. To ensure representation of the entire site a random or grid sampling strategy should be adopted.

Soil collected should be sealed in a plastic bag and sent to the laboratory. Fresh soil samples should be sent to the lab as soon as possible. Whether using a sampling auger, trowel or spade it is important to realise that sample contamination can occur if equipment is not cleaned thoroughly between sites. A weak bleach based solution is recommended for cleaning equipment between sites but cleaning equipment thoroughly with water will also avoid contamination.

Sampling Patterns

For random sampling, choose random points to sample across the entire field.

For grid sampling, take samples at regular fixed intervals across the area. This method is typically used where little is known about the field in question.



Growth Stage Definition

Key pea growth stages taken from BBCH monograph: Growth stages of mono - and dicotyledonous plants 2. Edition, 2001 (Weber and Bleiholder, 1990; Feller et al., 1995b)

	CODE	DESCRIPTION
Principal growth stage 0: Germination and emergence	00	Dry seed
	07	Shoot breaking through seed coat
	08	Shoot growing towards soil surface; hypocotyl arch visible
	09	Emergence: shoot breaks through soil surface
Principal growth stage 1: Leaf development	11	First true leaf (with stipules) unfolded or first tendril developed
	12	2 leaves (with stipules) unfolded or 2 tendrils developed
	1..	Stages continuous until
	19	9 or more leaves (with stipules) unfolded or 9 or more tendrils developed
Principal growth stage 5: Inflorescence emergence	51	First flower buds visible outside leaves (enclosed bud)
	55	First separated flower buds visible outside leaves but still closed
Principal growth stage 6: Flowering	61	Beginning of flowering: 10% of flowers open
	62	20% of flowers open
	64	40% of flowers open
	65	50% of flowers open (first pod)
	67	Flowering declining
	68	End of flowering
Principal growth stage 7: Development of fruit	75	50% of pods have reached typical length;
	79	Pods have reached typical size (green ripe): peas fully formed
Principal growth stage 8: Ripening of fruit and seed	81	10% of pods ripe, seed final colour, dry and hard
	88	80% of pods ripe, seed final colour, dry and hard (desiccation stage)
	8..	Stages continuous until
	89	Fully ripe: all pods dry and brown. Seeds dry and hard (dry ripe)
Principal growth stage 9: Senescence	97	Plants dead and dry
	99	Harvested product

Source: Extract from the internationally recognised BBCH crop growth stage key (BBCH - Biologische Bundesanstalt, Bundessortenamt and CHemical industry).

Weed Control

THIS SECTION CONSISTS OF GENERAL COMMENTS ON WEED CONTROL IN PEAS FOLLOWED BY DETAILS OF PRODUCTS/ACTIVE INGREDIENTS, WEED CONTROL CHECKLISTS AND A PHOTO SECTION WITH REFERENCE IMAGES OF WEEDS.

General Comments

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. These notes, partly based on the results of PGRO experimental work, are intended to help growers choose wisely.

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.

Post-emergence sprays can be applied from 3 nodes of the crop to well-waxed peas (tested with crystal violet dye).

Volunteer Oilseed Rape can be a serious problem if it is grown in the same rotation and control, particularly of rape germinating from depth, may be incomplete.

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.

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.

Post-emergence graminicides can control volunteer cereals and offer some reduction of black-grass and other grass weeds, however, resistant grass weed populations will cause problems. Control with graminicides, particularly of high populations of black-grass can be disappointing. Where black-grass 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.

At the end of this section there is a checklist of active ingredients and approved products for combining peas, a checklist of weed problem & timing for combining peas and a checklist of weed susceptibility to herbicides for combining peas.

There is also a set of reference images of weeds relevant to combining peas.

Weed Control Products/Active Ingredients

Several products are available for controlling weeds in peas and it is important that growers appreciate the properties of each and that they choose the one most suitable for their conditions, soil type and weed spectrum. These notes, based on the results of PGRO experimental work, are intended to help growers choose wisely.

For most pre-emergence pea herbicides there are recommendations that the land is ploughed or deep cultivated before sowing the following crop - please check the label.

Where buffer zones are required near surface waters or ditches these are denoted by BZ Category A or B. A LERAP can be applied to category B OR more recently specific product instruction regarding the required BZ.

General Broad-Leaved Weed Control

Experiments have shown benefits of early weed removal and it is best to use pre-emergence materials where possible. Pre-emergence residual herbicides require soil moisture for activity and are suitable for all except late drillings where conditions are often drier. Pre-emergence herbicides are ineffective at economic rates on highly organic soils, and some are damaging on gravelly or very light soil types. They are less effective on cloddy seedbeds and rolling the seedbed to provide a level surface is essential for good weed control with pre-emergence materials.

Perennial Broad-Leaved Weeds

These are not controlled by pre-emergence applications and the effects of post-emergence sprays vary. Mixtures containing MCPB will give useful control of volunteer oilseed rape, thistles and docks, or the material may be used alone. Perennial weeds may also be eradicated with glyphosate pre-harvest of the preceding wheat or barley crop.

General Weed Control – Pre-Emergence Herbicides

Pendimethalin (various products) LERAP: B

Pendimethalin should be applied as soon as possible after sowing. It may be used on any variety on all except organic or gravelly soils. Pendimethalin should not be used on soils where surface water is likely to accumulate. Maximum permissible rates of pendimethalin products controls volunteer rape, AMG, speedwells, knotgrass and chickweed amongst others but, control of mayweed is variable, and charlock and mustard are resistant. The activity of pendimethalin is very moisture dependent. Be aware that there are various pendimethalin products which have different approved rates of use in dry peas because they differ in the concentration of pendimethalin present e.g. there are 400, 455 and 330 gai/l formulations.

Clomazone (various products) LERAP: n/a A pre-emergence residual herbicide for the control of cleavers and other broad-leaved weeds. As well as cleavers it has good activity on chickweed, shepherd's purse, fools parsley and red dead-nettle, but control of other species can be variable. As it's spectrum of activity is quite narrow it is usually tank mixed with other pre-emergence products.

Nirvana (pendimethalin+imazamox):
LERAP: B

Nirvana is used pre-emergence and provides wide spectrum residual broad-leaved weed control.

Nirvana is crop safe on all commercially available varieties. Seed should be drilled to a depth of 25 mm and fields prone to water logging should be avoided.

