



Assured Produce

Crop Specific Protocol

BEANS (BROAD, PROCESSED)

(CROP ID: 61)



January 2009

Acknowledgements	4
1 General Introduction	5
2 Planning and Records	5
3 Site selection	5
3.1 Site history	5
3.2 Crop rotation	6
4 Site management	6
4.1 Soil mapping	6
4.2 Soil type	6
5 Variety selection	6
6 Nutrition	6
6.1 Nutrient requirement	6
7 Irrigation	7
8 Crop protection	7
8.1 The basic approach to crop protection	7
8.2 Plant protection product choice	8
8.3 Advice on the use of pesticides	8
8.4 Application of pesticides	8
8.5 Records of application	8
8.6 Protective clothing/equipment	8
8.7 Pesticide storage	8
8.8 Empty pesticide containers	9
8.9 Pesticide residues in fresh produce	9
8.10 Pest, disease and weed control	9
9 Harvesting and storage	13
10 Pollution control and waste management	13
11 Energy efficiency	14
12 Health & Safety	14
13 Conservation issues	14
Appendix 1 Typical application rates for nutrients	15
Appendix 2 Insecticides currently approved for control of pea and bean weevil in Broad Beans	16

Appendix 3 Insecticides currently approved for control of aphid in Broad Beans	17
Appendix 4 Fungicides currently approved for control of chocolate spot in Broad Beans	18
Appendix 5 Fungicides currently approval for control of downy mildew in Broad Beans	19
Appendix 6 Herbicides currently approved for use in Broad Beans	20
Appendix 7 Seed treatments currently approved for Broad Beans	23
Appendix 8 Specific off-label approvals for Broad Beans	24
Appendix 9 PGRO Publications	25
Appendix 10 Control Points: Beans (Broad, Processed)	26

Acknowledgements

Assured Produce gratefully acknowledges the contribution of all consultees in the preparation of this protocol, particularly Anthony Biddle of the Processors & Growers Research Organisation and Cathy Knott.

Preface

This crop specific protocol has been written to complement and avoid duplicating the generic principles of the scheme and appendices.

It is advisable to read the Assured Produce Generic Crop Protocol Standards and the Assured Produce Generic Protocol Guidance Notes (referred to in this document as the Generic Standards and Generic Guidance Notes) first before reading this crop specific protocol.

This protocol is designed to stimulate thought in the mind of the reader.

This crop specific protocol contains crop specific parameters and guidance, where applicable, for the requirements stated in the Generic Standards.

All statements in this protocol containing the word "**must**" (in bold type) will be verified during the Assured Produce assessment and their compliance will form a part of the certification/approval decision. The score required for these "**must**" control points can be found on the final page of this document and in the checklists produced by Assured Produce licensed certification bodies.

Disclaimer and trade mark acknowledgement

Although every effort has been made to ensure accuracy, Assured Produce does not accept any responsibility for errors and omissions.

Trade names are only used in this protocol where use of that specific product is essential. All such products are annotated[®] and all trademark rights are hereby acknowledged.

Notes:

There may be withdrawals or revocations. Products containing substances which have been revoked are shown on the PSD website (<http://www.pesticides.gov.uk>). Growers should check with their advisers, manufacturers, the Assured Produce website 'Newsflashes', the PSD website (www.pesticides.gov.uk)

Growers should comply with the 'Use up by' dates for all pesticide products. Growers should also be aware of and comply with changes on new product labels.

There may be changes for the following reasons:

- At re-registration stage after Annex 1 listing there may be: reductions of dose rates; changes in timings and/or number of applications for some products.

In the following Appendices products and use by dates are only listed for SOLAs, and in some cases new product MAPP numbers may not be available yet.

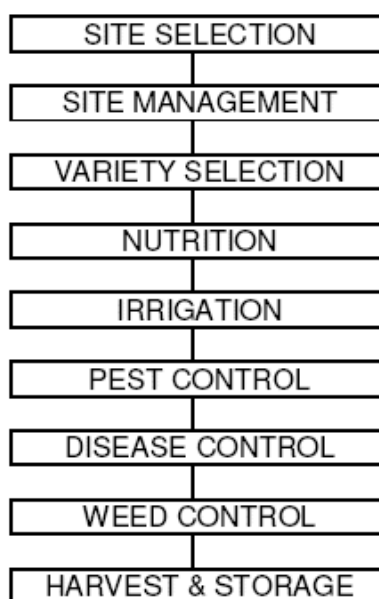
For pesticides on-label, only active substances are shown.

Any new standards have been prefixed in the text with **(NEW)**

1 General introduction

Following a systematic approach will help growers to identify and manage the risks involved in crop production. This protocol is based on a typical crop production process. Using a flowchart approach, food safety, Health & Safety, environmental and quality hazards are identified. Appropriate controls may then be established to minimise risk. Food safety and Health & Safety issues always take precedence over quality and environmental controls.

The flow chart is structured as shown below. Note that the sectional layout of both this protocol and the crop specific protocols follow the same structure.



The contents of each crop specific protocol are reviewed annually by informed farmers and growers, food technologists, scientists, the relevant fresh produce association, processors and agronomic consultants. Updated editions are issued prior to the cropping season.

The review process considers both new developments and all relevant technology which has emerged throughout the course of the previous year and which have been found to be both workable by the grower and beneficial to the environment. As one aim of the Scheme is to transfer such information and technologies to growers, attention is drawn to those features of specific relevance to ICM by using *italic* script. In order that growers may be confident that they are working to a current document, each protocol is dated and numbered.

2 Planning and Records

See Generic Standards and/or Generic Guidance Notes.

