Assured Produce

Crop Specific Protocol

CAULIFLOWER

(CROP ID: 56)

January 2009

Control Document No: 00018/09

Acknowledgements

Assured Produce gratefully acknowledges the contribution of all consultees in the preparation of this protocol, particularly members of the Brassica Growers Association and Andrew Richardson, Allium & Brassica Centre, Kirton, Boston, Lincs.

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 words **"must"** or **"should"** (in bold type) will be verified during the Assured Produce assessment and their compliance will form a part of the certification/approval decision.

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 other 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 Products containing substances which have been revoked are shown on the PSD website (http://www.pesticides.gov.uk).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:

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

- 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.

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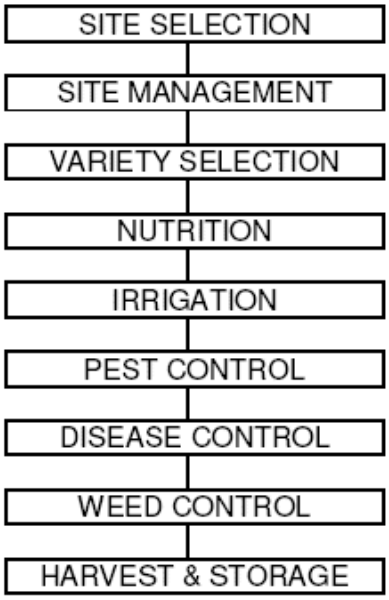
1 General introduction

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. Any changes to the text have been highlighted by marking the document with a line in the margin.

2 Planning and records

See Generic Standards and/or Generic Guidance Notes.

3 Site selection

3.1 Site history

When selecting a site for growing a cauliflower crop it is important to consider the following requirements.

3.1.1 Climate

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The crop can be grown throughout the UK. Winter cauliflowers, maturing from late November to March, can only be grown in the UK areas where frosts are infrequent and the winter temperatures are high; viz. in fields situated near the coast below an altitude of approximately 90 m in the South western counties of England (particularly Cornwall, the West coast of Wales and the Channel Islands and also the on the Isle of Thanet in Kent). In drier areas of the South and East, irrigation may be required during periods of drought to maintain continuity.

3.1.2 Weed status

Perennial weeds such as couch, docks and thistles should be controlled prior to planting/drilling a crop of cauliflower. The presence of potato groundkeepers can also be a problem to control in the growing crop.

3.1.3 Topography

Fields should be suitable for use of harvest machinery and safe for the use of spraying machinery avoiding the risk of toppling over. Use of fields sloping to the South and West should be made for early production. Avoid valley bottoms or other frost susceptible areas. In wet areas it can be advantageous to be over exposed to prevailing winds, so the crop dries out quickly and helps reduce the spread of disease.

3.1.4 Position

Access

Easy access into the field is necessary to facilitate the use of spraying and harvesting machinery.

Pest havens

Avoid heavily wooded field margins and wasteland, where pests such as rabbits, hares and pigeons can devastate crops. Also any rodent colonies should be identified and controlled.

Obstacles

Pylons, telegraph poles, walls and fences make it difficult to operate spraying and harvesting machinery without crop damage.

Spraying Safety

a. To humans: where possible avoid cropping areas adjacent to schools, housing estates, playing fields etc. where there is a high risk from spraying operations.
b. To flora: avoid areas adjacent to wildlife reserves, sites of specific scientific interest. Note the position of any beehives.
c. To watercourses: buffer zones now apply, prohibiting the spraying of certain pesticides within 5 metres of the top of the bank of a watercourse when using a ground-based vehicle mounted/drawn sprayer. Protocol operators should be aware of LERAP regulations introduced in 1999. Further information can be obtained from local NFU offices (see Generic Protocol 8.5.5).

3.2 Rotation

Crop rotation can be used to assist with crop health in conjunction with other practices.

Club root is a problem in some brassica production areas particularly on naturally acid soils. Production in these areas should be based on a wider rotation of four to five years between brassica crops together with a well-planned liming policy. However certain areas are uniquely placed for a

frost-free climate enabling good early production, requiring a balanced approach to be taken.

Brassicas thrive best on moisture retentive high alkaline situations and often continuous production can be sustained without detriment to crop quality or to the environment. In such cases growers must be able to justify their rotation with consideration to the following:

a. *Crop health*
b. *Avoidance of disease carry over by incorporating post harvest residues quickly and efficiently.*
c. *Satisfactory record of pH levels and liming policy*

4 Site management

4.1 Soil mapping

See Generic Standards and/or Generic Guidance Notes.

4.2 Soil management

Soils

The Cauliflower plant is not deeply rooted and some varieties are particularly shallow rooting. The crop can be grown successfully on a wide range of soil types provided they are well drained, of good structure and without any impediment to root development such as soil pans caused by poor cultivation techniques. Light sandy soils favour early production but irrigation is essential on these soils to guarantee good plant establishment, whether direct drilled or transplanted, and for subsequent growth and development throughout the summer period. Cauliflowers require moisture throughout their growing period.

A pH level of 7.0 to 7.5 is required, particularly where club root may be a problem. Over liming is wasteful and can cause temporary 'lock-up' of some nutrients such as manganese and boron. Lime should be applied well before planting/drilling if possible. As lime takes many months to balance soil acidity it is not advisable to grow any brassicas where liming has recently been carried out in very low pH situations. One should also consider potential soil structure damage caused by harvesting on heavier soil types particularly with winter cauliflowers.

Cultivations

Whether the crop is drilled to a stand or transplanted, firm soil with a good tilth is required. Timely cultivations are important, particularly on fine, sandy, or silty soils that have a weak structure and low organic matter content. On the lighter soils late ploughing followed by a minimum of cultivations will help to maintain soil structure. *Wheelings, from planting cultivations may cause compaction, therefore, the bed system is to be commended. On large units, the tramline system where two crop rows are left out for the passage of a tractor with wide tyres facilitates easier fertiliser application, spraying, irrigating and access for harvesting equipment, in addition to confining wheel damage to a designated area.*

Loss of soil structure in the surface layers, due to excessive or inappropriate cultivations, e.g. excessive working with reciprocating tines at high speeds can lead to soil capping and reduced emergence.

4.3 Soil fumigation

See Generic Standards and/or Generic Guidance Notes.

4.4 Substrates

See Generic Standards and/or Generic Guidance Notes.

4.5 Drilling and transplanting

4.5.1 Plant populations

Plant population has important effects on:

a. Total yield.
b. Curd size and weight for market outlets
c. Market for which the crop is grown.
d. Period over which the crop is to be harvested
e. Cost of production.

The higher the plant population, smaller the head, thus baby cauliflowers are grown at high plant populations.

4.5.2 Sowing

Owing to the increased cost of seed and establishment costs, direct drilling is no longer an economic proposition for the continuous production of cauliflowers. Apart from the early summer production where large modules/pots/blocks are used, the bulk of the UK crop is transplanted using 14 ml modules.

4.5.3 Transplanting

Propagation

The majority of the transplanted crop is grown from glasshouse raised modular transplants or small peat blocks. The modular trays (the most common size has cells of

14 ml volume containing peat compost) enable the propagator to have complete control over plant growth. Trays also provide a system that facilitates the application of cabbage root fly insecticides under glass, prior to despatch. This uses less active ingredient per hectare than field applications (See Appendix 4).

To ensure the best chances of good establishment, growers should ensure that transplants are:

- *Strong and well rooted in the module.*
- *Transplanted when plants are ready and not left too long in module .*
- *Adequately drenched for cabbage root fly where necessary.*
- *Are free from pest and disease .*
- *Are fully soaked and primed with nitrogen immediately prior to planting .*

Soft, floppy plants are undesirable and can have adverse effects on establishment.

Plants should be given a high nitrogen feed prior to despatch. Growers, especially those without irrigation, should ensure that the modules are at maximum water holding capacity at planting. Avoid over watering as this can leach out cabbage root fly insecticides. It is advantageous for the grower to have modules analysed routinely to check whether the propagator has applied the correct rate of cabbage root fly insecticide. This is especially important prior to the peaks of first and second-generation cabbage root fly. For those with irrigation, if the soil is dry or the weather hot or windy, water should be applied immediately post planting.

Propagators

Under EU Plant Health Regulations, propagators must be registered with the Plant Health and Seeds Inspectorate (PHSI) of DEFRA. Plant passport details must be incorporated on the delivery note or invoice.

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*Growers **must** ensure, to comply with the requirement of due diligence throughout the food distribution chain, that details of all pesticides are agreed and recorded by the propagator and passed to the grower. Applications of liquid feeds should be treated similarly.*

Bare root plants

Bare root transplanting is still occasionally used. Bare root plants, pulled from plant raising beds, should be laid in shallow layers in trays and immediately protected from exposure to wind and bright sunshine.

If planting is interrupted after the plants have been pulled, they can be stored at 5.0°C, with a relative humidity of 90-95% for up to two weeks.

4.5.4 Early production under covers

This technique needs easily worked soils with excellent structure and with the exception of the silts, irrigation must be available.

There is a disadvantage with narrower sheets due to an "edge effect". So 10-14 metre wide sheets of perforated polythene are the most economical forms of covering. Before laying the plastic cover, it is important that the plants are strong enough to carry the weight of the covers. Alternatively, plant in shallow ridges so that the soil may support the cover for a time.

The activity of herbicides under plastic film can be erratic. This may be due either to high light intensities and warmth accelerating the breakdown of the herbicide or to the drying out of the soil surface. It is important that residual herbicides are applied to moist soil or to a soil moistened soon after treatment, before the crop is covered with film.

Physiological problems soon arise if covers are left on too long. Uncover when the heads are just visible (10-15 mm in diameter). However, if the weather conditions are humid, it is worth sacrificing crop advancement in exchange for a reduced disease problem.

Covers should be removed on a dull day or in the late afternoon.

By using polythene film skilfully, crop maturity can be advanced by 14 days. The cost of plastic and associated laying and removal is expensive and usually only justified on early crops that command a premium.

Disposal of plastic

*To comply with legislation, and protect the environment, plastic must not be burnt. Growers **must** ensure that old polythene is either despatched to a recycling company or disposed of in a registered landfill site.*

5 Variety selection

None of the commercially important varieties at present have resistance to all the four major diseases (cauliflower mosaic virus, turnip mosaic virus, downy mildew and club root). Some varieties under certain prescribed conditions can be susceptible to hollow stem.

In future, provided they have good commercial qualities, disease resistant varieties should be included in any integrated crop management system.

Varieties are classified into four maturity groups:

Early summer cauliflower

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Early summer Cauliflowers are defined as those grown from an autumn sowing in October and over-wintered in a juvenile stage under cold glass, or those sown under heated protection in January. By sowing varieties with different lengths of maturity, curds may be cut from late May to early July.

Late summer and autumn cauliflower

Cauliflowers for late summer production are sown under glass from February to April and mature from late July to early September. Autumn Cauliflowers are sown under glass during late April to mid June and mature from mid September to mid November or the first frost.

Winter cauliflower

These are sown from early to mid May, maturing from late November until early May. The later maturing varieties should be sown or planted first. Growing of these types restricted to the milder winter areas of Kent and the Southwest.

Winter hardy cauliflower - spring heading

These are sown between end of May and mid June, maturing from late March until early June. They are grown mainly in Lincolnshire and the Midlands.

6 Nutrition

6.1 Nutrient requirement

Macro nutrients

Excessive use of macronutrients is not only wasteful, but can be costly and have a detrimental effect on groundwater supplies.

Nitrogen in particular must be tailored accurately to the precise needs of the Cauliflower crop. Excess nitrogen must be avoided because:

a. The crop does not need it - even in dry conditions there is no advantage in applying extra nitrogen.
b. Maturity can be delayed.
c. Soft unbalanced growth results in increased damage when handling, poor shelf life and increased susceptibility to disease.
d. It contaminates groundwater supplies, possibly introducing the health risk to drinking water and exaggerates eutrophication.