Maximum persistence is seen with the full permitted dose of 4.5 l/ha and this may allow a 'one-hit' herbicide programme. The 3.0 l/ha application appears to be a good compromise with possibly the additional option of a further drop to 2.5 l/ha when considering a mix with clomazone to maximise cleaver control. Work has shown the full 4.5 l/ha application reduced cleaver numbers effectively and may be a means of retaining the full weed control spectrum while still achieving adequate cleaver control. It shows excellent activity against polygonums, black-bindweed, redshank and knotgrass. Charlock is also effectively controlled as is chickweed. Nirvana also gives improved control of early emerging volunteer oilseed rape when compared to pendimethalin alone.

Stallion Sync TEC (pendimethalin + clomazone):
LERAP Aquatic buffer zone 5m

A micro encapsulated broad-spectrum pre-emergence product with useful cleaver activity. Other weeds which are effectively controlled include shepherd's purse, fat hen, deadnettle's, annual mercury, knotgrass, groundsel, black nightshade speedwells and field pansy amongst others.

Emerger (Aclonifen)

Aclonifen gained approval in 2023

Pea Leaf Wax Assessment

One of the problems encountered annually is to decide whether pea plants have sufficient leaf wax to enable post-emergence applications of contact-acting herbicides to be made without damaging the crop. It is not always possible to know the previous weather conditions which might affect this issue and therefore a simple method for carrying out a test on the plants was required.

Such a test was developed at Chesterford Park Research Station using a solution of crystal violet. (Assessment of wettability of leaves by dipping in crystal violet. R.C. Amsden & C.P. Lewins, World Review of Pest Control 1966, Vol. 5, No. 4.) This has proved to be an excellent method of determining leaf wax deposits on peas.

The test should be carried out before applying any sprays which include bentazone. Some approved MCPB products also recommend that leaf wax is tested prior to application.

Method

As a 1% solution of crystal violet in water. Crystal violet can be purchased through some chemists and pharmaceutical suppliers. The crystals can be bought and dissolved in water. The crystal violet solution is best conatined in a wide-necked container with a removable top and around 500ml capacity.

The plants to be tested should be carefully handled and a large pair of forceps should be used to pull the plant by gripping the base near the soil. It is then completely immersed in the dye. The plant is removed quickly and the surplus dye shaken off. Areas of the plant retaining the dye are where the wax deposit is either deficient or has been damaged. Several plants should always be tested. Different varieties should be tested separately before spraying.

A normal healthy pea plant will retain a certain amount of dye on the stem, the midribs, the tendrils, the leaf margins and on the oldest leaves at the very bottom of the plant. There is very little retention on the upper leaf areas and on the unopened growing points. Any mechanically damaged areas will also show retention.

If there is less than 5% of the area of surfaces of upper leaves showing retention and less than 10% of surfaces of lower leaves showing retention, the crop would be safe to spray.

On a plant with either insufficient or damaged leaf wax the dye will be retained on a considerable proportion of the leaf area and indeed under certain conditions virtually all the surface may show retention. If more than 5% of the upper leaf surface of more than 10% of the lower leaf surface retains the dye spraying should be delayed until the plants when tested show a normal amount of dye retention. This will probably take at least 5 - 7 days.

With a little experience this test can rapidly indicate whether pea crops are safe to treat, although knowledge of previous weather conditions will also be of value in helping to decide whether to spray or not.

Simple tests on various weeds will help the operator to develop experience of various degrees of dye retention.

It is recommended that protective gloves are worn when carrying out tests and avoid getting the dye onto skin or clothes as it is difficult to remove although not dangerous. In this event wash thoroughly as soon as possible with soap and methylated spirits. When the dye is dissolved rinse with water.

Post-emergence Herbicides

It may sometimes be necessary to apply a follow-up post-emergence herbicide if pre-emergence treatments have not given adequate control. Those treatments which a have a 'contact' action (bentazone treatments) must be applied to healthy peas which are well waxed. Pea leaf wax can be tested with crystal violet solution. There is a PGRO information sheet on Pea leaf wax assessment.

MCPB (Trade names various) LERAP: N/A

This material is specifically used to control thistles and docks and will effectively stunt volunteer oilseed rape. It only controls a limited range of annual weeds and so a bentazone + MCPB mix will be required to enhance the controlled weed spectrum. Apply before peas are at enclosed bud stage.

MCPB + bentazone tank-mix. LERAP: N/A

This tank-mix is relatively expensive the margin of crop safety is less compared to using the products individually. However, this mixture is capable of giving good weed control including cleavers and large volunteer oilseed rape under a wide range of conditions. Crops under stress may be checked. Peas should not be sprayed under conditions of high temperatures or humidity. Apply a single application from 3 node to before flower bud can be found in terminal shoot.

Bentazone (Basagran SG, Benta 480, Clayton Baritone). LERAP: N/A

Please note, there have been changes to the Basagran SG label and rates of application and number of applications permitted in peas altered. There is also advisory information regarding water stewardship with the aim of maximising product longevity. For the moment other bentazone product labels are as they were but please check. Bentazone can be used alone and is useful for cleaver control but is ineffective on large fat-hen and some other weeds including knotgrass and speedwells. Please check labels for specific product for earliest application timings, usually **from 2 to 3 nodes, latest applications before flower buds detectable in terminal shoots.**

Volunteers

Oilseed rape: This can be a problem weed several years after cropping. Allowing shed seed to germinate after harvest, before ploughing or cultivating, will help prevent carry over.

Products containing pendimethalin are the only pre-emergence herbicides which can control rape volunteers, but control may be incomplete and those germinating from depth will not be killed.

A cheap post-emergence application of MCPB will effectively control smaller specimens. Bentazone post-emergence is effective. Do not expect control of rape beyond 4 true leaf stage. Bentazone + MCPB may be needed where rape volunteers are at an advanced stage. If rape is not controlled in a combining pea crop an application of an appropriate glyphosate product pre-harvest may be required. Approved glyphosate products are slow to act.

Potatoes: Competition from volunteer potatoes can be severe, but it is not possible to selectively kill potatoes in combining pea crops.