3 Site selection

3.1 Site history

3.1.1 Climate

Broad Beans can be grown successfully in most parts of the UK but high rainfall leads to excessive vegetative growth and drought stress during flowering and pod fill stages reduces yield.

3.2 Crop rotation

Crop rotation is essential to prevent the build-up of pests and diseases. Several soil-borne fungi can infect Broad Beans and Peas as well as Field Beans and Green Beans. Pea cyst nematode can also be increased if Broad Beans and Peas are grown in the rotation. All beans and Peas should be treated as one and the same crop and not grown more frequently than once in five years.

4 Site management

4.1 Soil mapping

See Generic Standards and/or Generic Guidance Notes.

4.2 Soil type

Broad Beans have a strong taproot, withstanding adverse soil conditions better than Peas and can, therefore, be grown on heavier soil types.

Sowing

Broad Beans have a large flattish seed so only a belt feed and certain vacuum precision drills are suitable and an information leaflet is available from the Processors and Growers Research Organisation.

5 Variety selection

Continuity of cropping is achieved with the use of varieties with maturities from early to late, but more often using one variety and sequential sowings based on accumulated heat units, or on observations of seedling development.

6 Nutrition

6.1 Nutrient requirement

Major nutrients

Prior to cropping the field, nutrient status should be determined by soil sampling and analysis. Fertiliser application must be in accordance with crop needs and soil reserves. Particular care should be taken to avoid build up of unnecessarily high levels of phosphorus in the soil as this can cause pollution of surface waters.

Nitrogen-fixing *Rhizobia* bacteria, which are responsible for root nodulation of Broad Beans, occur naturally in UK soils and supply Broad Beans with their nitrogen requirement. Applications of nitrogen fertiliser, farm manure and sewage sludge are unnecessary and will delay and suppress nodulation. If Broad Beans show symptoms of nitrogen deficiency this may be due to destruction of root nodules, for example in conditions of waterlogging. Applications of nitrogen fertiliser will not be effective because the damaged root system is unable to take up nitrogen.

Phosphate and potash are applied as a base fertiliser before cultivation. Examples of typical fertiliser recommendations are given in Appendix 1.

Lime and pH

Broad Beans require a pH of at least 6.0 to 6.5. If the pH is below 5.5 growth will suffer and an application of lime will be needed. Over-liming should be avoided as it can induce deficiency of trace elements such as manganese.

Trace elements

Treatments should only be applied where a deficiency problem has been identified.

Manganese deficiency is less common in Broad Beans than Peas. Symptoms are chlorosis between veins and round margins of the leaves. Occasionally marsh spot disorder, a necrotic spot that appears on the cotyledons, occurs in Broad Beans. It occurs where the soil is deficient or if manganese is unavailable to the plant and is associated with peaty organic soils and sandy soils with pH over 6.8. Soil analysis for manganese, however, is of little value. It is corrected by foliar sprays of manganese sulphate + wetter.

Magnesium deficiency symptoms are interveinal chlorosis or necrosis of older leaves with leaf margins remaining green. The older leaves are affected first. It is uncommon but may occur on sandy acid soils or where there is excess potash. Soil analysis will identify where there is a problem. At index 0 and if liming is also necessary, it can be corrected with magnesian limestone (see Appendix 1), either before Broad Beans or elsewhere in the rotation. If crop treatment becomes necessary, corrective foliar sprays with magnesium sulphate should be applied.

7 Irrigation

Broad Beans are very sensitive to drought stress and are responsive to irrigation. Scheduling systems help to forecast the timing and priority order. Broad Beans are most sensitive to soil moisture deficits from the beginning of flowering onwards and irrigation can achieve large yield increases. There is no information available regarding possible increases in diseases such as chocolate spot (*Botrytis fabae*).

8 Crop protection

8.1 The basic approach to crop protection

The guiding principle is that pesticide use should be minimised. An integrated approach should be adopted to achieve this involving the following management steps.

Planning

- a. *sensible crop rotations to avoid build-up of problems.*
- b. *careful site selection to avoid potential or previous problems thereby enhancing crop health and cleanliness.*
- c. *inclusion of resistant varieties in cropping programmes whilst retaining the required quality parameters and eating characteristics.*

Cultural preventative techniques

- a. *good crop and field hygiene.*
- b. *promoting crop health by ensuring effective nutrient availability through soil analysis and accurate application of fertilisers and trace elements.*
- c. *utilising available irrigation to promote healthy growth and as a control measure wherever appropriate and feasible.*

Corrective action

Where corrective or protective action is necessary the following approach should be adopted.

- a. The need to take corrective or protective action must be established by regular monitoring and reference to established thresholds. The effect of prevailing and predicted weather conditions on the need for treatments must be considered.
- b. The availability and use of biological and natural methods of pest and disease control must be reviewed and applied if appropriate.
- c. Where chemical control is essential:
 - *Broad Beans are dependent on insects, for example bees, for pollination. Pesticides classed as harmful, dangerous or extremely dangerous to bees must not be used when Broad Beans are in flower.*
 - *The least toxic and persistent product should be selected with due regard to its efficiency and ecotoxicity.*
 - *The minimum effective dose should be used.*
 - *An appropriate application method with effectively maintained equipment should be chosen.*
 - *Selective and spot treatments should be used whenever appropriate.*

8.2 Plant protection product choice

See Generic Standards and/or Generic Guidance Notes.