Growers should use a soil nitrogen prediction system such as Soil Nitrogen Supply (SNS) and where applicable Soil Mineral Nitrogen (SMN) to schedule efficient nitrogen applications. Nitrogen prediction models such as WELLN offer a complete solution to assessing nitrogen requirement.

'WELL N' takes into account the residual nitrogen in the soil and the amount of nitrogen released from the organic breakdown of the previous crop residues, and predicts the total nitrogen required. Residual nitrogen testing thus enables applications to reflect accurately the cauliflower crops need, taking into account soil residues, thus reducing the opportunity of excess nitrogen leaching into ground water.

If it is not possible to undertake nitrogen analysis, a soil nitrogen index should be used, taking into account previous crop and manuring (See Appendix 3).

On intensive brassica land, where samples are being taken frequently for soil nitrate determination, it is cheap and economical to analyse for pH, phosphate, potassium and magnesium. Otherwise, in the absence of crop

failure, the field should be sampled and analysed at least every three years. Interim nutrient status can be evaluated using a balance sheet method.

Growers **must** ensure that when planning fertiliser applications, soil type and variety are taken into consideration.

Nutrients **must** be applied according to a recent soil analysis. Typical fertiliser recommendations are shown in Appendix 2.

Establishment of both drilled and transplanted crops can be adversely affected by excessive levels of fertiliser salts, especially nitrogenous fertiliser in the seedbed. The risk of poor results from high salts is less for transplants than for seed.

Where high rates of potash are also required, the total nitrogen and potassium application prior to drilling, should not exceed 190 kg/ha; the base nitrogen level may be reduced to 50 kg/ha, and the remainder of the potassium should be applied well before drilling (in the winter if possible) and incorporated into the soil.

Nitrate Vulnerable Zones

Certain vegetable production areas within the U.K. may be designated nitrate vulnerable zones (NVZ). These are areas where water sources are high in nitrate, and growers are asked to observe a programme of measures, designed to reduce nitrate loss from the land and help reduce nitrate levels in water.

Key action points relevant to brassica growers are:

i. Do not apply inorganic nitrogen fertiliser between 1 September and 1 February unless there is a specific crop requirement during that time.
ii. Do not exceed crop requirement for quantity of nitrogen fertiliser on each field every year, taking account of crop uptake and soil supply from soil organic matter, crop residues and organic manures.
iii. Application of organic manures should not exceed 170 kg N/ha of total nitrogen averaged over the farm area each year or 250kg N/ha for an individual field.
iv. Do not apply fertiliser or manures when the soil is water logged, flooded, frozen hard or covered in snow.
v. Consider a cover crop to use up excess nitrogen over the winter months, ryegrass, is a good choice as it does not involve a 'green bridge'. Sowing must be completed before September 15th to be of any value.

Trace elements

These should only be applied when deficiencies are evident from soil or tissue analysis or when crop growth and development appears to be reduced. In the absence of adverse symptoms, a healthy looking crop may not need foliar application of trace elements.

pH

In common with all horticultural brassica crops the soil pH for Cauliflower should be maintained at 7.0 to 7.5 although this can cause problem where potatoes are grown in rotation.

7 Irrigation

The greatest response is likely to be obtained following rapid establishment by irrigating immediately after planting out transplanted crops.

Plants under drought stress tend to be susceptible to attack by pests; therefore, irrigation helps to improve yield and quality.

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Where available, apply 25 mm of irrigation at 25 mm soil moisture deficit. If water supply has been limited, an application of 25 mm, made 21 days before cutting, has proved very beneficial.

8 Crop protection

8.1 The basic approach to crop protection

See Generic Standards and/or Generic Guidance Notes.

8.2 Plant protection product choice

See Generic Standards and/or Generic Guidance Notes.

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.defra.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.

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 harvest intervals are followed**
- **Ensuring that application equipment is applying products correctly**

See Appendix 13 for the pesticide targets and guidelines

8.10 Pest, disease, physiological disorders and weed control

8.10.1 Pest control

The main principle, with the exception of cabbage root fly, is that control measures should only be applied when the pest is present. Routine applications of insecticides at set time intervals, is not the correct approach. Prevention is also better than cure, therefore where possible, an integrated approach is needed.

Prevention:

i. *Management and Planning: where geographical and agricultural factors permit choose sites away from existing brassica and rape production to avoid a continuous 'green bridge' throughout the year. Plough in crop residues immediately cutting ceases.*
ii. *Crop rotation.*
iii. Provide good soil structure, correct nutrition and irrigation if possible to ensure conditions to facilitate strong, healthy growth.

Control:

i. *Use available pest forecasts as management tools to aid when to scout for pests.*
ii. *Regular, systematic crop walking to monitor crop development, pest and disease levels. Increase frequency of crop walking during periods of high pest incidence particularly during hot weather.*
iii. *In addition to crop walking, use of insect traps eg. pheromone traps, chemical attractant traps and soil sampling (cabbage root fly eggs) as monitoring tools.*
iv. *Once validated in the field, the use of tolerance levels may be introduced for cabbage aphids and caterpillars.*
v. Identify both pest and naturally occurring predators, to determine whether necessary to apply control measures and where possible use selective pesticides to reduce impact on naturally occurring predators and beneficial organisms. However, choice must be weighted up against efficacy and longevity of treatment. Use the least toxic product where possible.
vi. Resistance to many insecticides is building within aphid populations particularly peach potato aphid. It is important to alternate the use of different active ingredients to enable the best chance of control with the existing range of active ingredients.

vii. *Use the minimum effective dose rate, normally being that recommended. Do not reduce dose rates for peach potato aphid.*
viii. *Consider the use of natural and biological methods of pest control if available.*
ix. *Avoid spraying, or allowing drift into grassy banks, dyke sides, hedgerows etc., these can provide a reservoir of insect predators, such as ladybird larvae, hoverflies, ground beetles etc. However, also consider the implications of buffer zone restrictions on certain chemical uses.*
x. *Carefully consider the anticipated harvest date when selecting the appropriate product. Ensure you have enough time for the harvest interval to elapse prior to harvesting.*

The use of some approved pesticides may not be acceptable to processors. In order to conform to such requirements, proposed applications should be confirmed with the contracting company.

Section 8.10.1 reviews the main brassica pests in the UK. A review of the minor pests can be found in Appendix 1.

8.10.1.1 Cabbage root fly (*Delia brassicae*)

Even light attacks by larvae, which feed on the roots, can reduce yield. Severe infestations cause stunting, bluish or red/purple discoloration of the leaves and the plants may wilt and die. There are two or three generations each year, starting from fly emergence and egg laying in late April - early May and extending, with some overlapping into September. Preventive treatments are essential for the peak of the first generation, irrespective of whether the crop is direct drilled or transplanted.

The eggs of cabbage root fly are attacked by several beetle species. These beetles remain in the soil for long periods; insecticides applied to other crops in the rotation can reduce their numbers.

Forecasting/monitoring

Present monitoring methods include counting eggs laid at the stem base of brassicas to predict the size of the next generation and non-selective water traps to catch adult flies. The Warwick HRI computer prediction model gives the timing and duration of populations based on statistical information and local weather data.

A chemical attractant trap is available that selectively traps adult flies and thus in future a combination of this trap and the Warwick HRI computer prediction model will give a more reliable monitoring system.

Plant propagation

Pre-planting drenches

Chlorpyrifos or spinosad can be used as a pre-planting drench on block and module raised plants. Do not use on cells smaller than about 14 ml capacity. Chlorpyrifos should not be used to treat block/modules which will be planted out before April 1st .

When drenching with chlorpyrifos, ensure it does not become washed or leached into glasshouse soils. Where plants are treated outside glasshouses, safe disposal of all run-off drench is required. Where chlorpyrifos drenches are used, subsequent applications of pesticides in the glasshouse or in the field should be delayed until adequate wax has formed on plant leaves.

Transplanted crops

Crops grown from block or module raised plants, which were treated before planting (as above), should not need further treatment in the field. But there are occasions where subsequent treatment is necessary:

a. Where, due to planting delays, considerable irrigation has been applied and considerable arable time has elapsed before planting, which may have led to leaching of the insecticide.
b. Insufficient insecticide applied by propagator (maintain a check at planting by routine analysis of compost).
c. Early in the season, when the incorporated treatment is not persistent enough to protect the young plants up to the first peak of egg laying.
d. In the absence of irrigation, when upper layers of the soil dry or soil conditions are cloddy, it is essential to plant deeper in search of moisture for the plants to survive. This necessitates covering the module with soil and this renders the stem at soil surface level open to attack.

Granules can be applied at planting, either as a sub-surface treatment using a 'Leeds' type placement coulter or as a band applied of the row within 2 days of planting. With post planting treatments, avoid excessive lodging of granules on the foliage which may cause phytotoxicity, this is especially relevant when the foliage is wet during treatment. Sub-surface treatment is preferred for both environmental and efficacy reasons.

Treatment methods

Granules

Band treatment gives the most efficient placement and is recommended for all granules, but recommendations may specify the exact method, (e.g., surface band or bow wave, width of band, etc.). Applicators must be calibrated in the field before use.

There are noticeable increases in the speed of degradation of some soil applied granules. As a result the persistency of the product may possible be much shorter than that quoted by the manufacturer.

Sprays

These should only be used in areas of low cabbage root fly activity. Time the application as stipulated on product label.

8.10.1.2 Brassica aphids

Invasion occurs from April to July and in favourable weather the build up of aphids is greatest between July and October. Crops should be examined regularly between July and October and treated when aphids are found.

There are two species of aphid that are of commercial relevance to the fresh Cauliflower crop.

Mealy grey aphid (*Brevicoryne brassicae*)

Widespread pest of cauliflower, which checks the growth of young plants resulting in wilting and possible death, particularly in dry conditions. On older plants infested leaves curl up and the curd is spoiled by contamination with the aphid colonies.

All stages, including eggs, occur on stems and leaves of winter hosts (usually other cruciferous species) winged forms migrate to summer hosts from May/June onwards resulting in an early peak during July followed by a population crash. This is followed by a second, often higher peak in September/October. Early identification and treatment is essential as once colonies become established control is much more difficult and spoilage is inevitable.

Peach potato aphid (*Myzus persicae*)

Becoming more important of late, particularly in warmer, drier seasons, this aphid rarely causes significant damage but can be present in fairly high numbers affecting marketable quality. It doesn't normally form dense

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colonies and overwinters as adult and immature stages, on winter brassicas and Beet crops together with many herbaceous plants outdoors and under glass. Winged forms migrate to summer hosts in May and June reaching peaks similar to those of the mealy grey aphid.. The pest is an important vector of many plant viruses.

Three insecticide resistant mechanisms exist in UK populations; metabolic - confering resistance to organophosphates; modified acetyl-cholinesterase (MACE) confering resistance to carbamates, knock-down (KDR) conferring resistance to pyrethroids. No current resistance mechanisms exist in the UK with regard to the pymetrozine (Plenum®), nicotine or the neo-nicotinoids, imidacloprid (Gaucho®) and thiaclprid (Biscaya®). Use of these four actives should be made where there has been a previous history of resistance or where resistant populations are suspected.

Cultural control:*Most aphid infestations develop from colonies which overwinter on old brassica crops and autumn sown oil seed rape. Plough in or otherwise destroy these.*

Aphid populations can be reduced by a multitude of insect predators including ladybirds, hoverflies and parasitic wasps. Crops should be walked regularly to determine the balance of predators in relation to plant size etc., to determine whether the crop actually needs spraying, or whether the predators will naturally take care of the aphids. Many factors are involved in this biological 'integrated' approach and the risks associated with the various crop-walking techniques are being determined by Warwick HRI/ADAS currently.