Grass Weeds

The selective post-emergence grass weed killers, **fluazifop-p-butyl, quizalofop-p-ethyl** and **cycloxydim** will not control annual meadow-grass. **Propaquizafop** gives some suppression but only if applied up to 3 leaf stage. Pre-emergence residual herbicides containing pendimethalin offer some control annual meadow-grass.

Where graminicides are used in sequence with other post-emergence treatments, care must be taken that the crop has recovered and is undamaged (see labels).

Falcon and others (propaquizafop)

Falcon is a post-emergence treatment for wild-oats, optimum timing from two leaves folded to early tillering. Falcon may be applied to peas at 3rd node stage until when flower buds are visible. Minimum harvest interval is 7 weeks. No adjuvant is needed, and it is rain-fast after one hour following application.

Laser and others (cycloxydim)

Laser + Toil adjuvant oil (at 0.5% final spray volume) is a post-emergence treatment for control of wild-oats and other grasses. Optimum timing is at two fully expanded leaves to the end of tillering. The peas should be from 3rd node stage until before crop canopy prevents adequate spray penetration. Test pea leaf wax before application. Minimum harvest interval is 5 weeks.

Fusilade Max and others (fluazifop-p-butyl)

Fusilade Max requires no additional wetters. Applications should be made to peas from 4 node stage before first flower visible, and pea leaf wax should be tested. The wild oats should be from 2 leaf to fully tillered stages. Minimum harvest interval is 2 weeks. **Check product labels for dose rates**.

Leopard 5 EC (quizalofop-p-ethyl)

Timing for wild oats is from two leaves to fully tillered growth stage. It may be applied to peas before the crop canopy closes. Minimum Harvest Interval for vining and combining peas is 5 weeks.

Panarex (quizalafop-p-tefuryl)

Is a post-emergence graminicide for the control of wild-oats and other grasses. Spring applications only are permitted but can be made from 2-3 unfolded leaves up to flower buds visible. It has a 60 day harvest interval.

Black-grass

Pre-emergence herbicides for broad-leaved weeds will have little effect on germinating black-grass, but where extensive late germination is expected the most satisfactory control will be obtained by integrating cultural techniques and chemical options e.g., Fusilade Max (and others), Leopard 5 EC, Falcon, Panarex or Laser. A different approach will be needed where resistant black grass occurs and specialist advice should be sought.

Cereals

Volunteer cereals can be controlled by the wild-oat rate of the post-emergence herbicides, Fusilade Max (and others), Panarex and Falcon, and at a slightly higher rate than that for wild-oats for Laser.

Couch

The best and most economical means of control is by application of one of the various glyphosate products either pre-harvest in the previous cereal crop or in the autumn. Some control of this weed can be achieved by standard autumn cultivations or graminicide treatments.

Laser controls couch and can be used at 2.25 l/ha + Toil as a selective post-emergence treatment in peas, when couch is 15 cm tall (4 - 9 expanded leaves up to end of tillering). Leopard 5 EC from 4 leaves to before jointing.

No other post-emergence graminicides are approved for peas at rates for control of perennial grasses. Fusilade Max (no adjuvant required) applied at wild-oat rates gives useful suppression of couch foliage. These post-emergence graminicides will not give long-term couch control and at the higher rates suggested are usually uneconomic.

Barren Brome

There are recommendations for control of barren brome using, Laser or Fusilade Max (and others) post-emergence.

Checklists of Herbicides for Combining Peas

Important notes:

1. Products with Extensions of Authorisation for Minor Use (EAMU) may only be used under conditions relating to approval - obtain relevant MAFF/MAPP number and document and use accordingly.
2. Every effort is made to ensure this information is correct. However, materials may be withdrawn, or there may be additional recommendations.
3. PLEASE READ & FOLLOW PRODUCT LABEL RECOMMENDATIONS CAREFULLY

Active ingredients and example approved products

	Active Ingredient	Example Approved Products	Harvest Interval/Latest Time of Application
1	bentazone	Basagran SG, Benta 480, ClaytonBaritone	before enclosed flower bud
2	bentazone + MCPB (tank-mix)	Benta 480 + Tropotox	before enclosed flower bud
3	clomazone	Centium 360 CS and others	pre-emergence
4	cycloxydim	Laser	35 days
5	fluazifop-p-butyl	Fusilade Max & others	before flower buds visible and 90 day HI
6	glyphosate	Various	Pre-drilling/ 7 days before harvest (not seed crops)
7	imazamox + pendimethalin	Nirvana	pre-emergence
8	pendimethalin + clomazone	Stallion Sync TEC	pre-emergence
9	MCPB	Tropotox, Bellmac Straight, Butoxone	before enclosed flower bud
10	pendimethalin	Stomp Aqua, Most Micro + others	pre-emergence
11	propaquizafop	Falcon & others	49 days
12	quizalofop-p-ethyl	Leopard, Pilot Ultra	30-35 days (check label)
13	quizalofop-p-tefuryl	Panarex, Rango	60 days
14	carfentrazone-ethyl	Various	1 month before planting

Weed problems & Timings for Combining Peas

Weed Problem & Timing for Peas	Materials
annual grasses including volunteer cereals	4, 5, 11, 12, 13
annual meadow-grass	7, 8, 10, 11
annual weeds in stubbles/pre-cultivated land winter/spring	14
annual weeds, volunteer cereals pre-drilling/pre-emergence (translocated)	6
black-grass, post-emergence	4, 11, 12, 13 (but resistance issues)
cleavers, pre-emergence	2, 3, 8
couch, post-emergence	4, 5, 12, 13 (effective rates usually uneconomical)
couch, pre-harvest of combining peas	6 (not seed crops)
couch & perennial weeds in stubbles/pre-cultivated land winter/spring	6
Desiccation (not contact)	6 (not seed crops)
general broad-leaved weed control, pre-emergence	3, 7, 8, 10
general broad-leaved weed control, post-emergence	1, 2, 9
wild-oats, post-emergence	4, 5, 11, 12, 13

Materials are cleared for taints in crops for processing unless specified.