NEW

Approved uses not included on the product label

In some circumstances product labels do not include all of the approved uses and growers and advisers wishing to check the approval notice of a particular product should note that this information is available from www.pesticides.gov.uk/psd_databases.asp

A search on the database for a product name should yield a results page. A click on the product name should link to a summary of the approval information. At the bottom of the summary are links to available notices which will give the statutory conditions of use.

In the case of products with older approval an electronic approval may not be available. In these cases growers should contact the PSD Information Services Branch for details of the approved conditions of use. Contact details are: p.s.d.information@psd.hse.gsi.gov.uk tel. 01904 455775.

8.3 Advice on the use of pesticides

See Generic Standards and/or Generic Guidance Notes.

8.4 Application of pesticides

See Generic Standards and/or Generic Guidance Notes.

8.5 Records of application

See Generic Standards and/or Generic Guidance Notes.

8.6 Protective clothing/equipment

See Generic Standards and/or Generic Guidance Notes.

8.7 Pesticide storage

See Generic Standards and/or Generic Guidance Notes.

8.8 Empty pesticide containers

See Generic Standards and/or Generic Guidance Notes.

8.9 Pesticide residues in fresh produce

See Generic Standards and/or Generic Guidance Notes.

NEW

See Generic Protocol Guidance Notes 8.9 for further background and generic advice.

Assured Produce is aware that a key area in the production of fresh produce which requires continued attention by growers and their advisers is that of keeping pesticide residues to a minimum. This issue is not just one of meeting the MRL trading standard but ensuring that any individual or multi residues are kept as low as possible below this level.

The key targets are -

- **Optimising late applications of fungicides and insecticides to the edible part of the crop**
- **Optimising the use of post harvest treatments**
- **Ensuring minimum harvests intervals are followed**
- **Ensuring that application equipment is applying products correctly**

Currently there are no residue issues associated with this crop but awareness needs to be maintained for any future issues.

8.10 Pest, disease and weed control

8.10.1 Pest control

8.10.1.1 Pea and bean weevil (*Sitona lineatus*)

Weevils feed on the leaves and cause semi-circular notches around the leaf margins. Adults migrate to beans from their overwintering sites mainly in early spring when the maximum air temperature exceeds 12°C. Larvae, from eggs laid by the adults, feed below ground on the nitrogen-fixing root nodules. Newly emerged seedlings are more prone to weevil injury.

Chemical control: Where weevil are known to be an annual problem, an insecticide spray applied to newly emerged seedlings at the first sign of leaf notching, particularly after a few warm days, will reduce further leaf injury and interrupt egg laying.

Cultural control: *Avoid producing cloddy seedbeds that are preferred by the weevils. Good soil conditions will allow rapid germination and emergence of the crop increasing the chances of growing away quickly from attack. Later sown crops are less likely to be severely attacked. A monitoring system is available from Agralan Ltd, Ashton Keynes, Swindon.*

8.10.1.2 Stem and bulb nematode (*Ditylenchus dipsaci*)

Damage is often first seen as the plants reach the flowering stage. Plants are stunted with thickened, twisted stems. Leaves may be thickened and brittle with discolouration occurring in the leaf petioles. Stems may

discolour and break and pods fail to fill evenly and seeds are poorly developed or discoloured.

Chemical control: The nematodes can survive in the soil for several years, but no chemicals are approved for control in the soil.

Cultural control: *Nematodes can be seed-borne and you should ensure that all seed is tested for the presence of the pest and discarded if found. The pest can infest new land and so an adequate rotation will help to prevent build-up in the soil.*

There are two races, the 'oat onion' race has a very wide host range but the 'giant' race is the one most usually found infesting beans. When established in a crop, the produce should not be used for seed and a break of at least ten years should be left before Beans (Field and Broad) flower bulbs, Onions, susceptible varieties of Oats, Lucerne or Peas are grown. A seed test is available from Processors and Growers Research Organisation or NIAB.

8.10.1.3 Black bean aphid (*Aphis fabae*)

Dense colonies of black aphid can develop at any time on the upper part of the stem from the onset of flowering onwards. Damage occurs mainly as a direct effect of feeding and pods can be blemished. In addition both black bean aphid and pea aphids can transmit viruses such as bean leaf-roll virus (see Section 8.10.2.6).

Chemical control: Black bean and pea aphids are relatively easy to control, but the choice of insecticides should be limited to those that will not harm pollinating insects. . When 10% of the plants are colonised, spraying should be carried out as soon as possible (see BLRV). The most effective timing of sprays is at early flower but insecticides that are harmful to bees should not be used on flowering beans.

Cultural control: *The presence of thistles or fat hen in the crop can encourage aphid infestation.*

8.10.1.4 Bean seed beetle (*Bruchus rufimanus*)

The damage is caused by the larvae of the beetle, which feed inside the developing beans within the pod. Adult beetles are black, oval in shape, 3.5 -4.5 mm long with ridged wing cases that do not cover the abdomen. Eggs are laid on young pods and the larvae burrow down through the pod and into the seed. They are creamy white, with a dark head, and the legs are not obvious to the naked eye. The presence of the pest is not detected until after the beans have been shelled. If allowed to mature to seed in the field, the larvae pupate within the seed and bite their way out leaving a circular hole.

Chemical control: Flowering crops should be examined for the presence of adults by tapping the flowering stems into the hand or a small flat box. An insecticide should be sprayed in at least 200 l water/ha if adults are found when the first pods have begun to set on the lowest truss as soon as possible after two consecutive days where the temperature has reached 20°C. Using angled nozzles may assist penetration of the spray. A second spray should be applied 7 days later. Beekeepers should be warned before applications are made.