Chemical control:*Numerous insecticides are currently approved for use (see Appendix 5). Select insecticides with the least harmful effect on beneficial insects and avoid broad-spectrum insecticides. Some synthetic pyrethroids, despite their reputations, often kill a wide range of beneficial predatory insects.*

Alternate insecticides with different modes of action in order to avoid build-up of aphid resistance. Weather conditions and time of year should be taken into account when selecting the aphicide. (Late in the season, from October onwards, control of cabbage aphid with pirimicarb may fail and during dry periods the uptake of systemic insecticides is reduced).

Current work at Warwick HRI is creating forecasting techniques for aphid populations. Studies of populations show a regular midsummer "crash" where natural mortality is actually greater than by applying aphicides. This normally occurs in later July - early August.

8.10.1.3 Caterpillars

The caterpillar larvae of many species attack brassicas and may appear at almost any time between mid-May and harvest, although the degree of infestation varies from season to season. The damage caused depends upon the species responsible; both the leaves or curd may be eaten or the curd may be fouled with droppings. The very presence of caterpillars in the head also makes the product unmarketable. Some species, when nearly mature, are difficult to kill with insecticides and cause considerable spoilage. Others, even when numerous, may not justify treatment.

The caterpillars of the diamond back moth feed on the underside of leaves, leaving the upper surface as a 'window pane'. Now becoming a common pest, it can have several generations in a season. If control is needed insecticides need to be applied whilst the caterpillars are still young. To help in crop walking and establishing pest thresholds, pheromone traps are available to catch the moths.

Cultural control:*Frequent crop walking is essential to identify both the caterpillar species and natural predator presence, as high populations are capable of destroying every caterpillar in the crop. Some caterpillar species only have one generation per year and thus if there is a low-level infestation on the vegetative parts of the plant, chemical control may not be necessary.*

Chemical control: Check crops regularly and only apply insecticides when necessary caterpillars found. A list

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of currently approved insecticides is given in Appendix 6.

Treating only the crop headlands and/or the periphery of the field may be sufficient for control as they tend to invade the field from the field margins.

Consider using more specific control measures such as *Bacillus thuringiensis* and diflubenzuron that will not have such a damaging effect on beneficial predators as broad spectrum insecticides.

8.10.1.4 Cutworms

Cutworms are the caterpillars of several species of noctuid (night-flying) moth, the most important of which is the turnip moth, *Agrotis segetum* . The young caterpillars hatch in June and July, feed on the foliage for at least a week, before descending to feed on the underground parts of the host plant.

Cutworm attacks are most severe in hot dry summers; routine treatment is not required. Warnings are issued based on trap catches sometimes combined with a weather model to define 'high risk' periods, when the caterpillars are small and can be controlled by rainfall/irrigation or chemical treatment. Use pheromone traps to monitor moth numbers. If local information is not available and irrigation is possible, apply at least 20 mm of water as advised by the cutworm warning. In absence of rainfall or irrigation, control with a pyrethroid insecticide, timed as recommended by the spray warning.

8.10.1.5 Pollen beetle

Adults, dispersing principally from oilseed rape, can damage brassicas in summer. They are capable of inflicting damage to the quality of cauliflower curds.

Cultural control:*A forecasting service is already available to HDC members that will predict the onset of migration of pollen beetles. This should alert growers to start field monitoring. Simple yellow sticky traps set in at slightly above the crop level will adequately indicate the level of this pest.*

Chemical control: If beetles are found damaging the crop or are likely to contaminate harvested produce, apply an insecticide with a recommendation for application to leafy flowerhead brassicas. Pyrethroids should be particularly considered because of their subsequent repellent effect. Best timing is immediately after a harvest to effect control before the next cut is due; frequency will depend on pest pressure. Re-inspect crops frequently.

8.10.1.6 Slugs

Slugs damage brassica seedlings and established plants on medium to heavy-textured soils in wet seasons; Cauliflower curds may be grazed. Slugs are occasionally taken with produce into the processing factory.

Cultural control:*Consolidate soils to inhibit slug movement where necessary. Surface bait to determine need and timing of further control measures.*

Chemical control: Broadcast affected areas with an approved molluscicide if trap catches and weather pattern indicate a period of high risk. Aerial applications are permitted and have given good results. See Appendix 10 for current list of approved molluscicides.

8.10.1.7 Cabbage stem weevil *(Ceutorhynchus quadridens)*

A widely distributed but sporadic pest which attacks all cruciferous crops, particularly direct drilled crops. The larvae feed in stems and petioles of plants that may subsequently wilt.

8.10.1.8 Beneficial organisms

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Beneficial organisms include predators, parasitoids and disease. Although a great deal of research has been undertaken regarding the biology and behaviour of natural enemy species, relatively little is known about the numerical impact that they have on pest populations in commercial brassica crops.

Natural enemies of pests can themselves be attacked by predators, parasitoids and disease; which may limit their effectiveness. They can also be affected by the use of agrochemicals, which may cause mortality, have sub-lethal effects on development or behaviour, or suppress disease outbreaks.

Finally, with cases of direct pest damage, natural enemies are often effective only after the crop damage has been done. The presence of some natural enemies in produce may also at times cause problems for growers.

Predators
Specific predators - such as ladybird larvae and adults and hoverfly larvae consume only aphids. They are able to consume large numbers of aphids but may be present in crops only at certain times of the year.

Generalist predators - Many predators consume a wide range of pest and non pest species. Generalist predators include species of beetles, spiders, mites, harvestmen, lacewings, flies, earwigs, ants, bugs, wasps and vertebrates such as birds and small mammals. It is estimated that, in cereal fields, there may be about 400 species of generalist predator. Laboratory studies have shown that some predators are able to consume large numbers of pests. However, predation rates in the field will depend upon how often particular pests are encountered and whether there are alternative sources of food. Some species, such as ground beetles, eat both live and dead material.

Parasitoids
Parasitoids spend their larval stages as parasites, feeding on host tissue and killing the host in the process. They tend to be fairly specific, although some species will, for example attack several species of aphid.

The cabbage root fly is attacked by two main parasitoids, a wasp and a rove beetle. The adult rove beetle is also a predator. Rates of parasitism vary from crop to crop and are reduced usually when non specific insecticides are used.

Cabbage aphids have only one parasitoid, the small wasp, *Diaeretiella rapae* which also attacks the peach potato aphid. The life-cycles of aphids and their parasitoids are closely linked. Again, levels of parasitism vary between crops and may be affected by insecticide use.

Caterpillar pests are also attacked by a range of parasitoids, mainly wasps and flies. These may cause significant mortality in species such as the diamond-back moth.

Diseases
Insect pests may be attacked by a number of bacterial, fungal and viral diseases. Aphids and adult cabbage root flies appear to be particularly susceptible to fungal diseases, whilst caterpillars are more susceptible to bacteria and viruses. Fungal diseases can be particularly devastating, but may be triggered only when environmental conditions are favourable.

Exploiting beneficial organisms

1. Monitor crops regularly to determine the balance of insect predators in relation to pest numbers and plant size to determine whether to apply a pesticide or not.
2. If a pesticide is required avoid use of broad spectrum insecticides which can have a harmful effect on beneficial insects.
3. Consider the use of biological control agents such as *Bacillus thuringiensis* .

For further information on beneficial organisms contact Mrs R Collier, Warwick HRI.

8.10.2 Disease control

Introduction

Cauliflower is subject to many of the diseases that attack brassicas. In modular plant propagation under glass, seedling diseases are common and consistently damaging, thus requiring routine treatment. Regular monitoring during propagation and crop walking in the field, coupled with the correct identification of diseases, is an important element in minimising fungicide use.

Where possible, the guiding principle is that pesticide inputs should be minimised through prevention rather than cure. Where possible an integrated approach is needed, involving the following management steps:

Good management and planning

a. *Careful site selection. Where possible avoid known potential or previous problems, thereby enhancing plant health. If possible site away from crops such as oil-seed rape and other brassica. In intensive brassica areas, where this is not possible, plough in plant remains immediately harvesting ceases, to prevent spread of diseases such as mildew, etc.*
b. *It is good agronomic practice to rotate crops to prevent the build up of soil-borne diseases. In intensive areas this is not possible, therefore agronomy and disease monitoring must be good.*
c. *Use resistant varieties (where available) whilst respecting the need to meet the required agronomic, quality parameters and eating requirements.*

Cultural control techniques:

a. *Plant propagation under glass, goes a long way to reducing the incidence and severity of seedling diseases, especially downy mildew.*

   Irrigate plants in the morning, or soon enough to allow leaves to dry off before the night. Avoid over-watering, as this both washes nutrients and crop protection chemicals out of the compost, and creates favourable conditions for damping-off pathogens. The amount of time seedlings are allowed to sit wet in the glasshouse should be kept to a minimum.

   Maintain adequate ventilation to prevent the creation of a still, humid environment around seedlings. Control feeding to prevent over-soft growth. Adequately sterilise trays to prevent carry-over of diseases such as club root, Pseudomonas, damping-off etc.
b. *In the field apply nutrients according to soil analysis.*
c. *Encourage steady growth by ensuring a regular supply of water where possible.*
d. *Through good agronomy provide good growing conditions ie. avoid poorly drained soils or the presence of soil pans.*

Chemical control:

a. Regularly field walk and monitor the crop for diseases as well as pests, to establish the need to take corrective action. Refer to thresholds where established. Regular monitoring, both during propagation and in the field, coupled with correct identification of diseases, is an important element in minimising fungicide use. The decision whether it is worthwhile to apply fungicides must consider the disease, time of year, degree of infection and nearness to harvest. The effect of prevailing weather conditions should also be considered.

   *Computer prediction models have been developed at Warwick HRI for Alternaria, Ringspot and White Blister and are now in widespread commercial use. In the fields, growers **should** ensure that fungicide use is justified and that fungicides are not applied on a routine prophylactic basis . (Revised)*
b. Where fungicidal control is required, the following points should be considered, whilst ensuring effective control is achieved.

- Use the least toxic and persistent product.
- Use the minimum effective dose rate.
- Check that use within 5 metres of the top of the bank of watercourses is approved.

8.10.2.1 Club root *(Plasmodiophora brassica)*

This effects all vegetables of the Cabbage family and a number of ornamental cruciferous plants and weeds, including charlock and shepherds purse. It causes swelling of the roots which subsequently rot; the leaves turn blue/purple and wilt whilst the plant may be stunted or even die. This disease is of considerable significance in some cauliflower production areas, particularly where soil pH is naturally marginal. The resting spores of the fungus remain viable in soil for at least twenty years.

Cultural control:

i. *Consider clubroot resistant varieties where available*
ii. *Wide rotation as possible in vulnerable areas.*
iii. *Soil tests can give a guide to potential infection. Sample at least 3 - 4 months before anticipated planting date to allow change of cropping.*
iv. *Liming to maintain a soil pH 7.0-7.5 gives good control, but there is no cure once plants are affected. In susceptible areas, patches, (usually of lower pH) of club root can occur. These small areas should be tested and limed separately.*
v. *High pH levels can give rise to minor nutrient problems.*
vi. *In dry times, plants suffering from a small infestation can be brought to marketable yield by copious irrigation*
vii. *It is essential to use disease free modules.*
viii. *Liming will not work immediately; it should be part of rotational planning.*

Chemical control: None available.

8.10.2.2 Damping off and wirestem *(Pythium spp.* and *Rhizoctonia solani)*

These fungi attack the roots and stems of young seedlings and can cause serious losses during glasshouse propagation and occasionally affect field drilled crops.

In the field *Rhizoctonia* causes the stem base to become hard, brown and shrunken and the stems usually break off later in the season. *Pythium* control is most effective in glasshouse propagation if fungicides are used as preventative treatments pre-sowing or pre-planting. For both diseases treatment in the field crops is impractical.