Weed susceptibility to herbicides for combining peas

	PRE	PRE	PRE	PRE	POST	POST	POST	POST	POST	POST	POST
WEED SPECIES COMMON NAME	clomazone	pendimethalin + clomazone	pendimethalin	pendimethalin + imazamox	bentazone	bentazone + MCPB	MCPB	cycloxydim	fluazifop-p-butyl	propaquizafop	quizalofop-p-ethyl
Annual meadow-grass	MS	MS	S	MS	R	R	R	7	7	SU	R
Annual mercury	MS	MS		MS							
Barren brome	R	R	R		R	R	R		S		S
Black-bindweed	MS	MS	MS	S	MS	MS	S*				
Black-grass	R	R	MS	MR	R	R	R	MR	S	S	S
Black-nightshade	MS	S	MS	MS	S	S	R				
Charlock	MR		R	S	S	S	MS				
Chickweed, common	S	S	S	S	S	S	R				
Cleavers	S	MS		MS-	MS	S	R				
Corn Marigold			S		S						
Couch, common	R	R	R		R	R	R	S	(S)	S	S
Creeping thistle					MS	MS	MS				
Dead-nettle, red	MS	S	S	S	MR	R	R				
Dock							S				
Fat-hen	MS	S	S	S	MR	S	S				
Fool's parsley	S		R	MR	S	S	R				
Forget-me-not		S	S		S						
Fumitory, common	MR	MS	MS	S	MS	S	MS				
Groundsel	MS	S	R	MR	MS	S	R				
Hemp-nettle, common	MR	S	S		R	MS	S*				
Henbit dead-nettle		S	S	S	MS						
Knotgrass	MS	S	S	S	R	MS	MR				
Mayweeds	MR	MS	MS	MS	S	S	R				
Nettle, small	MS	S	S	MS	S	S	S				
Orache, common	MS		S	S	MS	MS	MR				
Pale persicaria	MS				S	S					
Pansy, field	MR	S	S	MR	R	MS	S*				
Parsley piert											
Poppy, common	MR		S	S	MS	MS	MS				
Redshank	MS	MS	MS	S	S	S	S*				
Scarlet pimpernel			S	S	S	S	MR				
Shepherd's purse	S	S	MS	MR	S	S	S				
Sow-thistle, smooth	MS	S	S	MS	MS	MS	S*				
Speedwell, common field	MS	S	S	S	R	R	R				
Volunteer cereals	R	R	R		R	R	R	S	S	S	S
Volunteer oilseed rape	R		MS	MS-	S	S	MS				
Wild-oats	R	R	R		R	R	R	S	S	S	S
Wild radish				MS	MS		R				

Susceptible	Moderately Susceptible	Resistant	Moderately Resistant	Some Suppression

***** Small seedling stage 1 -2 leaves
- Best results from 4.5 l/ha application
n Non label weed but control seen with linuron alone
( ) Only the wild-oat rate is approved for peas, this will give some suppression

Peas are uncompetitive during their early development

Volunteer oilseed rape can be a problem in peas

Choosing a spring crop does not guarantee black-grass control.
Both cultural and chemical approaches have to be carefully considered together and carried out effectively

High numbers of uncontrolled maywead in peas

Amaranthus

Charlock

Overdosing may not cause visual damage but may affect development.

At early crop development - so long as soil conditions are suitable - it is possible to achieve acceptable weed control in peas using a tined weeder.

Fools Parsley

Bindweed

Cleaver

Corn Marigold

Chickweed

Corn Marigold cotyledon stage

Field Pansy

Fumitory

Pests & Diseases

THIS SECTION CONSISTS OF DETAILS OF THE MAIN PESTS AND DISEASES IN COMBINING PEAS FOLLOWED BY FUNGICIDE AND INSECTICIDE CHECKLISTS, AND A PHOTO SECTION WITH REFERENCE IMAGES.

General Comments

Many factors can affect growth of the pea crop, and the notes below describe the main pests and diseases which reduce yield and quality.

A wide range of localised climatic effects can influence the development of foliar diseases. In certain circumstances fungicides have been shown to be useful in controlling diseases.

However, responses to treatment can only be expected if weather conditions favour disease development. Routine or prophylactic treatments do not produce an economic return year after year.

EARLY RISK PESTS AND DISEASES

Pea and Bean 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.

The adult weevils are beetle-like in shape and 4-5 mm in length. They are light grey to brown in colour with faint striping along the length of the wing cases. They have a very short 'snout' but have the 'elbowed' antennae typical of weevils. Adults migrate from their over-wintering sites, mainly around the grassy uncultivated edges of fields previously cropped with peas or beans. Migration occurs early in the spring and this often coincides with short periods where the maximum air temperature exceeds 12°C.

During feeding, eggs laid by the female weevil are washed into the soil around the stem bases and produce larvae which begin feeding inside the root nodules. After 3-4 weeks, the larvae pupate and newly emerged adults return to the overwintering sites. There is one generation each year.

If leaf damage is anticipated, early treatment of the crop is necessary to interrupt the egg laying period and reduce root damage. A monitoring system is available which detects adults when they begin migrating in the early spring. The system was developed by Rothamsted Research and the field development was undertaken by PGRO in conjunction with Rothamsted Research and ADAS.

The monitoring system comprises five cone traps containing a pheromone lure. It can be used as an aid to decision making in the following ways:

- Identifies seasons where weevil numbers are low and crops do not require treatment
- Identifies the time of peak activity and allows crops to be treated at the optimal time
- Reduces the need for prophylactic spraying
- Allows the selection of drilling time to avoid periods of serious damage (useful in organic crop production systems)
- An aid in integrated pest management systems for assured produce crops

Traps are sited on a single grassy verge or headland of a field which had been cropped with peas or beans the previous year. They should be sited by mid-February and weevils counted three times each week. Full instructions are supplied with the traps.

A threshold catch occurs when an average count per trap exceeds 30 weevils on any one recording day. Monitoring should continue until a threshold catch is reduced or until the latest sown crops have emerged (whichever is the sooner).

When a threshold has been reached, crops which have just emerged or will emerge during the next 10 days may be at risk. A spray can be applied as soon as the first sign of notching is observed if previous experience is that weevil damage occurs regularly. During periods of slow growth a second spray should be applied 10-14 days later. Crops emerging later should not be at risk. If a threshold is not reached or if it occurs more than 10 days before crop emergence there is no need to spray.

A monitoring system is available from Koppert UK to predict the likely severity of attack.

Field thrips (Thrips angusticeps)

In most seasons, damage caused by thrips to newly emerging pea crops occurs to a greater or lesser degree. Attacks are more severe during periods of slow growth and in particular on stony soils.