Cultural control: *The beetles fly to beans during flowering from overwintering sites adjacent to the previous years field bean crops. Avoid planting beans near to such areas.*

8.10.1.5 Capsids (*Lygus* spp.)

Capsids (plant bugs) can be a problem in some areas. They overwinter as adults on evergreen foliage and in all types of leaf litter. They emerge from their overwintering sites in late spring and can feed on a wide range of plants. The main damage to Broad Beans occurs just after pod formation, when the adults puncture the pod wall with their hollow piercing-sucking mouthparts. Young Broad Beans within the pods can also be pierced and as the seeds develop, the damage begins as a small split, which discolours after vining. Such blemished seeds are unacceptable by the processors. Damage is more likely in hot dry weather and is highest in beans

growing close to areas of perennial vegetation.

Chemical control: Sprays applied for bruchid beetle control will control capsids. However, as the damage is likely to be more severe around the edges of the crop, selective treatment of those areas may be more desirable.

Cultural control: *Avoid planting Broad Beans in close proximity to large hedges or areas of perennial vegetation.*

8.10.2 Disease control

8.10.2.1 Foot rot (*Fusarium solani f. sp. viciae* / *Fusarium culmorum*)

Individuals or groups of plants are stunted, the foliage becomes progressively chlorotic and wilting is followed by premature leaf fall and death. The stem base is blackened and decayed and the root system is severely restricted and discoloured.

Chemical control: There are no chemicals available to control foot rot in beans. Approved seed treatments are inadequate to reduce infection.

Cultural control: *Broad Beans are particularly susceptible especially in consolidated soil which can cause a moisture stress in dry summers. An adequate rotation is necessary to avoid the build up of fungi in the soil. Avoid adverse soil conditions and grow beans only on well-drained soils.*

8.10.2.2 Downy mildew (*Peronospora viciae*)

Severe infection can reduce flower numbers, cause defoliation and death of the growing point. Early symptoms appear as pale areas on the upper surface of the leaves. The lesions become grey and necrotic at the centre with paler green zones at their margins. The undersides of the lesions are grey-brown becoming a greyish-mauve with a velvety fungal growth. If the growing points become infected, the whole leaves appear pale and are covered with the light grey downy growth of the fungus.

Chemical control: You should monitor the development of downy mildew and fungicide applications should be made where they can be justified. A fungicide should be applied at early flowering when symptoms are first seen on about 25% of the plants. A repeat spray may be necessary 10-14 days if the disease develops later on, particularly during humid weather conditions. If mildew infects the upper leaves after all the pods have set, treatment is not worthwhile.

Cultural control: *The disease is soil-borne and spreads within the crop by means of air-borne spores. Avoid planting beans on fields where there is a known history of downy mildew. Later sown crops tend to be more susceptible to mildew as they are less well developed at the time that air-borne spores enter the crop.*

8.10.2.3 Chocolate spot (*Botrytis fabae* / *Botrytis cinerea*)

Symptoms may show from early flowering onwards when the first 'non-aggressive' lesions develop on the lower leaves. They are reddish brown and vary in size from small dots to rounded sunken spots 1-2 mm in diameter. During May and June, if weather conditions are wet, the disease develops on all of the leaves and the disease becomes 'aggressive' to form larger grey-brown blotches. On the stem, reddish brown streaks occur and the pod surfaces may be discoloured and pitted. Spring sown crops may develop the disease from mid-flowering onwards.

Chemical control: You should monitor that the development of chocolate spot and fungicide applications are only made where they can be justified. A spray at early to mid-flower may be necessary if spotting is present

on the bottom half of the plants. A second spray may be applied 2-3 weeks later if necessary.

Cultural control: *Chocolate spot is favoured by wet conditions or high humidity together with low light intensity. High plant population should be avoided. Beans that are under stress are also susceptible and there is evidence that where beans have been drilled shallowly and treated with simazine herbicide are also more prone to chocolate spot.*

8.10.2.4 Ascochyta leaf and pod spot (*Ascochyta fabae* = *Didymella fabae*)

The disease is primarily seed-borne and beans develop symptoms shortly after the first leaves have expanded. Brownish grey circular lesions 3-5 mm in diameter appear in the leaves and stems. These can then enlarge and spores are splashed by rain onto surrounding plants. Deep brown lesions develop on the pod making them unmarketable.

Chemical control: Seed treatments containing thiabendazole are only partially successful in controlling *Ascochyta* in the seed. Some fungicides applied for chocolate spot or downy mildew control have little effect on *Ascochyta*, although azoxystrobin has been shown to reduce foliar infection (Appendix 9)

Cultural control: *Use only healthy seed. Seed should be tested for the presence of *Ascochyta fabae*. Site Broad Beans away from winter field bean crops that may be infected.*

8.10.2.5 Rust (*Uromyces fabae*)

Late sown beans are more likely to suffer infection of rust in dry seasons. Small white to orange dots surrounded by a thin pale yellow halo appear on the leaves. Later the dots develop as orange brown pustules, sometimes occurring in rings and release brown spores as a dust. The pustules can develop on the stems. Yield can be severely affected as the plant can defoliate before pods are completely filled.

Chemical control: Mixtures containing chlorothalonil applied for downy mildew control, suppress rust infection. For control, apply tebuconazole or metconazole as soon as rust pustules are seen (see Appendix 8). Azoxystrobin will also suppress rust. If rust appears after pod fill, the yield is not significantly affected.