Cultural control:

i. *Good glasshouse hygiene is essential*
ii. *Good glasshouse management as outlined in Section 8.10.2 (Introduction), above .*
iii. *Use plastic modular trays rather than polystyrene because when the surface coating wears off, roots and fungi can penetrate the polystyrene and present a reservoir of disease. Plastic trays can be sterilised easier and more effectively.*

Chemical control: Fungicides currently approved for use in propagation both as pre-sowing drenches or pre-planting treatments are listed in Appendix 7 and 8.

8.10.2.3 Downy mildew *(Peronospora parasitica)*

This disease is endemic when propagating under glass but it can attack outdoor crops during the autumn.

Yellow-brown areas develop between the veins on the upper surface of the leaves corresponding with white/grey fungal growth on the under surface. Severely attacked leaves turn yellow and die off. On mature crops, the fungus may also cause black spots on the curds. Running down the floret stems, it produces a browning which can look like insect damage.

The practicalities and economics of treating maturing crops may be questionable, but in wet weather the risk of damage increases and control is justified.

Cultural control:

i. *Good glasshouse hygiene is essential.*
ii. *Good glasshouse management as outlined in Section 8.10.2 (Introduction) is essential.*
iii. *The crops under propagation from January to March are most at risk.*
iv. *Varieties vary in susceptibility. Therefore choose the more resistant varieties, provided they give the other required agronomic features.*

Chemical control:

i. In propagation, routine treatment, both on a preventative and eradicant basis, is essential.
ii. Currently approved products are listed in Appendix 7 and 8.
iii. Preferably alternate fungicides with different modes of action to avoid development of resistant strains.

8.10.2.4 Dark leaf spot *(Alternaria brassicae* and *Alternaria brassicicola)*

Dark leaf spot affects the lower leaves, mainly causing symptoms ranging from small, black spots to large black/brown spots. These fungi are seed-borne and can be controlled by seed treatments that use very small amounts of fungicide compared to overall spray applications. The disease may occasionally affect the curd, but the economics of treating maturing crops may be questionable.

Cultural control:

i. *Good glasshouse hygiene is essential.*
ii. *Good glasshouse management as outlined in Section 8.10.2 (Introduction) is essential.*
iii. *Plough in crop residues as soon as possible.*
iv. *If possible, isolate brassica crops from each other particularly oilseed rape .*

Chemical control:

i. Seed treatments listed in Appendix 8.
ii. Currently approved fungicides are listed in Appendix 7.

8.10.2.5 Ring spot *(Mycosphaerella brassicicola)*

Occurs mainly in the wetter western counties during the autumn. Circular grey or brown spots about 15 mm diameter are formed on the leaves and stem being more frequent on the outer leaves. Very small black fruiting bodies of the fungus are dotted over the surface of the spots in concentric rings. Badly affected leaves turn black and prematurely wither. Debris of previously affected brassica crops is the main source of the disease.

Cultural control:

i. *Isolate out-door plants beds.*
ii. *If possible, have a wide brassica rotation.*
iii. *If possible, isolate Cabbage crops from other brassica .*

Chemical control: Not common on the top of the curd and therefore the economics of treating maturing crops in the eastern counties may be questionable. Currently approved fungicides are listed in Appendix 7.

8.10.2.6 White blister (*Albugo candida)*

White blister was an occasional problem but it is now becoming more frequent. All the aerial parts of the plant may be affected. White patches, at first small and glossy but later powdery, appear on the lower surfaces of leaves and on stems. On the curd it causes individual flower buds to swell, grow above their neighbours and turn white.

Cultural control:*Plant beds should be in a dry open position.*

Chemical control: Currently approved fungicides are listed in Appendix 7.

8.10.2.7 Bacterial soft rot *(Erwinia carotovora* and *Pseudomonas spp.)*

In the mature crop in the field the soft internal tissue of the stem may disintegrate, reducing it to a bad smelling slimy mess. In winter cauliflower the curd may show brown discolour patches resembling frost injury.

The biggest problem from bacterial soft rot is the invasion through wounds to which cauliflower curds are very susceptible during cutting and subsequent packing. Infection begins as small, yellow water soaked specks in the florets, and as decay progresses the florets become increasingly discoloured and "water soaked".

Cultural control:*Avoid damage during cutting and packing. Immediately cool crop once cut and store at low temperature (see Section 9).*

8.10.2.8 Bacterial spot *(Pseudomonas maculicola)*

Not a widespread bacterial disease but can be a locally severe problem. Leaves have small brown or purplish spots and become distorted and finally turn yellow and drop off. Small brown or dark brown spots conform on the surface of the curd. Disease can be seed or soil-borne.

Cultural control:*Adequate rotation together with strict hygiene, especially in module production under glass.*

8.10.2.9 Virus diseases

a. Turnip mosaic virus is probably the most severe virus that attacks Cauliflower. Dark necrotic rings and spots on the older leaves of plants associated with severe stunting are the typical symptoms.
b. Cauliflower mosaic is reasonably common. Virus symptoms are vein clearing followed by vein banding with stunted growth and distorted leaves. Affected plants are usually very susceptible to frost injury. Cauliflower and turnip mosaic viruses often infect the same plant. Peach potato aphids spread both viruses. Aphicides will not prevent introduction of virus but will restrict its subsequent spread.
c. Turnip Yellows Virus (TYV) formerly Beet Western Yellows Virus (BWYV) commonly affects brassica crops. Symptoms vary considerably as the virus is commonly associated with CaMV or TuMV. Recent work at Warwick HRI suggests that TYV is implicated in tipburn in processing storage cabbage.

Cultural control:*If possible, grow apart from other brassica crops. Isolate outdoor beds from other growing brassica. Destroy and plough in immediately and all other brassica crop residues, especially overwintered crops.*

Chemical control: Control the aphid vectors, especially in outdoor plant raising beds or early in the life of direct drilled crop. Currently approved aphicides are listed in Appendix 5.

8.10.2.10 Black rot *(Xanthamonas campestris)*

This is a bacterial disease, commonly found on cauliflower particularly during the winter months.

Initial field infections are nearly always seed-borne or spread during propagation but then become endemic by surviving on incorporated residues. The symptoms are V-shaped chlorotic lesions on the leaf margins. Within the lesions the veins become blackened. A characteristic ring of vascular tissue can be seen when the stalks of affected plants are cut transversely. The disease can expand very rapidly in warmer damp conditions.

Control: Plant debris is a source of infection together with cruciferous weeds (eg. shepherds purse). Quick removal or incorporation of crop residue is advised.

Where the disease is identified a rotational break of at least two years should be practised.

Seed testing: Involves batch treating of major seed lots. A negative result does not guarantee complete freedom for the seed lot but rather present at an economically insignificant level.

Where seed batches are infected, hot water treatment is currently the only viable method of control. This can affect seed vigour.

8.10.3 Physiological disorders

8.10.3.1 Hollow stem

When the heads are harvested, the butts have hollow centres. The primary cause is not known and when the cavity is dry, hollow stem causes no problem with the appearance or eating quality of the head. The basic symptom results from a failure of the internal tissues to keep up with the increase in stem diameter after a period of rapid growth. One school of thought suggests that where the cavities are clean and there is no rotting that the trouble has been caused by a nitrogen-potassium imbalance, ie. an excess of nitrogen. Another suggestion is that the hollowness may be due to rapid growth after irrigation or rain. The problem is generally seen in large leafy plants.

Where the hollowness is accompanied by rotting, boron deficiency may be suspected. If this condition is common on the farm, boron should be applied to the soil before planting or sowing. Borax is a popular standard boron fertiliser and is applied at 22-26 kg/ha. However, as it is not easy to apply evenly the commercial product Solubor® applied as a spray, may be preferred. Other boronated fertilisers can be used if they have the correct N,P,K ratio. Leaf sample analysis should take place to justify any treatment.

8.10.3.2 Bracting

Bracting occurs when the curd does not develop successfully in periods of high temperature. When flower buds form the bract or leaf buds are usually suppressed, but in high temperatures the bract buds grow and this results in green leaves forming within the curds (ie. bractiness). Varieties vary in susceptibility, therefore, consult NIAB trials information.

8.10.3.3 Riciness

High temperatures also predispose the curds to "riciness", a condition in which the flower stalks become extended to resemble a woolly covering to the curd. This often happens when warm temperatures cause sudden growth to take place after a time of little growth. Varieties vary in susceptibility, therefore, consult NIAB trials information.

8.10.3.4 Strangles

This is first noticed in the field when plants fall over or break off at soil level. The disease is caused by secondary fungal pathogens and starts in the seedling stage. It may not be noticed until the plants have become much larger, the stem is constricted near the ground and often swollen above the constriction. The disease is initiated by injury from wind or careless planting.

Cultural control:*Avoid exposed locations. Take care at transplanting or inter-row to avoid injuring the stem.*

8.10.3.5 Pinking

When the curds are exposed to high light intensities, there is a tendency for anthocyanin to form and the curds to turn pink. Varieties vary in susceptibility, therefore, consult NIAB trials information.

8.10.3.6 Premature buttoning

This occurs mainly in the early planted, new season crops. Buttoning is caused by curd initiation and growth before the leaves have developed sufficiently to support full curd formation. It is affected both by variety and environmental factors. Early summer varieties, which have the lowest leaf number at maturity button more readily if subjected to conditions which retard growth once curd initiation has been reached.

8.10.4 Weed control

The use of herbicides can be reduced considerably by attention to the following:

a. Use of stale seedbed technique.
b. Avoiding use of covers where resistant weeds eg. Pennycress is a problem.
c. Identifying those weeds present and targeting with the use of more selective active ingredients.
d. Use of mechanical weeding machines frequently through the crop. These should be set to give minimal disturbance to the soil in drier conditions and so that soil is lightly thrown around the base of the stem thus "smothering" seedling weeds. New designs involving spring tines are now available to effect better control of seedling weeds within the cropping row. Provided soil conditions are not too wet this method is much preferred.

A range of soil acting residual and post emergence contact herbicides is available. Generally approved herbicides for Cauliflowers are given in Appendix 9. Select a herbicide according to the weed spectrum present.

For residual herbicides to work effectively a fine, firm, moist tilth is required. Cloddy soil conditions greatly reduce the effectiveness of herbicides.

9 Harvesting and storage

9.1 Hygiene

See Generic Standards and/or Generic Guidance Notes.

9.2 Post-harvest treatments

See Generic Standards and/or Generic Guidance Notes.

9.3 Post-harvest washing

See Generic Standards and/or Generic Guidance Notes.

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9.4 Harvesting

Prior to harvesting all growers need to ensure that the statutory harvest intervals have elapsed for every pesticide used and crop spraying records need to show a safe harvesting date (positive release dates) for each application.

The cutting costs constitute a significant proportion of Cauliflower production costs, therefore, aim for the least number of harvests as possible.

Growers **must** ensure that harvested product is not contaminated by or exposed to anything that could affect food quality.

9.4.1 Prediction

Cauliflower prediction models are now available from a variety of sources. Models use information taken at curd initiation and meteorological data to predict cutting date. Hot weather enhances maturity and reduces the cutting interval.

9.4.2 Cutting

When heads are exposed ready for harvesting, they can only subsequently deteriorate.

Various mechanical aids are used to assist the harvesting process but during cutting cauliflower curds are at risk from physical damage such as cuts, grazes and bruises, all of which speed up post-harvest deterioration as well as adversely affecting appearance. It is therefore essential that the method of harvesting poses the least risk of physical damage.

Tractor-mounted harvesting aids eg. cups or belts should be used. This enables pickers to place the trimmed curds carefully in a cup or on a belt that gently transfers them to a covered trailer towed behind the tractor, where they are graded and packed. The finished product is therefore immediately taken out of direct sunlight. Preferably the cauliflower should remain in this packaging right up to point of sale as it reduces the amount of direct handling of the curd and hence reduces the risk of damage. Placing cauliflowers that are destined for the fresh market directly into a bulk bin for subsequent re-packing is not recommended due to the risk of abrasion and bruising.