Thrips are tiny, narrow-bodied, black insects of the type known as ‘thunderflies’. Many generations of thrips are wingless and spend most of the year in the soil, feeding on a wide range of non-legume crops including Brassicas, linseed and sugar beet. As peas begin to emerge in the spring, thrips feed inside the tightly rolled leaves of the growing point. Because feeding causes damage to the leaf surface, young leaflets appear pale and slightly distorted and, if held to the light, small translucent markings are obvious.

In many situations, peas can outgrow the initial attack, with no long-term effects on the crop. However, occasionally when the attack is severe, peas may develop multiple secondary shoots and develop as small bushy young plants. Where damage is noted in most years, then treatment can be justified.

Thrips in peas may be difficult to control as the insects feed inside the enclosed shoots. PGRO trials have shown that Hallmark with Zeon technology has given a useful and consistent reduction of leaf damage.

The product is approved for use on all peas for weevil control. Early treatment is essential and where thrips damage is confirmed as the peas are just emerging, and before the leaves have expanded, a single spray should be applied as soon as possible.

Downy mildew (Peronospora viciae)

The pathogen produces resting spores, which persist in the soil and initiate primary infection in young pea plants. Primary infected plants are stunted, covered on the underside of the leaves with grey coloured mycelial growth and often die before flowering. They are the source for secondary infection of older plants by producing air borne spores, especially under cool and humid conditions. Pods develop yellow blotchy patches on the surface. Seeds fail to develop properly and are often blemished. Varietal resistance should be used to avoid serious losses. There are currently no fungicidal seed treatments for peas. There are no foliar fungicides which give effective control.

PRE/EARLY FLOWER PESTS AND DISEASES

Pea midge

Attacks by this pest may result in loss of yield and can be very serious where populations have built up in intensive pea growing areas.

Description and life history

The adult, a small gnat-like insect, has a yellow-grey coloured body about 2mm in length, and six long legs. The head is dark with a pair of very fine antennae. The wings are semi-transparent and slightly longer than the body and when the midge is at rest, they are folded together along the insect's back.

Midges begin to emerge from previously infested fields during the first half of June, and after mating the females fly to those pea crops where buds and flowers are present. Batches of 20 or more eggs are laid on the young leaves surrounding the rudimentary buds, and on the buds themselves. After 4 days the eggs hatch and the larvae enter the developing buds where they live and feed at the base of the ovaries. The buds become swollen and gouty and do not produce pods, thereby resulting in loss of yield. Larvae may also feed in the clustered leaves of the growing point and the top of the plant remains shortened and develops a 'cabbage' or 'nettle-head' appearance. In wet periods, the damaged tissue may also provide a site for infection by fungi such as Botrytis spp.

After about 10 days, the larvae are mature and fall to the soil where some pupate and give rise to a second generation of adults 11 - 14 days later. Larvae produced by these adults, and those which do not pupate from the first generation, remain in the soil over winter. The majority emerge in the following two seasons.

Cultural control

There is little evidence of differences in susceptibility between varieties of peas although often it is the later sown crops which are affected. The prime sources of pea midge are those fields which carried heavily infested crops in the two previous seasons. Sowing peas in areas adjoining such infested fields should be avoided where possible. Crops in which the majority of flowering is over and where pods have set will not themselves suffer yield loss, but if attacked would contribute to the increase in the general level of midge population in the area. Large scale rotational practice involving neighbouring farms could be considered.

Chemical control

In areas of high incidence of attack, spraying of vining peas is recommended as soon as the first midges are seen in the crop. Vining pea crops from the Humber, northwards, may not suffer damaging attacks until late June and this means that in most areas, early crops need not be sprayed, but mid and late-season crops should be treated as they reach the susceptible stage.

Susceptible crops

At the early green bud stage, when crops will show their first white flowers in a weeks' time.

- The risk of midge damage can be anticipated using the Pea Midge Monitoring system. The system was developed jointly by PGRO and the Swedish Agricultural University funded by SAU, PGRO and AHDB Horticulture. It comprises 4 sticky traps complete with pheromone lures. By monitoring catches of newly emerged midge in the overwintering site - in last year's pea field - the peak activity of pests can be determined. This will provide advance warning of infestation in the nearby pea crops. The trap system is available from Koppert UK.
- Traps should be placed in last year's pea field 10 m apart by third week of May. An estimate of male midge numbers caught on the sticky base of the trap is made 2-3 times per week.
- When a peak catch of more than 500 midges are recorded on one trap, susceptible pea crops in the near vicinity should be examined for midge.
- Because female midges fly to pea crops in the afternoon, examination of crops should take place as late in the day as possible.
- A spray should be applied to those crops at the early green bud stage as soon as midges are found in the crop. In areas of severe attack, a second spray should be made 7 days later.
- Where midge catches are low, no treatment to peas is worthwhile.

Pea aphid (Acyrthosiphon pisum)

Attacks by aphids may result in loss of yield by spoiling flowers, causing failure of pods to fill and by generally reducing plant efficiency. Aphids transmit viruses and produce honeydew, an ideal medium for colonisation by saprophytic fungi, in particular the sooty moulds. In addition, honeydew is very sticky and can lead to increased costs through the necessity of more frequent washing down of vining machinery.

Description and life history

The pea aphid (Acyrthosiphon pisum) is green in colour with a pear-shaped body, long legs and long antennae. There are both winged and wingless forms, the winged females being 2.5 – 3.0 mm long with deep red or black eyes, while the wingless females are of similar form but have a smooth, shiny outer skin.

Colonies are formed quickly, smothering the plant, as the female needs no male for fertilisation (parthenogenesis), and bears living young (viviparous) at a rate of 15 per day in suitable conditions. There are several generations in the pea aphid life-cycle. Eggs over-winter on forage crops such as lucerne and clover, hatching in the spring to give wingless stem mothers. These produce spring colonies of wingless females, which in turn produce winged females that move into the crop in summer. These migrants produce the colonies that damage the crop.

As the pea plants deteriorate the colonies produce winged female migrants that move to other plants to produce new colonies. Later in the season winged females move to over-wintering host plants where they produce males and females that lay eggs on the winter hosts.