Cultural control: *Rust is favoured by hot dry conditions with humid nights. Late sown crops are more susceptible to infection.*

8.10.2.6 Bean leaf roll virus (BLRV) / Pea enation mosaic virus (PEMV)

Black bean aphid and pea aphid transmit both viruses. The leaves display interveinal yellowing and BLRV predisposes the plant to chocolate spot. PEMV produces a mosaic pattern on the leaves. Individual or small groups of plants are infected coinciding with earlier aphid infestation.

Control: As for aphids.

8.10.2.7 Broad bean stain virus (BBSV)

Leaf symptoms include a mottling with light and dark green areas visible on the surface. Some leaf distortion may occur. The main effect of the virus is on the produce, which displays a dark brown coloured area around the periphery of the seed.

Chemical control: The virus is seed-borne, but can be transmitted to neighbouring plants by the pea and bean weevil and clover seed weevil. Such transmission however, may be low and specific control measures are unnecessary.

Cultural control: *The health of new seed has been generally good, but care should be taken with home-*

saved seed particularly if used repeatedly over several years. The use of new seed at regular intervals is likely to prevent infections from virus-infected seed.

8.10.3 Weed control

Weeds **must** be controlled to prevent yield loss and ensure ease of harvesting. Some species can contaminate produce; for example, pieces of volunteer oilseed rape stem and leaf and every effort should be made to eliminate them.

The most effective means of eradicating perennial grasses is with an application of glyphosate in autumn before sowing Broad Beans. Weeds that have not been eliminated by cultivations can be killed, prior to sowing, with non-selective herbicides (e.g. glyphosate).

Inter-row cultivations can be used, since the crop is normally grown in wide rows. However cultivations will usually stimulate another flush of weeds.

8.10.3.1 Herbicides

A few residual pre-emergence herbicides for broad-leaved weeds are available for the Broad Bean crop, but only one, bentazone, is approved for post-emergence use and the weed spectrum it controls is limited.

Most Broad Beans are treated with a residual herbicide provided the soil type is suitable.

Some varieties of Broad Beans may be sensitive to herbicides and information is available from the Processors and Growers Research Organisation (see Appendix 10).

Currently approved herbicides are listed in Appendix 6.

8.10.3.2 Problem weeds

Growers **must** adopt a policy for reducing volunteer problems of oilseed rape and potatoes by using appropriate husbandry practices after harvest of these crops. Volunteer potatoes can be a problem and they cannot be killed in Broad Beans. *After the potato harvest, do not plough down remaining tubers as this aids their survival. Potato tubers left on or near the soil surface are likely to be affected by frosts or eaten by animals.* Every attempt should be made to control them in other crops in the rotation.

Allowing shed seed to germinate after harvest can reduce volunteer oilseed rape numbers. Pendimethalin/imazamox pre-emergence of Broad Beans, and bentazone post-emergence will give good control of volunteer rape.

Thistles cannot be controlled in Broad Beans.

9 Harvesting and storage

Crop hygiene

Although this is difficult in a tall crop, it is recommended that areas adjacent to lay-bys, public highways and footpaths, and housing etc. are inspected just before machine harvesting. Any glass, metal, plastic, wood or other foreign bodies should be removed to avoid product contamination and the resulting problem in the factory.

10 Pollution control and waste management

See Generic Standards and/or Generic Guidance Notes.

11 Energy efficiency

See Generic Standards and/or Generic Guidance Notes.

12 Health & Safety

See Generic Standards and/or Generic Guidance Notes.

13 Conservation issues

See Generic Standards and/or Generic Guidance Notes..

Appendix 1 Typical application rates for nutrients

Major nutrient requirements (kg/ha) (Source: DEFRA booklet RB209)

Nutrient (kg/ha)	Soil Index				
	0	1	2	3	3+
Phosphate (P ₂ O ₅)	200	150	100	50M	0
Potash (K ₂ O)	200	150	100(2-) 50M(2+)	0	0
Magnesium ⁽¹⁾ (MgO)	100	50	0	0	0

Notes:

⁽¹⁾ Magnesium is not necessary for every crop and can be applied elsewhere in the rotation as magnesian limestone on acid soils

These recommendations for P and K are very high and are to build up soil nutrients in a vegetable rotation. Where there is no plan to raise the soil index level, or in an arable rotation, the recommendations may be reduced by 150 kg/ha at index 0, 100 kg/ha at index 1 and 50 kg/ha at index 2 . The amounts shown as M replace nutrients removed by typical crop yields and are maintenance dressings.

At indices of 2 or above in an arable rotation, P and K are seldom applied to Broad Beans in practice.

The total quantity of fertiliser required should be applied to the seedbed.

Untreated or digested sewage sludge must not be applied within the crop rotation

Only advanced treated sewage sludge may be used within the crop rotation and it must not be applied within 10 months of harvest. Applications shall be carried out in accordance with the Regulations and the current DEFRA Code of Practice for the Agricultural Use of Sewage Sludge.

"Exempted wastes" for example septic tank sludge and blood & guts from abattoirs should not be used within the rotation.

Consult your processor if vegetable waste is to be applied to the field.

Appendix 2 Insecticides currently approved for control of pea and bean weevil in Broad Beans

Active Ingredient	Product Features	Harvest Interval ⁽¹⁾	Hazard Rating	LERAP Category	MRL (mg/kg)
alpha-cypermethrin	contact and ingested pyrethroid; emulsifiable concentrate. Dangerous to bees. Extremely dangerous to fish and aquatic life.	11 days	Harmful Irritant	A	0.05*
deltamethrin	contact pyrethroid: emulsifiable concentrate or granule. Dangerous to bees. Extremely dangerous to fish and aquatic life.	none stated	Harmful Irritant	A	0.05*
cypermethrin	Specific off label for Toppel Dangerous to bees. Extremely dangerous to fish and aquatic life.	7 days	Harmful Irritant	A	0.05
zeta cypermethrin	Specific off label for Fury 10EW Dangerous to bees. Extremely dangerous to fish and aquatic life.	14 days	Harmful Irritant	A	0.05

Notes:

* set at or about the limit of determination

(1) or latest time of application

Category A - This product is not eligible for buffer zone reduction under the Local Environmental Risk Assessment for Pesticides (LERAP) scheme.