Palletisation on the rig also assists management and helps to prevent damage to the box and its contents. It is acceptable to harvest cauliflowers for processing directly into a bulk bin.

The practice of field packing, direct into the customer's container, leaves the trimming waste in the field to be ploughed in.

Although harvesting is exempt from the Food Safety (General Food Hygiene) Regulations, the more sophisticated packing rigs do need a hazard analysis assessment. A FPC code of practice for food safety on field packing rigs will be published shortly.

9.5 Cooling

Cauliflower has a very high post harvest respiration rate. Unless cooled rapidly soon after cutting, cauliflower will rapidly lose turgidity and moisture loss will continue until arrested by chilling. Therefore delays between cutting and the commencement of cooling should be minimised. The causes of cauliflower deterioration (dehydration, microbiological attack and physiological changes) are temperature related. Cooling immediately after harvest, followed by a cool chain distribution, is the most effective means of preserving quality and shelf life.

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9.5.1 Cooling rate

Equipment should be capable of reducing cauliflower temperature down to possibly a minimum of 6°C in 12 hours. Cooling rates faster than this are unnecessary and require very expensive cooling equipment.

Cauliflower is sensitive to chilling injury and temperatures of less than 2°C can actually reduce shelf life and adversely affect crop qualities. Cauliflowers should be cooled and held in conditions where the relative humidity is in excess of 95% and this should be maintained right through to the retail point of sale.

9.5.2 Cooling equipment

Conventional direct expansion refrigeration cool stores are not generally suitable unless coupled with supplementary humidification and some form of forced air ventilation.

Wet air coolers with positive ventilation such as ice bank coolers are ideal. Other suitable systems use a water to air heat exchange or inject a fine moisture mist into the cooling air (the Hydrair method) eg. Bi-tec Air-spray, Howe-Cool and Polacell. Most refrigeration engineers can supply a suitable wet air system if they are provided with detailed design information. The major disadvantages are the difficulty of cooling packaged produce and the need for moisture resistant packaging materials.

Vacuum cooling is the fastest method and also has the advantage of being able to cool overwrapped and packaged produce. Once cooled, cauliflower must be held at the target temperature, this often involves a holding store.

If cauliflower needs pre-packaging, it must be taken out of the primary cooling equipment, passed through the packhouse, then re-cooled prior to despatch.

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.

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Appendix 1 Minor pests of Cauliflower

Chemical treatment for these pests is only justified if they are present in crops or where there is a history of infestation on the farm.

Beet cyst nematode (*Heterodera schachtii*)

Found mainly in East Anglia and the Isle of Axholme, it attacks most members of the Beet and Cabbage families. Although cauliflowers are rarely damaged they are effective hosts on which the nematode can increase to a level that will affect future Beet crops.

Sample if its presence is suspected and avoid frequent cropping with alternative host crops if the nematode is present.

Brassica cyst nematode (*Heterodera cruciferae*)

Although this pest is widely distributed, it rarely reduces crop yield. Cysts survive in the soil for several years until stimulated to hatch by the presence of a fresh host crop.

Sample if its presence is suspected and avoid overcropping with brassica crops.

Cabbage leaf miners (*Phytomyza rufipes* and *Scaptomyza aplicalis*)

Both species are widely distributed, occasionally damaging Cauliflower . *As large populations can develop in oilseed rape crops, avoid siting Cauliflower nearby if possible. Control measures are only required if damage levels are high;* treatments applied for diamond back moth will keep leaf miner under control.

Cabbage seed weevil

In recent years large numbers of adult cabbage seed weevils have arrived on brassica crops in some localities in mid-summer. Weevils can damage the mature crop by feeding on the outer leaves and contaminate the head prior to harvest. They have occasionally checked the growth of newly planted crops.

Vulnerable crops, particularly those on the point of harvest, should be examined frequently from mid-July to mid-August. Applications of a synthetic pyrethroid, as for control of caterpillars, should kill some weevils and deter others from entering the crop.

Cabbage stem flea beetle (*Psylliodes chrysocephala*)

A widespread and locally serious pest that attacks most overwintering brassica crops especially seed crops. The build up of this pest on oilseed rape may lead to more serious attacks on vegetable brassicas. Even comparatively light attacks can reduce the size of heads.

Site overwintering vegetable brassica crops as far as possible from oilseed rape or other seed crops which can harbour large number of the pest. Pyrethroids applied as soon as serious adult feeding is seen, or when larval damage is noted, will give some control.

Cabbage whitefly (*Aleyrodes proletella*)

An occasional pest, but damage on cauliflower is rare.

Destroy overwintering brassica crops soon after harvest to prevent the movement of whitefly to the new season's crops. Treatment is rarely necessary , but pyrethroids will provide some control of adults given good coverage.

Flea beetles (*Phyllotreta spp* .)

In direct drilled crops, small holes are eaten in cotyledons, stems and first and second rough leaves. In warm dry conditions, the damage can be severe and seedlings may be killed.

Damage to young plants is fairly rare and most crops establishing quickly grow away satisfactorily without further treatment.

Use of pyrethroids will give some control.

Leatherjackets (*Tipula spp* .)

Leatherjackets are only likely to be of importance in fields previously in grass, or weedy stubble. Most damage occurs in the spring.

Plough grassland before early August to prevent egg laying. If early ploughing is not possible, seek advice on potential risk. If this is high, it may be necessary to use an organophosphorus insecticide, applied pre-planting.

Turnip gall weevil (*Ceutorhynchus pleurostigma*)

This localised and sporadic pest is frequently found in southwest England. It attacks late-sown or late-planted cauliflower the legless grubs feed on the roots within hollow marble-sized galls. Yields are rarely affected.

Good soil and growing conditions help plants withstand attack.

Wireworms (*Agriotes spp* .)

Wireworms are only likely to be of consequence in fields cropped soon after long term grass.

Plough early with additional cultivations if wireworm damage is anticipated. Seek advice on the degree of risk if in doubt. Little can be done once an attack has started.

Swede midge (*Contarinia nasturtii*)

Midge occasionally causes severe localised damage in the growing points of young plants, resulting in premature death of the plant or blindness that may be followed by a stem rot. The first generation of larvae appears during the second half of May/beginning of June. There are two or three generations in a season. High humidity situations favour their build-up, whereas drought slows or stops emergence. The larvae hatch from eggs laid in groups of 15-25 and feed on the young tissue in the growing point. Attacks are very rare in the UK.

At present no chemical has approval for the control of swede midge, however, when pyrethroids have been used for caterpillar control, midge larvae control has been observed.

Appendix 2 Typical fertiliser requirements for Cauliflower (kg/ha)

Based on DEFRA Fertiliser Recommendations (RB 209)

Nutrient (kg/ha)	**Soil Index**						
	0	**1**	**2**	**3**	**4**	**5+**	**Top dressing**
Nitrogen				-	-	-	-
Summer and Autumn	290	250	210	175	120	40	-
Winter hardy/Roscoff	75	75	75	0	0	0	up to 200
Phosphorus	200	150	100	50M	0	0	-
Potassium	275	225	(2-) 175 (2+) 125M	35	0	0	-
Magnesium (all soils)	150	100	0	0	0	0	-

Notes:

With Roscoff Cauliflowers for February cutting in frost-free areas, apply the top dressing of nitrogen in late autumn. For crops to be harvested later than mid-February apply top dressings in early February. For winter hardy cauliflower nitrogen top dressing should be applied in the January to March period, depending on the prevailing weather. The maximum rate should only be applied to later harvested crops.

The magnesium/potassium ratio should not exceed 1:4; otherwise compensatory magnesium will need to be applied. For vegetable crops, soils should be maintained at 3 for phosphorous, and 2 for potassium. At these levels only maintenance amounts of fertiliser are needed.

Well-rotted farmyard manure at about 25 t/ha will provide adequate phosphate and potash at index 3 without additional of fertiliser. All manures should be well incorporated to avoid microbial contact with the crop. At lower indices the recommended fertiliser rates shown in the table above should be reduced for each 10 t/ha farmyard manure applied by 15 kg/ha nitrogen, 20 kg/ha phosphorous and 40 kg/ha potassium.

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Appendix 3 Soil Nitrogen Supply (SNS) Indices based previous cropping and rainfall

Detailed SNS tables based on previous cropping and average annual rainfall can be found in DEFRA publication 'Fertiliser Recommendations for Agricultural and Horticultural Crops – 7th Edition (RB209) published by the Stationary Office (ISBN 0 11 243058 9) telephone orders 0870 600 5522. Tables can also be downloaded free of charge from www.defra.gov.uk/farm/environment/land-manage/nutrient/fert/rb209/intro.pdf

Appendix 4 Insecticides currently approved for cabbage root fly control on leaf, head and flowerhead brassicas

Active Ingredient	Product Features	Crop Approval Type					Harvest Interval	LERAP Category	Hazard Rating	UK MRL (mg/kg)				
		Broccoli	Brussels Sprouts	Cabbage	Cauliflower	Collards				Broc	B Spr	Cabb	Cauli	Coll
chlorpyrifos (1)	available as granule and emulsifiable concentrate formulation. Contact and ingested organo-phosphate. Broad spectrum. Only EC/WG formulations approved for use on Kale/Collards and Sprouts.	Full	Full EC & WG formulations. Module and plant drench only.	Full	Full	SOLA's Various see App. 12.	Granule: 42 days EC/WG: 21 days	A	Harmful Irritant	0.05 LOD	0.05 LOD	1.0	0.05 LOD	0.05 LOD
spinosad	a selective insecticide derived from naturally occurring soil fungi. Applied as a module or in-field drench. All MRLs , tMRL's.	SOLA 2086/06	SOLA 0319/06	SOLA 0319/06	SOLA 0319/06	No Approval	Preplant or within 3 days of planting	B	None	2.0	2.0	2.0	2.0	2.0

Notes:

MRL Key : Broc - Broccoli, B Spr - Brussels Sprouts, Cabb - Head Cabbage, Coll - Collards

LOD - MRL set at or about the Limit of Determination

(1) **SOLA** - See Appendix 12 for specific product names and expiry dates.

Not all products containing these active ingredients may be currently approved for use on leaf and flowerhead brassicas. As label recommendations are revised regularly, always read a current label prior to use.

MRL's have been included where a level has been set in the Maximum Residue in Crops, Food and Feeding Stuffs Regulations, 1995.

Appendix 5 Insecticides currently approved for aphid control in leaf, head and flowerhead brassicas

Foliar sprays

Active Ingredient	Product Features	Crop Approval Type					Harvest Interval	LERAP Category	Hazard Rating	UK MRL (mg/kg)				
		Broccoli	Brussels Sprouts	Cabbage	Cauliflower	Collards				Broc	B Spr	Cabb	Cauli	Coll
Acetamiprid(1)	neo-nicotinoid systemic insecticide	No Approval	SOLA	No approval			21 days	B	None	0.01 LOD	0.05	0.01 LOD	0.01 LOD	0.01 LOD
alpha cypermethrin (1)	contact and ingested pyrethroid insecticide	Full	Full	Full	Full	SOLA	7 days	A	Harmful Irritant	0.5				1.0
bifenthrin	contact and residual pyrethroid insecticide for control of aphid and whitefly.	Full	Full	Full	Full	No Approval	2 days	A	Harmful Irritant	0.2	1.0	1.0	0.2	0.05 LOD
chlorpyrifos	contact organo-phosphate, broad spectrum.	Full	No Approval for field application	Full	Full	No Approval	21 days	A	Harmful Irritant	0.05 LOD	0.05 LOD	1.0	0.05 LOD	0.05 LOD
cypermethrin	contact and ingested pyrethroid insecticide.	Full	Full	Full	Full	No Approval	Zero	A	HarmfulIrritant	0.5	0.5	0.5	0.5	1.0
deltamethrin(1)	contact and ingested pyrethroid insecticide.	Full	Full	Full	Full	SOLA	Zero	A	Harmful Irritant Flammable	0.1				0.5

Notes:

MRL Key : Broc - Broccoli, B Spr - Brussels Sprouts, Cabb - Head Cabbage, Coll - Collards

LOD - MRL set at or about the Limit of Determination.