Control

Losses due to aphids can be varied and considerable. If there is a light but general distribution in humid weather, or if breeding colonies are evident, then control measures are generally warranted. The thresholds for treatment of pea aphid to prevent direct feeding damage are as follows: spray combining peas when 20% of plants are infested and vining peas when 15% of plants are infested. Always check labels for harvest intervals.

The choice of product should be made with consideration of any other pests that are present at the time, such as pea midge and pea moth.

Timing of application can also affect the degree of virus infection as well as yield loss. In the case of pea seed-borne mosaic virus and pea enation mosaic virus aphids should be controlled as soon as they appear, even if the above thresholds are not met and particularly if this occurs before flowering. Where aphid infestation occurs late in the growing season yield increases from aphicides can be obtained in combining peas up to the development of the fourth pod-bearing node. Where infestation occurs after this point there is no appreciable yield loss.

Pea seed-borne mosaic virus (PSbMV)

The virus is primarily seed-borne but is transmitted by several aphids including the pea aphid, black bean aphid and peach-potato aphid. The virus becomes established after using infected seed and is transmitted by winged aphids early in the spring. Symptoms include vein-clearing, narrowing and downward rolling of leaflets and foreshortening of the apical internodes. Pods at the upper part of the plants may be stunted and appear to have a glossy green appearance. As the peas mature inside the pod a white blistering may develop giving the peas a ‘tennis-ball’ marking over the seed coat.

The virus affects quality in vining peas and it is important to maintain disease-free seed stocks. PSbMV can be detected in seed using an ELISA (enzyme linked immunosorbent assay) test, although not all infected seeds give rise to infected seedlings.

Pea enation mosaic virus (PEMV)

The presence of this disease is seldom noticed before the approach of flowering, and often not until much later. PEMV is aphid-transmitted and is likely to have a greater effect on the crop if transmitted before flowering occurs. PEMV causes vein clearing and the formation of translucent spots which are apparent when infected leaves are held up to the light. Development of stipules is often retarded and they remain very narrow. Leaflets are crinkled and necrotic spots may appear. Often the tops of the plants become yellow and mottled with distorted leaves. Pods may be severely malformed and fail to fill.

The appearance of enations, small, irregular, protruding ridges of plant tissue which are found on the undersides of leaves and on pods, indicates an advanced stage of infection. Terminal growth ceases, axillary buds disappear and flower set is impaired. In severe cases yield is greatly reduced. Efficient control of aphids reduces the risk of losses.

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 /Manganese deficiency

A deficiency or unavailability of the trace element manganese can cause a reduction of yield in combining peas, and, in addition, it may result in the appearance of marsh spot, which is liable to spoil the produce for human consumption and for seed purposes.

Occurrence and symptoms

The disorder is commonly associated with organic soils, although crops on other soil types can also be affected. Soil with a pH of more than 6.8 is likely to give a problem, especially in wet or compacted conditions, when manganese becomes unavailable to the plants and is "locked-up" in the alkaline soil. Over-liming must be avoided. Wheeling's cause compaction and symptoms of manganese deficiency can often be seen as lines running through a crop.

Manganese deficiency causes a yellowing around the leaf edges and between the veins; entire leaves may become yellow in time, but the veins and the areas of tissue adjoining them are the last to lose their green colour, giving a somewhat striped appearance to the leaf.

Affected plants are likely to produce peas which have a brown and often granular area in the flat faces of the cotyledons, a condition which is known as "marsh spot". Such produce is unsuitable for human consumption, and for use as seed as resulting seedlings are often weak and malformed, with multiple shoots and short-lived growing points.

Treatments

Treat crops which are growing on land known to have a history of manganese deficiency and/or on land of pH 6.8 or more as routine, spraying at the 1st pod stage and again 10-14 days later. Crops in which symptoms are seen should be sprayed immediately and treatment repeated at the 1st pod stage. During wet weather flowering may be prolonged and a third application may be beneficial.

Treat with manganese sulphate (32% manganese) at 5 kg/ha in a high volume of water with an added wetter. Trials have shown that other products containing a high percentage of manganese are also effective. However, sprays with chelated forms (6% manganese) do not contain enough manganese to give adequate control.

Combined treatments

Sometimes, treatment against manganese deficiency coincides with treatment against pea moth or pea aphid or with a fungicide. Certain insecticides and fungicides can be mixed, but before doing so, the manufacturers of the products must be consulted.

Sclerotinia (Sclerotinia sclerotiorum)

Sclerotinia is favoured by warm, wet conditions. Infection occurs during flowering when sections of stems of individual or groups of plants become bleached and wilt or collapse. The fungus produces a fluffy white mycelium over the infection site. Pods can also become infected. Black, elongated sclerotia develop within the stem or on pods and these can contaminate the harvested produce.

LATE FLOWER/EARLY POD PESTS AND DISEASES

Pea moth

Pea moth is one of the most damaging pea pests in this country and in Europe. The caterpillars (larvae) feed on peas within the pod. In vining peas, there is a risk of crop rejection because of contamination of the produce by damaged peas which cannot be removed mechanically. In combining peas for premium markets including human consumption or seed, damaged peas are removed by the merchant and the price paid to the grower is reduced in proportion. Although moth damage can reduce quality, the yield loss is rarely significant and the presence of damage in peas for animal feed compounding is not important. Control in these crops may only be justifiable where the damage levels in previous crops have been high.

Control

Spraying should be related to the development of the insect rather than to the stage of growth of the crop and therefore insecticides should be applied while the larvae are exposed, that is, from the time of hatching to the time of entering the pods. The timing of application is critical for maximum control.

Timing of sprays

Since pea moth can be a localised problem, overall spraying of peas over a wide area on any one date is not advisable as local conditions influence the behaviour of the pest. A system of accurately timing the application of insecticides is commercially available in the form of pheromone traps, combined with a simple model provided by PGRO to predict egg hatching. The traps, when placed in a pea field, attract male moths and by monitoring the catches in the trap, a grower can decide whether there is a need to spray, and time any necessary spray application efficiently on his own farm. The traps were developed by Rothamsted Research and fully tested by PGRO and ADAS.