Consult processors before using any of these agrochemicals.

Not all products containing these active ingredients may be currently approved for use on Broad Beans. Check before use. Label recommendations are revised regularly, read a current label before use.

Appendix 3 Insecticides currently approved for control of aphid in Broad Beans

Active Ingredient	Product Features	Harvest Interval ⁽¹⁾	Hazard Rating	LERAP Category	MRL (mg/kg)
nicotine	alkaloid: liquid non-persistent contact. Harmful to bees. Dangerous to fish and aquatic life.	2 days	Harmful	none stated	none set
pirimicarb	carbamate with contact fumigant and translaminar activity: water dispersible granule. Has little effect on bees, ladybirds or other insects.	3 days	Harmful	none stated	1.0

Notes:

⁽¹⁾ or latest time of application

Consult processors before using any of these agrochemicals.

Not all products containing these active ingredients may be currently approved for use on Broad Beans. Check before use. Label recommendations are revised regularly, read a current label before use.

Appendix 4 Fungicides currently approved for control of chocolate spot in Broad Beans

Active Ingredient	Product Features	Harvest Interval ⁽¹⁾	Hazard Rating	LERAP Category	MRL (mg/kg)
cyprodinil + fludioxonil	Broad spectrum mixture of anilopyrimidine and phenylpyrrole fungicides:water dispersible granules. Toxic to aquatic animals	14 days	Irritant	B	0.05
chlorothalonil + metalaxyl M	mixture of chlorophenyl and acylaniline fungicides: suspension concentrate	14 days	Irritant	B	0.05/0.02

Appendix 5 Fungicides currently approval for control of downy mildew in Broad Beans

Active Ingredient	Product Features	Harvest Interval ⁽¹⁾	Hazard Rating	LERAP Category	MRL (mg/kg)
cymoxanil + metalaxyl M + fludioxinil	off-label approval for downy mildew control (seed treatment)	none stated	none stated	none stated	none set
fosetyl aluminium	systemic phosphonic acid: wettable powder	17 days	none stated	none stated	none set
metalaxyl + chlorothalonil	mixture of acylaniline and chlorophenyl fungicides: suspension concentrate	14 days	Irritant	B	2.0

Notes:

Category B - This product qualifies for inclusion within the LERAP scheme for ground crop sprayers if there are measures applicable (eg. nozzles).

Consult processors before using any of these agrochemicals.

Not all products containing these active ingredients may be currently approved for use on Broad Beans. Check before use. Label recommendations are revised regularly, read a current label before use.

Appendix 6 Herbicides currently approved for use in Broad Beans

Active Ingredient	Product Features	Harvest Interval ⁽¹⁾	Hazard Rating	LERAP Category	MRL (mg/kg)
bentazone	contact diazinone: soluble concentrate or water soluble granule. Apply post-emergence for annual broad-leaved weeds. One application or two as a split dose. Minimum 6 hr free from rain required after application. Harmful to aquatic organisms	Single dose: 4 leaf pair stage. Split dose: 6 leaf pairs and before crop exceeds 15cm in height	Harmful SG SL Irritant SL Risk of serious damage to eyes SG	none stated	0.1* (beans without pods)
carfentrazone-ethyl	contact triazolinone: microemulsion (ME). Non-selective. Apply pre-planting for control of emerged annual broad-leaved weeds. It does not control grasses. Dangerous for environment, very toxic to aquatic organisms	One month pre-planting	Irritant	none stated	0.01* (beans without pods)
clomazone ⁽²⁾	SOLA Apply pre-emergence of crop and weed for control of cleavers and some other broad-leaved weeds.	pre-emergence	Irritant	none stated	0.01* (beans without pods)
cycloxydim ⁽²⁾	SOLA ACCase inhibitor #Apply post-emergence for annual and perennial grass weeds and volunteer cereals. Not annual meadow-grass. Toxic to aquatic organisms. Applications must not be made during flowering, or when bees are actively foraging.	35 days	Harmful Irritant	none stated	2.0## (beans without pods)
fluazifop-p-butyl ⁽²⁾	SOLA ACCase inhibitor # emulsifiable concentrate. Very toxic to aquatic organisms	before flower buds visible	Irritant Harmful	none stated	1.0## (beans without pods)
glufosinate - ammonium	contact phosphinic acid: soluble concentrate. Non-selective. Apply only between 1 March - 30 Sept. Apply pre-drilling or pre-emergence of the crop, alone or in tank-mix with some residual herbicides. Rain free period of 4 hr should follow spraying.	pre-drilling or pre-emergence	Harmful Irritant	none stated	2.0## (beans without pods)
glyphosate	translocated phosphonic acid: soluble concentrate or water-soluble granule. Non-selective. Apply pre-drilling and (some formulations) pre-emergence of the crop alone or in tank-mix with some residual herbicides. Rain free period of 6 hr should follow spraying. Toxic to aquatic organisms	pre-drilling or pre-emergence		none stated	0.1* (beans without pods)

Notes:

To avoid the build up of resistance do not apply products containing an ACCase inhibitor herbicide more than twice to any crop

* level at or about the limit of determination; ##draft MRL not yet harmonised

(1) or latest time if application

(2) SOLA see Appendix 8 for the specific product and expiry date

To avoid the build up of resistance do not apply products containing an ACCase inhibitor herbicide more than twice to any crop

Consult processors before using any of these agrochemicals.