(1) **SOLA** - See Appendix 12 for specific product names and expiry dates.

Not all products containing these active ingredients may be currently approved for use on leaf and flowerhead brassicas. As label recommendations are revised regularly, always read a current label prior to use.. MRL's have been included where a level has been set in the Maximum Residue in Crops, Food and Feeding Stuffs Regulations, 1995.

Appendix 5 Insecticides currently approved for aphid control in leaf, head and flowerhead brassicas (Cont'd)

Foliar sprays (Cont'd)

Active Ingredient	Product Features	Crop Approval Type					Harvest Interval	LERAP Category	Hazard Rating	UK MRL (mg/kg)				
		Broccoli	Brussels Sprouts	Cabbage	Cauliflower	Collards				Broc	B Spr	Cabb	Cauli	Coll
dimethoate (1)	systemic organo-phosphate. Broad spectrum. Dangerous to a wide range of beneficial insects.	Full	Full	SOLA (up to 7TL only)	Full	SOLA (up to 7TL only)	21 days	A	Harmful Irritant	0.02 LOD	0.3	1.0	0.2	0.02 LOD
lambda cyhalothrin	contact and ingested pyrethroid insecticide. Broad spectrum.	Full	Full	Full	Full	No Approval	Zero	B	Harmful Irritant	0.1	0.05	0.2	0.1	1.0
lambda cyhalothrin* + pirimicarb**	useful combination of pyrethroid and carbamate insecticides where both caterpillars and aphids are a problem.	Full	Full	Full	Full	No Approval	3 days	A	Harmful Irritant	0.1* **2.0	0.05* **1.0	0.2* **1.0	0.1* **2.0	1.0* **2.0

Notes:

MRL Key : Broc - Broccoli, B Spr - Brussels Sprouts, Cabb - Head Cabbage, Coll - Collards

LOD - MRL set at or about the Limit of Determination.

(1) **SOLA** - See Appendix 12 for specific product names and expiry dates.

(2) True Leaf.

Not all products containing these active ingredients may be currently approved for use on leaf and flowerhead brassicas. As label recommendations are revised regularly, always read a current label prior to use.

MRL's have been included where a level has been set in the Maximum Residue in Crops, Food and Feeding Stuffs Regulations, 1995.

Appendix 5 Insecticides currently approved for aphid control in leaf, head and flowerhead brassicas (Cont'd)

Foliar sprays (Cont'd)

Active Ingredient	Product Features	Crop Approval Type					Harvest Interval	LERAP Category	Hazard Rating	UK MRL (mg/kg)				
		Broccoli	Brussels Sprouts	Cabbage	Cauliflower	Collards				Broc	B Spr	Cabb	Cauli	Coll
Nicotine(1)	general purpose, non-persistent, contact, alkaloid insecticide. All approvals expire 08/06/2010	Full	Full	Full	Full	SOLA	2 days	None stated	Very Toxic Irritant	LOD 0.01				
pirimicarb	contact, fumigant and translaminar insecticide. Little effect on bees or beneficial insects. *Myzus persicae* resistance reported in some areas.	Full	Full	Full	Full	Full	3 days	None stated	Harmful Toxic Irritant	2.0	1.0	1.0	2.0	2.0
pymetrozine (1)	novel azomethine systemic aphicide which prevents aphid feeding. Controls OP and carbamate resistant *Myzus persicae*.	Full Approval				SOLA	Full 14 days SOLA 7 days	None stated	Harmful	0.02 LOD	0.02 LOD	0.05	0.02 LOD	0.2
Thiacloprid(1)	neo-nicotinoid insecticide controls MACE resistant Myzuz persicae	Full Approval				SOLA	7 days	none	Harmful	0.1	0.05	0.2	0.1	1.0

MRL Key : Broc - Broccoli, B Spr - Brussels Sprouts, Cabb - Head Cabbage, Kale - Kale/Collards

LOD - MRL set at or about the Limit of Determination

(1) **SOLA -** See Appendix 12 for specific product names and expiry dates.

Not all products containing these active ingredients may be currently approved for use on leaf and flowerhead brassicas. As label recommendations are revised regularly, always read a current label prior to use.

MRL's have been included where a level has been set in the Maximum Residue in Crops, Food and Feeding Stuffs Regulations, 1995.

Appendix 6 Insecticides currently approved for caterpillar control in leaf, head and flowerhead brassicas

Active Ingredient	Product Features	Crop Approval Type					Harvest Interval	LERAP Category	Hazard Rating	UK MRL (mg/kg)				
		Broccoli	Brussels Sprouts	Cabbage	Cauliflower	Collards				Broc	B Spr	Cabb	Cauli	Coll
alpha cypermethrin (1)	contact and ingested pyrethroid insecticide.	Full	Full	Full	Full	SOLA 2265/05	7 days	A	Harmful Irritant	0.5				1.0
Bacillus thuringiensis (1)	bacterial insecticide affecting the gut lining of the larvae and therefore must be eaten to be effective	Full	Full	Full	Full	SOLA 0739/04	Full - Zero SOLA - 28 days	None stated	None stated	LOD 0.01				
bifenthrin	contact and residual pyrethroid insecticide for control of aphid and whitefly	Full	Full	Full	Full	No Approval	2 days	A	Harmful Irritant	0.2	1.0	1.0	0.2	0.05 LOD
chlorpyrifos	contact organo-phosphate, broad spectrum	Full	No Approval	Full	Full	No approval	21 days	A	Harmful Irritant	0.05 LOD	0.05 LOD	1.0	0.05 LOD	0.05 LOD
cypermethrin (1)	a contact and stomach acting pyrethroid insecticide	Full	Full	Full	Full	SOLA 1772/07	Zero	A	Harmful Irritant	0.5				1.0
deltamethrin	a pyrethroid insecticide with contact and residual activity.	Full	Full	Full	Full	SOLA	Zero	A	Harmful Irritant Flammable	0.1				0.5

Notes:

MRL Key : Broc - Broccoli, B Spr - Brussels Sprouts, Cabb - Head Cabbage, Kale - Kale/Collards

LOD - MRL set at or about the Limit of Determination

(1) **SOLA** - See Appendix 12 for specific product names and expiry dates.

Not all products containing these active ingredients may be currently approved for use on leaf and flowerhead brassicas. As label recommendations are revised regularly, always read a current label prior to use.

MRL's have been included where a level has been set in the Maximum Residue in Crops, Food and Feeding Stuffs Regulations, 1995.

Appendix 6 Insecticides currently approved for caterpillar control in leaf, head and flowerhead brassicas (Cont'd)

Active Ingredient	Product Features	Crop Approval Type					Harvest Interval	LERAP Category	Hazard Rating	UK MRL (mg/kg)				
		Broccoli	Brussels Sprouts	Cabbage	Cauliflower	Collards				Broc	B Spr	Cabb	Cauli	Coll
diflubenzuron	selective, persistant, contact and stomach acting substituted urea. Acts by disrupting chitin synthesis and prevents egg hatch.	Full	Full	Full	Full	No Approval	14 days	B	None stated	1.0				
indoxacarb	Ingested and contact oxadiazine insecticide	Full	SOLA	Full	Full	No Approval	Full - 1 day SOLA – 28 days	None	Harmful	0.3	0.02 LOD	3.0	0.3	LOD 0.02
lambda cyhalothrin	contact and ingested pyrethroid insecticide. Broad spectrum.	Full	Full	Full	Full	No Approval	Zero	A	Harmful Irritant	0.1	0.05	0.2	0.1	1.0
lambda cyhalothrin* + pirimicarb**	useful combination of pyrethroid and carbamate insecticides where both caterpillars and aphids are a problem.	Full	Full	Full	Full	No Approval	3 days	A	Harmful	0.1* **2.0	0.05* **1.0	0.2* **1.0	0.1* **2.0	1.0* **2.0
Nicotine(1)	general purpose, non-persistent, contact, alkaloid insecticide. All approvals expire 08/06/2010	Full	Full	Full	Full	SOLA	2 days	None stated	Very Toxic Irritant	LOD 0.01				
Spinosad(1)	a selective insecticide derived from naturally occurring soil fungi.	SOLA	Full	Full	Full	No Approval	3 days	B	None stated	2.0	2.0	2.0	2.0	2.0
Teflubenzuron(1)	Selective insecticide for caterpillar control	SOLA	SOLA	No Approval	SOLA	No Approval	14 days	None	Toxic	0.5	0.5	0.5	0.5	0.5

Notes:

MRL Key : Broc - Broccoli, B Spr - Brussels Sprouts, Cabb - Head Cabbage, Kale - Kale/Collards

(1) **SOLA** - See Appendix 12 for specific product names and expiry dates.

LOD - MRL set at or about the Limit of Determination.

Not all products containing these active ingredients may be currently approved for use on leaf and flowerhead brassicas. As label recommendations are revised regularly, always read a current label prior to use.

MRL's have been included where a level has been set in the Maximum Residue in Crops, Food and Feeding Stuffs Regulations, 1995.

Appendix 7 Fungicides currently approved for use on leaf, head and flowerhead brassicas

Field application

Active Ingredient	Product Features	Crop Approval Type					Harvest Interval	LERAP Category	Hazard Rating	UK MRL (mg/kg)				
		Broccoli	Brussels Sprouts	Cabbage	Cauliflower	Collards				Broc	B Spr	Cabb	Cauli	Coll
azoxystrobin (1)	target : Xanthomonas; systemic translaminar and protectant strobilurin	Full	Full	Full	Full	Full	14 days	None stated	None	0.5	0.3	0.3	0.5	5
azoxystrobin* + difenoconazole**	target : ringspot, Alternaria. Mixture of eradicant triazole and protectant strobilurin fungicide	Full	Full	Full	Full	Full	21 days	None stated	Irritant	0.5* **0.2	0.3* **0.2	0.3* **0.2	0.5* **0.2	5* **0.2
boscalid* + pyraclostrobin**	target : ringspot, *Alternaria* and white blister. Anilide and strobilurin fungicide mixture.	No Approval	Full	Full	Full	No Approval	14 days	B	Harmful	1.0* 0.1**	2.0* 0.2**	2.0* 0.2**	1.0* 0.1**	10.0* 0.02 LOD**
chlorothalonil	target : *Alternaria* sp., *Botrytis* sp., downy mildew, damping off and wirestem. Protectant chlorophenyl.	Full	Full	Full	Full	No Approval	7 days	B	Harmful Irritant	3.0	3.0	3.0	3.0	0.01 LOD
chlorothalonil* + metalaxyl-M†	target : white blister & downy mildew. Protectant chlorophenyl and systemic phenylamide.	Full	Full	No Approval	Full	No Approval	14 days	B	Harmful Irritant	3.0* 0.2†	3.0* 0.05† LOD	3.0* 1.0†	3.0* 0.2†	0.01* LOD 0†0.05 LOD

Notes:

MRL Key : Broc - Broccoli, B Spr - Brussels Sprouts, Cabb - Head Cabbage, Coll - Collards

(1) **SOLA** - See Appendix 12 for specific product name(s) and expiry date(s).

LOD - MRL set at or about the Limit of Determination.

Not all products containing these active ingredients may be currently approved for use on leaf and flowerhead brassicas. As label recommendations are revised regularly, always read a current label prior to use. MRL's have been included where a level has been set in the Maximum Residue in Crops, Food and Feeding Stuffs Regulations, 1995.