Pea moth monitoring systems are available from the following suppliers:

Dragonfli
Unit 4 Rippers Court, Sible Hedingham, Halstead, Essex, CO9 3PY, UK
Tel: 01376 563322 www.dragonfli.co.uk

Andermatt UK
47 Compton Road, Brighton, West Sussex, BN1 5AL, UK
Tel: 07939 395059 www.andermattuk.com

Koppert UK
www.koppert.co.uk/products-solutions/

Traps are received in sets of one or two, depending on the supplier. One set is required for each block of peas, i.e. a farm having all the pea fields within a restricted area need only purchase one set of traps, but in fields of 50 ha or more two sets are required.

Traps must be placed in the pea crop by early May and examined at two-day intervals. The number of moths caught by each of them is noted on each occasion. Traps can be suspended on pheromone trap pole kits or fence posts in the field and should be placed at canopy height, moved upwards at intervals as the crop grows.

The threshold, which determines whether treatment is necessary, is ten or more moths caught in the single trap, or either of the two traps, on two consecutive occasions. Timing of sprays must be related to egg development and this is affected by temperature.

A spray date can be obtained from the pea moth page of the **PGRO website - www.pgro.org/pea-moth/** based on a computer prediction, 3 - 4 days after reaching a threshold. On the predicted spray date, crops which are at the first pod set stage, or which have flowered should be sprayed, but later crops should only be sprayed when they reach first pod set. Crops with flat pods are susceptible to damage. A second application should be applied 10-14 days later.

Leaf and pod spots (Didymella pinodes, Didymella pinodella and Ascochyta pisi)

Severe infection usually occurs after a prolonged period of wet weather and may appear on crops at a slightly later stage than Botrytis. Often the disease is observed as a purple-brown flecking of the leaves and a more general browning or blackening of the stem, before lesions develop on the pod. The fungi are seed-borne and if infected seed is sown the following year, seedling losses, and later development of leaf and pod spotting, can result in more serious yield loss.

The most frequent is D. 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 D. pinodes but seed, especially farm-saved, should be tested. Fungicides such as azoxystrobin, metconazole and boscalid + pyraclostrobin give useful control of the disease in the crop and can give yield increases when applied during flowering and pod set.

Grey mould (Botrytis spp)

The fungus is attracted first to wet flower petals which, after pod set, either become detached and lodge in the leaf axils or remain stuck to the developing pods. Once Botrytis comes into contact with green plant tissue via the rotting flower petal, it can penetrate and cause a rot of the stems or pods. Infected stems die prematurely, and pods may either abort, or the disease can rot the seeds within the pods and the pod itself. As well as a direct effect on yield, produce may be blemished, thereby reducing the quality of peas for processing or for seed.

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. However, in dry conditions, sprays during flowering are unnecessary. Suitable products include boscalid + pyraclostrobin, cyprodinil + fludioxonil and azoxystrobin.

LATER DISEASE RISKS

Powdery mildew (Erysiphe pisi)

Occasionally late maturing crops may become covered with a grey-white film of powdery mildew. The disease can delay maturity but several commercial varieties are resistant to powdery mildew. The sulphur formulation, Thiopron (EAMU 0281/21), can be used to control powdery mildew.

OTHER DISEASE RISKS

Pea wilt (Fusarium oxysporum f. sp. pisi)

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 growers using land in known high risk areas should select these.

Foot, root and stem rots

Information on pea foot and root rots can be found in the crop husbandry section of this guide: **www.pgro.org/crop-husbandry/**

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. Cyprodinil + fludioxonil 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.

FUNGICIDE AND INSECTICIDE CHECKLISTS

1. Every effort is made to ensure this information is correct. However, materials may be withdrawn, or there may be additional recommendations.

2. PLEASE READ & FOLLOW PRODUCT LABEL RECOMMENDATIONS CAREFULLY

Fungicides for combining peas

Fungicides									
Active Ingredient(s)	Approved Product(s)	Harvest Interval (days)	Restrictions Of Use	Botrytis	Damping-off	Downy mildew	Leaf and pod spot	Powdery mildew	Sclerotinia
azoxystrobin	Various	35-36		●			●		●
benzovindiflupyr +	Elatus Era, Levee, Lizard, Pro-Benzo, Tacanza Era, Velogy	NS	Apply from BBCH 51 up to and including 20% of pods have reached typical length (BBCH 72).	●				●	
boscalid + pyraclostrobin	Darwin, Pyrabos, Signum	21		●			●		
cyprodinil + fludioxonil	Various	28		●			●		●
metconazole	Various	14		●			●	●	
sulphur	Thiopron (EAMU)	NS	Apply between May and September when pods have reached typical size, peas fully formed (BBCH 79)					●	

● Target **NS** Not Stated

Products containing potassium phosphonates (phosphites) are used to manage crop performance in both combining peas and field beans. However, residues of phosphonic acid are regularly detected in crops above the maximum residue levels. A recent publication in the EFSA journal desribes changes to maximum reside levels in several crops (EFSA Journal, September 2020, https://doi.org/10.2903/j.efsa.2020.6240), but legumes are not mentioned and there remains a risk that crops will be rejected for use where phosphonates have been applied, if they exceed maximum reside levels.

Insecticides and molluscicides for Combining Peas

Insecticides										
Active Ingredient(s)	Approved Product(s)	Harvest Interval (days)	Restrictions Of Use	Caterpillars	Pea aphid	Pea midge	Pea moth	Pea & bean weevil	Slugs & snails	Thrips
alpha-cypermethin	Fasthin 10EC, Hi-Aubin	7	Risk to bees. Must not be used during flowering.	●	●		●	●		●
cypermethrin	Afrisect 500EC, Cyper 500, Cythin 500 EC, Cythin Max EC, Permasect 500 EC, Supasect 500 EC	14	Risk to bees. Must not be used during flowering.	●	●		●	●		●
deltamethin	CMI Delta 2.5 EC, Decis Forte, Decis Protech, Deltason-D, Tecsis	7		●	●	●	●	●		●
esfenvalerate	Barclay Alphasect, Clayton Cajole, Clayton Slalom, Clayton Vindicate, Gocha, Kingpin, Sumi-Alpha, Sven	35						●		●
ferric phosphate	Various	1							●	
lambda-cyhalothrin	Various	25		●	●	●	●	●		●
pirimicarb	Aphox, Clayton Pirimicarb, Jaspin, Pomona	14	Do not apply before BBCH51 - 1st flower buds visible. A single application only. Must be applied between 1st May and 31st August.		●					

● Target **NS** Not Stated

Sitona weevil larvae eating roots

Thrip damage in peas

Pea Enation Mosaic Virus transmitted by pea aphid

Pea aphid

Pea downy mildew

Pea cyst nematode cysts on pea-roots

Manganese deficiency

Marsh spot in peas caused by manganese deficiency

Pea moth trap

Pea leaf and pod spot

Pod botrytis in peas

Sclerotinia in peas

Pea Wilt

Pea foot and root rot

Pea bacterial blight

Harvesting, Drying & Storage

HARVESTING

Great 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. If destined for the packet trade, chip shop or export, value is reduced if pea seed is 'bleached' by the sun. If peas are left in the field too long until moisture content is 12%, 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 can be combined when moisture content of the mature seed is 18% MC and higher quality seed and human consumption is often achieved by early combining at 18-20% MC followed by careful drying. This avoids damage to the seed coat, and the incidence of non-soakers.