Not all formulations of each active ingredient may be currently approved for use on Broad Beans. Check before use. Label recommendations are revised regularly, read a current label before use.

Appendix 6 Herbicides currently approved for use in Broad Beans

Active Ingredient	Product Features	Harvest Interval ⁽¹⁾	Hazard Rating	LERAP Category	MRL (mg/kg)
isoxaben/ terbuthylazine ⁽²⁾	SOLA Soil-acting amide/triazine: suspension concentrate. Apply pre-emergence for control of annual meadow-grass and broad-leaved weeds. Very toxic to aquatic organisms	pre-emergence/ before 2 nd node detectable (but only safe pre- emergence)	Harmful	none stated	isoxaben 0.02* terbuthylazine 0.1## (beans without pods)
linuron/ trifluralin Use up by 20 March 2009	Residual and contact urea / dinitroaniline:emulsifiable concentrate. Apply pre-emergence for control of annual meadow-grass and annual broad-leaved weeds. Very toxic to aquatic organisms.	pre-emergence	Harmful Irritant Flammable	B	0.1 linuron 0.5## trifluralin (beans without pods)
diquat	contact bipyridyls: soluble concentrate. Non-selective. Apply to stubble, pre-sowing or pre-emergence of the crop, alone or in a tank-mix with some herbicides. Spray is rainfast after minutes. Very toxic to aquatic organisms.	pre-drilling or pre-emergence	Harmful Irritant Toxic	none stated	0.05* (beans without pods)
pendimethalin ⁽²⁾	SOLAs (maximum dose rate 2.5 L/ha. Do not apply if the plumule is less than 13mm from the soil surface. Very toxic to aquatic organisms.	pre-emergence	Irritant	B	0.2 (beans without pods)
pendimethalin/ imazamox ⁽²⁾	dinitroaniline/imidazolinone residual; emulsifiable concentrate. Apply pre- emergence of the crop for broad-leaved weeds. Very toxic to aquatic organisms. Winter oilseed rape and other brassicas should not be drilled as the following crop.	pre-emergence	Irritant	B	0.2 pendimethalin/ 0.05* imazamox (beans without pods)
quizalofop-p-ethyl ⁽²⁾	SOLA. ACCase inhibitor # Apply post- emergence for annual and perennial grass weeds or volunteer cereals. Not for annual meadow-grass. Toxic to aquatic organisms.	56 days	Harmful Irritant	none stated	0.4## (beans without pods)

Notes:

(1) or latest time if application

(2) SOLA see Appendix 8 for the specific product and expiry date

* level at or about the limit of determination; ##draft MRL not yet harmonised

to avoid the build up of resistance do not apply products containing an ACCase inhibitor herbicide more than twice to any crop

Buffer Zone: Category B - This product qualifies for inclusion within the LERAP scheme for ground crop sprayers if there are measures applicable (eg nozzles).

Consult processors before using any of these agrochemicals. Not all formulations of each active ingredient may be currently approved for use on Broad Beans. Check before use. Label recommendations are revised regularly, read a current label before use.

Appendix 6 Herbicides currently approved for use in Broad Beans (Cont'd)

Active Ingredient	Product Features	Harvest Interval ⁽¹⁾	Hazard Rating	LERAP Category	MRL (mg/kg)
tri-allate ⁽²⁾	SOLA apply pre-or post drilling and incorporate, but pre-emergence of the crop for wild oats, blackgrass and annual meadow-grass. Not volunteer cereals. Toxic to aquatic organisms.	pre-emergence	Harmful Irritant	none stated	0.1* (beans without pods)
trifluralin \$ Use by 20 March 2009	Soil-incorporated dinitroaniline: emulsifiable concentrate. Apply pre-sowing and incorporate (or some products apply pre-emergence). For annual meadow-grass and some broad-leaved weeds. Mayweeds, volunteer oilseed rape and other cruciferous weeds resistant. Very toxic to aquatic organisms.	pre-sowing or pre-emergence	Harmful Irritant	none stated	0.5## (beans without pods)

Notes:

⁽¹⁾ or latest time if application

* level at or about the limit of determination; ##draft MRL not yet harmonised

\$ Take care with waste disposal. Substance prescribed under the Water Resources Act.

To avoid the build up of resistance do not apply products containing an ACCase inhibitor herbicide more than twice to any crop

Buffer Zone: Category B - This product qualifies for inclusion within the LERAP scheme for ground crop sprayers if there are measures applicable (eg. nozzles).

Consult processors before using any of these agrochemicals.

Not all formulations of each active ingredient may be currently approved for use on Broad Beans.

Check before use. Label recommendations are revised regularly, read a current label before use.

Appendix 7 Seed treatments currently approved for Broad Beans

Active Ingredient	Product Features	Harvest Interval ⁽¹⁾	Hazard Rating	LERAP Category	MRL (mg/kg)
thiram	a protectant dithiocarbamate fungicide: flowable concentrate for control of damping-off.	none stated	Irritant	none stated	0.05
thiram + thiabendazole	mixture of dithiocarbamate and benzimidazole: flowable concentrate for control of <i>Ascochyta</i> and damping-off.	none stated	Harmful	none stated	0.05
cymoxanil + metalaxyl M + fludioxonil ⁽²⁾	Mixture of acylanilines and cyanopyrole fungicides for control of downy mildew	none stated	Irritant	none stated	0.5

Notes:

(1) . or latest time of application

(2) SOLA Consult processors before using any of these agrochemicals. Not all products containing these active ingredients may be currently approved for use on Broad Beans. Check before use. Label recommendations are revised regularly, read a current label before use.