Appendix 8 Seed treatments for use on leaf, head and flowerhead brassicas

The following seed treatments have been approved and are available either individually or in a mixture as an optional service from UK seedhouses.

Active Ingredient	Product Features	Crop Approval Type					Harvest Interval	LERAP Category	Hazard Rating	UK MRL (mg/kg)				
		Broccoli	Brussels Sprouts	Cabbage	Cauliflower	Collards				Broc	B Spr	Cabb	Cauli	Coll
imidacloprid (1)	target : early aphid control (Myzus persicae). Systemic insecticide.	SOLA					NA	None stated	Irritant	0.5				0.3
thiram	target : seedling damping off diseases	No Approval	No Approval	Full	Full	No Approval	NA	None stated	Irritant	1.0	2.0	3.0	1.0	0.5

Notes:

MRL Key : Broc - Broccoli, B Spr - Brussels Sprouts, Cabb - Head Cabbage, Coll - Collards

LOD : MRL set at or about the Limit of Determination

(1) **SOLA** - See Appendix 12 for specific product name and expiry date.

Not all products containing these active ingredients may be currently approved for use on leaf and flowerhead brassicas. As label recommendations are revised regularly, always read a current label prior to use.

MRL's have been included where a level has been set in the Maximum Residue in Crops, Food and Feeding Stuffs Regulations, 1995.

Appendix 9 Herbicides currently approved for use on leaf, head and flowerhead brassicas

Active Ingredient	Product Features	Crop Approval Type					Harvest Interval	LERAP Category	Hazard Rating	UK MRL (mg/kg)				
		Broccoli	Brussels Sprouts	Cabbage	Cauliflower	Collards				Broc	B Spr	Cabb	Cauli	Coll
chlorthal-dimethyl(1)	target : residual benzoic. Apply after drilling, before crop emergence or after planting. Do not plant lettuce within 6 months other crops within 3 months.	Full	Full	Full	Full	SOLA	Not restricted	Harmful	None stated	0.5	0.5	5.0	5.0	0.5
chlorthal-dimethyl* + propachlor**(1)	target : residual benzoic and chloroacetanilide herbicide mix.	Full	Full	Full	Full	SOLA	Not restricted	None stated	Irritant	*0.5 **0.3	*0.5 **0.3	*5.0 **0.3	*5.0 **0.3	*0.5 **0.2
clomazone	target: residual herbicide	SOLA					Not restricted	None stated	Irritant	0.01 LOD				
clopyralid	target : control of *Compositae* weeds. Foliar, translocated piclonic.	Full	Full	Full	Full	SOLA	42 days	None stated	None stated	0.5				
cycloxydim	target : annual grasses, blackgrass and couch. Translocated post-emergence oxime herbicide. No control of annual meadow grass.	No Approval	Full	Full	Full	No Approval	Check product label	None	Irritant	2.0	3.0	3.0	5.0	2.0

Notes:

MRL Key : Broc - Broccoli, B Spr - Brussels Sprouts, Cabb - Head Cabbage, Coll - Collards
LOD : MRL set at or about the Limit of Determination
(1) **SOLA** - See Appendix 12 for specific product name and expiry date.

Not all products containing these active ingredients may be currently approved for use on leaf and flowerhead brassicas. As label recommendations are revised regularly, always read a current label prior to use.

MRL's have been included where a level has been set in the Maximum Residue in Crops, Food and Feeding Stuffs Regulations, 1995.

Appendix 9 Herbicides currently approved for use on leaf, head and flowerhead brassicas (Cont'd)

Active Ingredient	Product Features	Crop Approval Type					Harvest Interval	LERAP Category	Hazard Rating	UK MRL (mg/kg)				
		Broccoli	Brussels Sprouts	Cabbage	Cauliflower	Collards				Broc	B Spr	Cabb	Cauli	Coll
fluazifop-p-butyl (1)	target : volunteer cereals and couch (no control of annual meadow grass). Phenoxyproprionic acid graminicide.	No Approval	No Approval	SOLA	No Approval	SOLA	see SOLA	None stated	Irritant Harmful	0.2	2.0	0.3	0.2	0.5
metazachlor	target : residual anilide herbicide for broad leaved weed control.	Full	Full	Full	Full	SOLA	Full - 42 days . See SOLA	None stated	Harmful	0.3				
pendimethalin	target : residual dinitroaniline. Approval for pre-planting application only.	Full	Full	Full	Full	No approval	Pre-planting	None stated	None stated	0.05 LOD				
propachlor	target : residual chloroacetanilide for control of annual dicotyledons and annual grasses. **Note all approvals expire 18/3/10.**	Full	Full	Full	Full	Various SOLAs see App 12	Young plant	None stated	Harmful Irritant	0.3				0.2

Notes:
MRL Key : Broc - Broccoli, B Spr - Brussels Sprouts, Cabb - Head Cabbage, Coll - Collards
LOD : MRL set at or about the Limit of Determination
(1) **SOLA** - See Appendix 12 for specific product name and expiry date.

Not all products containing these active ingredients may be currently approved for use on leaf and flowerhead brassicas. As label recommendations are revised regularly, always read a current label prior to use.

MRL's have been included where a level has been set in the Maximum Residue in Crops, Food and Feeding Stuffs Regulations, 1995.

Appendix 9 Herbicides currently approved for use on leaf, head and flowerhead brassicas (Cont'd)

Active Ingredient	Product Features	Crop Approval Type					Harvest Interval	LERAP Category	Hazard Rating	UK MRL (mg/kg)				
		Broccoli	Brussels Sprouts	Cabbage	Cauliflower	Collards				Broc	B Spr	Cabb	Cauli	Coll
pyridate	target : an nual dicotyledons. Contact acting herbicide.	No Approval	Full	Full	No Approval	No Approval	Before 6TL	None stated	None stated	0.05 LOD				
Trifluralin	target : annual dicotyledons & grasses. Soil incorporated dinitroaniline. Long residual action.	Full **All approvals expire 20 March 2009**				SOLA	Pre-planting	None stated	Irritant Flammable	0.5	0.5	0.5	3.0	0.5
tepraloxydim	A systemic post emergence herbicide	No approval	No approval	Full Approval		No approval	Before head/curd forms	None stated	Irritant	0.5	0.1	0.5	0.5	1.0

Notes:

MRL Key : Broc - Broccoli, B Spr - Brussels Sprouts, Cabb - Head Cabbage, Coll - Collards

LOD : MRL set at or about the Limit of Determination

(1) **SOLA** - See Appendix 12 for specific product name and expiry date.

Not all products containing these active ingredients may be currently approved for use on leaf and flowerhead brassicas. As label recommendations are revised regularly, always read a current label prior to use.

MRL's have been included where a level has been set in the Maximum Residue in Crops, Food and Feeding Stuffs Regulations, 1995.

Appendix 10 Molluscicides currently approved for use on leaf, head and flowerhead brassicas

Active Ingredient	Product Features	Crop Approval Type					Harvest Interval	LERAP Category	Hazard Rating	UK MRL (mg/kg)				
		Broccoli	Brussels Sprouts	Cabbage	Cauliflower	Collards				Broc	B Spr	Cabb	Cauli	Coll
copper silicate	target : slugs/snails. Repellent effect.	Full	Full	Full	Full	Full	None stated	None stated	None	20.0				
ferric phosphate	target : slugs/snails. Low toxicity to non target species.	Full	Full	Full	Full	Full	None stated	None stated	None	0.01 LOD				
metaldehyde	target : slugs/snails. Use does preserve ground beetle populations.	Full	Full	Full	No Approval	Full	None stated	None stated	None	1.0				
methiocarb	target : slugs/snails. Stomach acting carbamate. Reduces population of cutworms and millipedes.	No approval	Full	Full	Full	No approval	14 days	None stated	Harmful	0.1 LOD				
phasmarhabditis hermaphrodita	target : slugs. Parasitic nematode. Best applied in moist conditions.	Full	Full	Full	Full	Full	None	None stated	None	0.01 LOD				

Notes:

MRL Key : Broc - Broccoli, B Spr - Brussels Sprouts, Cabb - Head Cabbage, Coll - Collards

LOD : MRL set at or about the Limit of Determination

(1) **SOLA** - See Appendix 12 for specific product name and expiry date.

Not all products containing these active ingredients may be currently approved for use on leaf and flowerhead brassicas. As label recommendations are revised regularly, always read a current label prior to use.

MRL's have been included where a level has been set in the Maximum Residue in Crops, Food and Feeding Stuffs Regulations, 1995.

Appendix 11 Broccoli/Calabrese Approvals

The green flower-head brassica referred to as "Broccoli" throughout these appendices is referred to as "Calabrese" in the 2006 U.K. Pesticide Guide, whilst "Broccoli" is used as a generic term to describe various minor forms such as white sprouting, purple sprouting and cape Broccoli.

Broccoli and Calabrese are in the same PSD crop hierarchy therefore both SOLA and full label approvals stating broccoli can be legally used on calabrese and vice versa. PSD define broccoli/calabrese as “varieties of *Brassica oleracea var italica* grown for their immature inflorescences. Includes all forms of purple and green sprouting broccoli and calabrese”.

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Appendix 12 Specific off-label approvals for leaf, head and flowerhead brassicas

SOLA Number	Product	Active Ingredient	Crop	Expiry
2866/07	Insyst	Acetamiprid	brussels sprout (outdoor)	31-Dec-14
2265/05	Contest	Alpha-cypermethrin	collard (outdoor)	31-Dec-13
0739/04	Dipel DF (11184)	Bacillus thuringiensis var. kurstaki	calabrese (outdoor)	31-Aug-12
2922/05	Agriguard Chlorothalonil	Chlorothalonil	calabrese (outdoor)(seedling)	28-Feb-11
2940/05	Bravo 500	Chlorothalonil	calabrese (outdoor)	31-Dec-13
2940/05	Bravo 500	Chlorothalonil	calabrese (outdoor)(seedling)	31-Dec-13
0993/07	Cleancrop Rio	Chlorothalonil	calabrese (outdoor)	28-Feb-11
0993/07	Cleancrop Rio	Chlorothalonil	calabrese (outdoor)(seedling)	28-Feb-11
2948/05	Jupital	Chlorothalonil	calabrese (outdoor)(seedling)	31-Dec-13
2888/05	Repulse	Chlorothalonil	calabrese (outdoor)	31-Dec-13
2053/07	Sonar	Chlorothalonil	calabrese (outdoor)	31-Dec-13
3667/06	Ballad	Chlorpyrifos	broccoli (outdoor)	31-Dec-13
3654/06	CYREN	Chlorpyrifos	broccoli (outdoor)	31-Dec-13
3655/06	Dursban WG	Chlorpyrifos	broccoli (outdoor)	31-Dec-13
3640/06	Equity	Chlorpyrifos	broccoli (outdoor)	31-Dec-13
1587/06	Parapet	Chlorpyrifos	collard (outdoor)	31-Dec-13
1587/06	Parapet	Chlorpyrifos	collard (outdoor)(seedling)	31-Dec-13
1552/06	Dacthal W75	Chlorthal-dimethyl	collard (outdoor)	31-Dec-13
0087/08	Centium 360 CS (11607)	Clomazone	broccoli (outdoor)	31-Dec-09
0087/08	Centium 360 CS (11607)	Clomazone	brussels sprout (outdoor)	31-Dec-09
0087/08	Centium 360 CS (11607)	Clomazone	cabbage (outdoor)	31-Dec-09
0087/08	Centium 360 CS (11607)	Clomazone	calabrese (outdoor)	31-Dec-09
0087/08	Centium 360 CS (11607)	Clomazone	cauliflower (outdoor)	31-Dec-09
0417/08	Gamit 36 CS (12598)	Clomazone	broccoli (outdoor)	28-Feb-10
0417/08	Gamit 36 CS (12598)	Clomazone	brussels sprout (outdoor)	28-Feb-10
0417/08	Gamit 36 CS (12598)	Clomazone	cabbage (outdoor)	28-Feb-10
0417/08	Gamit 36 CS (12598)	Clomazone	calabrese (outdoor)	28-Feb-10
0417/08	Gamit 36 CS (12598)	Clomazone	cauliflower (outdoor)	28-Feb-10
3315/07	Barclay Karaoke	Clopyralid	collard (outdoor)	30-Apr-09
2637/06	Dow Shield	Clopyralid	collard (outdoor)	31-Dec-13