If the peas are destined for animal feed they can be combined at moisture contents much lower than this, reducing drying costs. Harvesting at low moistures (e.g. less than 15%) the seed may split, but split peas are still acceptable for animal feed. However, harvesting at such low moisture contents may well significantly reduce the recoverable yield due to pod shatter and shelling out.

Determination of moisture content is a useful means of assessment of desiccation stage (40-45%), combining stage (25% or less), grain storage (14-16%) and long-term storage 14-15% MC.

Crops should be direct combined with a cereal combine wherever possible - and without pre-harvest desiccation. This is only practicable in a dry harvest, in a crop free from weeds and dying back evenly.

Most varieties of peas lodge to some degree before harvest although semi-leafless and stiff-strawed types are less prone to this. It is easier to harvest long-strawed varieties, and an even, adequate plant stand is an advantage.

- Combine in the opposite direction or at an angle to the direction of lodging.
- Lifting fingers are essential at least one every fourth position.
- Adjustments may be necessary to lower the cutter bar close to the soil surface.
- The reel is positioned slightly forward of the cutter bar and speed adjusted to lift the crop onto it.
- Combine settings - peas are easy to thresh so drum speed should be set to a low setting as per manufacturers recommendation.
- The concave should be opened up to reduce time the crop is in contact with the drum.
  Use high fan setting.
- The appropriate screen size for peas must be used..
- Efficient lifters are helpful with badly lodged crops and it may be necessary to combine in one direction only.

Quality is reduced by soil contamination. Do not combine when there is surface moisture on the haulm, or when the soil is wet, and make sure the combine is clean.

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% moisture content will reduce drying costs.

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. Glyphosate is currently the only material to prevent further growth of crop and weeds prior to harvest. It can help even up straw maturity, but more importantly kills remaining green weed material so that less troublesome and more effective combining can take place. However, it is slower to work compared to diquat.

Moisture content of the pea seed should have fallen to below 30% and remember 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 fingernail 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.

After application, harvesting should be possible 10-14 days later, or a little sooner if weather conditions are favourable.

Note that glyphosate must not be used on seed crops.

DRYING

Drying and storage for peas needs to ensure that quality standards are met. These are usually 14% moisture content and 2% impurities ex farm, 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 peas, the drying temperature should not exceed 49°C if the moisture content is below 24%, or 43°C if the moisture content is higher. At higher temperatures, a tougher texture or splitting of the grain may result.

When the moisture content is high, two dryings may be necessary with at least two days between to enable the moisture to spread evenly throughout the bulk.

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.

STORAGE

Drying, Storing & Delivery for the Wherry contract:

- Peas for the Wherry contract should be dried to a maximum of 15% as soon as possible after harvest. Either with a drier or by using air via a ventilated floor - the best method, which causes the least amount of damage is unheated warm air on sunny days.
- If peas are up to 16% moisture, they should be continually monitored and the grower must have the facility to blow air through them to maintain the quality.
- Peas of more than 16% moisture should be dried as soon as possible and should never be stored at more than 17.0%.
- If adequate storage or drying facilities are not available, this can be arranged through Wherrys – please note there will be a cost associated.
- The crop can be collected from farm anytime between October and June, but if an earlier collection date is required, please speak to us about it as soon as possible and before the crop is planted.
- The Wherry contract is based upon a maximum delivery charge of £20 per tonne. A charge of circa £10 including VAT per load will be levied to cover the cost of weighing.
- No mixed farm loads.

Notes: If extensive pulses have been grown on the land previously then we suggest checking with the PGRO for soil borne diseases.

Quality Standards

Quality standards are generally based on 15% MC and 2% admix and deductions are usually made where the level is higher than this.

Quality requirements for the Wherry contract:

Deliveries will be assessed for:

- Moisture
- Screenings
- Stain
- Visual infection from pea borne mosaic virus and/or pea enation mosaic virus
- Insect Damage
- Cracked seed coats
- Admix
- Bleach (greater than 50% of the surface of the individual pea)
- Dun/Maple off types)

Note: There will be on-farm sampling of crop within two weeks of harvest to provide indicative prices for the crop.

The Yield Enhancement Network

The Pea & Bean YENs are independent, industry-wide networks with the goal to improve pulse yields for all.

Why join a Pulse YEN?

See what the full yield potential of your crop is, based on local weather & soil data. ADAS & PGRO scientists will also benchmark your crop performance & management practices against other pulse growers on 60+ factors, allowing you to discover new ways to improve your yields.

YEN membership includes:

- **Lab analysis** of your soil & crop samples
- A **comprehensive post-harvest report** on your crop to identify any yield constraints.
- Access to the **latest pulse crop research**
- An **annual results meeting** for ideas sharing, discussion and networking.

Scan below to learn more & join YEN!

The Pulse YENs are proudly supported by PGRO and ADAS.

www.yen.adas.co.uk
yen@adas.co.uk

The PGRO Website

There is lots of useful information on the PGRO website, including agronomy advice, research and events. You can access this by visiting **www.pgro.org** To find the latest agronomy advice for combining pea, visit the home page and click on the 'combining peas' tab – this will take you to the agronomy guide for combining peas.

As a grower for Wherry's you are automatically entitled to be a member of the PGRO and so can access all the information on the site – you just have to register your details using the black 'register' tab in the top right hand corner of the site.

There is also an **app** which you can download onto your phone from Apple and Google app stores – just search for PGRO Pea and Bean Guide.

If you need any help accessing this information, please let us know.