Appendix 8 Specific off-label approvals for Broad Beans

Number	Product Name	Ingredients	Expiry Date
Fungicides			
2311/03	Amistar [®]	azoxystrobin	31/12/11
3932/02	Wakil XL [®]	cymoxanil + metalaxyl M + fludioxonil	31/12/13
3080/06	Sunorg Pro [®]	metconazole	31/12/13
1873/03	Folicur [®]	tebuconazole	31/12/13
1393/05	Orius	tebuconazole	31/12/13
1390/07	Alpha Tebuconazole 20EW	tebuconazole	31/12/13
1364/07	Mitre	tebuconazole	31/12/13
1338/07	Orius 20 EW	tebuconazole	31/12/13
0549/07	Riza	tebuconazole	31/12/13
Insecticides			
0431/07	Dipel DF	bacillus thuringiensis var. kurstaki	31/12/13
1980/07	Toppel 10 [®]	cypermethrin	31/08/08
1961/07	IT Cyper [®]	cypermethrin	31/08/08
1944/07	Cleancrop Pyrimet [®]	cypermethrin	31/08/08
1898/07	Agriguard Cypermethrin EC [®]	cypermethrin	31/08/08
1774/07	Permasect C [®]	cypermethrin	31/08/08
3764/06	Clayton Lanark	lambda cyhalothrin	13/11/09
3234/07	Markate 50 [®]	lambda cyhalothrin	28/06/11
1298/07	Cleancrop Silo	lambda cyhalothrin	13/11/09
0753/06	Hallmark with Zeon Technology	lambda cyhalothrin	13/11/09
3573/06	Fury 10EW	zeta cypermethrin	31/12/13
Herbicides			
0088/08	Centium 360 CS (11607)	clomazone	31/12/09
1136/08	Laser [®]	cycloxydim	31/12/13
1777/08	Fusilade Max [®]	fluazifop-p-butyl	31/12/13
1776/08	Fusilade 250 EW [®]	fluazifop-p-butyl	31/12/13
0490/07	Nirvana	Imazamox/pendimethalin	31/10/10
0076/07	Skirmish [®] #	isoxaben/terbuthylazine	31/12/13
1016/08	Stomp 400SC	pendimethalin	31/12/13
3485/06	Sceptre [®]	quizalofop-P-ethyl	31/12/13
3531/06	Avadex Excel 15 G [®]	tri-allate	31/12/13

Notes:

Sceptre: the marketing company have indicated that they are not selling this product.

Advisory note: Do NOT apply post-emergence to broad beans - they will be damaged

Specific off-label approvals (SOLAs) provide for the use of the product named in respect of crops, situations or pests other than those included on the product label. Such use is undertaken at the user's choosing and the risk is entirely theirs and/or their advisers.

Specific off-label use may only take place if all the conditions given in the "Notice of Approval" document, the product label and/or leaflet and any additional guidance on off-label approvals have first been read and understood. The conditions of approval given in the "Notice of Approval" are statutory and supersede any on the label which would otherwise apply.

All SOLAs are conditional on the extant approval of the specific product.

Fusilade 250 EW: the marketing company have indicated that they are not selling this product

Appendix 9 PGRO Publications

The following is a list of PGRO publications applicable to broad bean production:

Reaction of varieties of green beans, broad beans & field beans to herbicides	Inf. sheet 135
Notes on growing broad beans	Inf. sheet 131
Choice of herbicides for beans	Inf. sheet 179
Checklist of fungicides & insecticides for beans	Inf. sheet 174
Varieties of broad beans: Descriptive List	Advisory leaflet
Pea and bean weevil (<i>Sitona lineatus</i>)	Inf. sheet 164
Tenderometer standardisation & maintenance	Inf. sheet 141
Bean seed beetle (<i>Bruchus rufimanus</i>)	Advisory leaflet
Pests & diseases of peas & beans	Booklet
Herbicide damage in peas & beans	Booklet
Stem and bulb nematode	Inf. sheet 168
Field thrips in peas and beans	Inf. sheet 163
Fungicides for beans	Inf. sheet 167

PGRO publications are available from:

The Information Officer, PGRO, Thornhaugh, Peterborough, PE8 6HJ.

Tel: 01780 782585 Fax: 01780 783993 or www.pgro.org

Appendix 10 Control Points: Beans (Broad, Processed)

CS.61 BEANS (BROAD, PROCESSED)

CS.61.1 You should be able to provide evidence that your seed has been tested for the presence of *Ascochyta fabae* -

Protocol reference: Section 8.10.2.4

CS.61.2 You should be able to provide evidence that your seed has been tested for the presence of stem and bulb nematode -

Protocol reference: 8.10.1.2

CS.61.3 You should have a policy for reducing volunteer problems for oilseed rape and potatoes by using appropriate husbandry practices after harvest of these crops -

Protocol reference: 8.10.3.2

CS.61.4 You must be able to demonstrate that you monitor the development of chocolate spot to justify fungicide application -

Protocol reference: 8.10.2.3

CS.61.5 You must be able to demonstrate that you monitor the development of downy mildew in order to justify fungicide application -

Protocol reference: 8.10.2.2

CS.61.6 You must be able to demonstrate that you monitor the crop and temperatures before applying an insecticide for control of bean seed beetle

Protocol reference 8.10.3.1