Notes:

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Appendix 12 Specific off-label approvals for leaf, head and flowerhead brassicas (Cont'd)

SOLA Number	Product	Active Ingredient	Crop	Expiry
3318/07	Fernpath Torate	Clopyralid	collard (outdoor)	30-Apr-09
1956/06	Glopyr 200 SL	Clopyralid	collard (outdoor)	31-Dec-13
3333/07	Loncid	Clopyralid	collard (outdoor)	30-Apr-09
1932/06	Lontrel 200	Clopyralid	collard (outdoor)	31-Dec-13
0115/01	Cuprokylt	Copper oxychloride	broccoli (outdoor)	31-Dec-13
0115/01	Cuprokylt	Copper oxychloride	brussels sprout (outdoor)	31-Dec-13
0115/01	Cuprokylt	Copper oxychloride	cabbage (outdoor)	31-Dec-13
0115/01	Cuprokylt	Copper oxychloride	calabrese (outdoor)	31-Dec-13
0115/01	Cuprokylt	Copper oxychloride	cauliflower (outdoor)	31-Dec-13
0156/08	Headland Inorganic Liquid Copper	Copper oxychloride	broccoli (outdoor)	31-Dec-13
0156/08	Headland Inorganic Liquid Copper	Copper oxychloride	brussels sprout (outdoor)	31-Dec-13
0156/08	Headland Inorganic Liquid Copper	Copper oxychloride	cabbage (outdoor)	31-Dec-13
0156/08	Headland Inorganic Liquid Copper	Copper oxychloride	calabrese (outdoor)	31-Dec-13
0156/08	Headland Inorganic Liquid Copper	Copper oxychloride	cauliflower (outdoor)	31-Dec-13
1801/07	Cleancrop Decathlon	Deltamethrin	collard (outdoor)	31-Dec-13
2458/08	Decis	Deltamethrin	collard (outdoor)	31-Dec-13
1687/07	Pearl Micro	Deltamethrin	collard (outdoor)	31-Dec-13
0389/94	BASF Dimethoate 40	Dimethoate	broccoli (outdoor)	31-Dec-13
0389/94	BASF Dimethoate 40	Dimethoate	calabrese (outdoor)	31-Dec-13
0808/06	Danadim	Dimethoate	broccoli (outdoor)(seedling)	31-Dec-13
0808/06	Danadim	Dimethoate	calabrese (outdoor)(seedling)	31-Dec-13
0682/05	Danadim Progress	Dimethoate	calabrese (outdoor)(seedling)	31-Dec-13
1776/08	Fusilade 250 EW	Fluazifop-P-butyl	collard (outdoor)	31-Dec-13
0328/08	Fusilade Max	Fluazifop-P-butyl	cabbage (outdoor)	31-Dec-13
1777/08	Fusilade Max	Fluazifop-P-butyl	collard (outdoor)	31-Dec-13
1777/08	Fusilade Max	Fluazifop-P-butyl	collard (outdoor)(spring greens)	31-Dec-13
0102/07	Capitan 25	Flusilazole	brussels sprout (outdoor)	31-Dec-13
0101/07	Genie 25	Flusilazole	brussels sprout (outdoor)	31-Dec-13
3998/06	Lyric	Flusilazole	brussels sprout (outdoor)	31-Dec-13

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Appendix 12 Specific off-label approvals for leaf, head and flowerhead brassicas (Cont'd)

SOLA Number	Product	Active Ingredient	Crop	Expiry
0100/07	Sanction 25	Flusilazole	brussels sprout (outdoor)	31-Dec-13
3524/06	Aliette 80 WG	Fosetyl-aluminium	broccoli (outdoor)	31-Dec-13
2031/08	Aliette 80 WG	Fosetyl-aluminium	broccoli (outdoor)	31-Dec-13
3524/06	Aliette 80 WG	Fosetyl-aluminium	broccoli (outdoor)(seedling)	31-Dec-13
3524/06	Aliette 80 WG	Fosetyl-aluminium	brussels sprout (outdoor)	31-Dec-13
2031/08	Aliette 80 WG	Fosetyl-aluminium	brussels sprout (outdoor)	31-Dec-13
3524/06	Aliette 80 WG	Fosetyl-aluminium	brussels sprout (outdoor) (seedling)	31-Dec-13
3524/06	Aliette 80 WG	Fosetyl-aluminium	cabbage (outdoor)	31-Dec-13
2031/08	Aliette 80 WG	Fosetyl-aluminium	cabbage (outdoor)	31-Dec-13
3524/06	Aliette 80 WG	Fosetyl-aluminium	cabbage (outdoor)(seedling)	31-Dec-13
3524/06	Aliette 80 WG	Fosetyl-aluminium	calabrese (outdoor)	31-Dec-13
2031/08	Aliette 80 WG	Fosetyl-aluminium	calabrese (outdoor)	31-Dec-13
3524/06	Aliette 80 WG	Fosetyl-aluminium	calabrese (outdoor)(seedling)	31-Dec-13
3524/06	Aliette 80 WG	Fosetyl-aluminium	cauliflower (outdoor)	31-Dec-13
2031/08	Aliette 80 WG	Fosetyl-aluminium	cauliflower (outdoor)	31-Dec-13
3524/06	Aliette 80 WG	Fosetyl-aluminium	cauliflower (outdoor)(seedling)	31-Dec-13
3524/06	Aliette 80 WG	Fosetyl-aluminium	collard (outdoor)	31-Dec-13
2031/08	Aliette 80 WG	Fosetyl-aluminium	collard (outdoor)	31-Dec-13
3524/06	Aliette 80 WG	Fosetyl-aluminium	collard (outdoor)(seedling)	31-Dec-13
3570/07	Cleancrop Chicane	Fosetyl-aluminium	broccoli (outdoor)	31-May-09
3570/07	Cleancrop Chicane	Fosetyl-aluminium	broccoli (outdoor)(seedling)	31-May-09
3570/07	Cleancrop Chicane	Fosetyl-aluminium	brussels sprout (outdoor)	31-May-09
3570/07	Cleancrop Chicane	Fosetyl-aluminium	brussels sprout (outdoor) (seedling)	31-May-09
3570/07	Cleancrop Chicane	Fosetyl-aluminium	cabbage (outdoor)(seedling)	31-May-09
3570/07	Cleancrop Chicane	Fosetyl-aluminium	calabrese (outdoor)	31-May-09
3570/07	Cleancrop Chicane	Fosetyl-aluminium	calabrese (outdoor)(seedling)	31-May-09
3570/07	Cleancrop Chicane	Fosetyl-aluminium	cauliflower (outdoor)	31-May-09
3570/07	Cleancrop Chicane	Fosetyl-aluminium	cauliflower (outdoor)(seedling)	31-May-09
3570/07	Cleancrop Chicane	Fosetyl-aluminium	collard (outdoor)	31-May-09

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Appendix 12 Specific off-label approvals for leaf, head and flowerhead brassicas (Cont'd)

SOLA Number	Product	Active Ingredient	Crop	Expiry
3570/07	Cleancrop Chicane	Fosetyl-aluminium	collard (outdoor)(seedling)	31-May-09
0271/08	Standon Fullstop	Fosetyl-aluminium	broccoli (outdoor)	31-Dec-13
0271/08	Standon Fullstop	Fosetyl-aluminium	broccoli (outdoor)(seedling)	31-Dec-13
0271/08	Standon Fullstop	Fosetyl-aluminium	brussels sprout (outdoor)	31-Dec-13
0271/08	Standon Fullstop	Fosetyl-aluminium	brussels sprout (outdoor) (seedling)	31-Dec-13
0271/08	Standon Fullstop	Fosetyl-aluminium	cabbage (outdoor)	31-Dec-13
0271/08	Standon Fullstop	Fosetyl-aluminium	cabbage (outdoor)(seedling)	31-Dec-13
0271/08	Standon Fullstop	Fosetyl-aluminium	calabrese (outdoor)	31-Dec-13
0271/08	Standon Fullstop	Fosetyl-aluminium	calabrese (outdoor)(seedling)	31-Dec-13
0271/08	Standon Fullstop	Fosetyl-aluminium	cauliflower (outdoor)	31-Dec-13
0271/08	Standon Fullstop	Fosetyl-aluminium	cauliflower (outdoor)(seedling)	31-Dec-13
3927/02	Gaucho	Imidacloprid	broccoli (outdoor)	31-Dec-13
3927/02	Gaucho	Imidacloprid	brussels sprout (outdoor)	31-Dec-13
3927/02	Gaucho	Imidacloprid	cabbage (outdoor)	31-Dec-13
3927/02	Gaucho	Imidacloprid	calabrese (outdoor)	31-Dec-13
3927/02	Gaucho	Imidacloprid	cauliflower (outdoor)	31-Dec-13
3927/02	Gaucho	Imidacloprid	collard (outdoor)	31-Dec-13
1485/08	Steward	Indoxacarb	brussels sprout (outdoor)	31-Mar-16
1610/01	Fubol Gold WG	Mancozeb/metalaxyl-M	cabbage (outdoor)	31-Dec-13
3643/06	Fubol Gold WG	Mancozeb/metalaxyl-M	collard (outdoor)	31-Dec-13
0381/08	MetMan 680	Mancozeb/metalaxyl-M	cabbage (outdoor)	30-Jun-11
3306/07	Alpha Metazachlor 50 SC	Metazachlor	collard (outdoor)	31-Dec-13
1420/08	Sultan 50 SC	Metazachlor	collard (outdoor)	31-Dec-13
3012/06	Devrinol	Napropamide	collard (outdoor)	31-Dec-13
3010/06	Devrinol (09374)	Napropamide	collard (outdoor)	31-Dec-13
3278/06	No-FID	Nicotine	collard (outdoor)	31-Dec-13
3288/06	Stalwart	Nicotine	collard (outdoor)	31-Dec-13
3292/06	XL All Nicotine 95%	Nicotine	calabrese (outdoor)	31-Dec-13
2565/08	Alpha Propachlor 50 SC	Propachlor	collard (outdoor)	18-Mar-10

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Appendix 12 Specific off-label approvals for leaf, head and flowerhead brassicas (Cont'd)

SOLA Number	Product	Active Ingredient	Crop	Expiry
2542/07	Alpha Propachlor 50 SC (04873)	Propachlor	collard (outdoor)	31-Jan-09
2578/08	Brasson	Propachlor	collard (outdoor)	18-Mar-10
2586/08	Ramrod 20 Granular	Propachlor	calabrese (outdoor)	18-Mar-10
2582/08	Ramrod 20 Granular	Propachlor	collard (outdoor)	18-Mar-10
3130/06	Ramrod Flowable	Propachlor	collard (outdoor)	18-Mar-10
2599/08	Sentinel 2	Propachlor	collard (outdoor)	18-Mar-10
2595/08	Tripart Sentinel	Propachlor	calabrese (outdoor)	18-Mar-10
2596/08	Tripart Sentinel	Propachlor	collard (outdoor)	18-Mar-10
0788/07	Chess WG	Pymetrozine	broccoli (outdoor)	31-Oct-11
0788/07	Chess WG	Pymetrozine	broccoli (outdoor)(seedling)	31-Oct-11
0788/07	Chess WG	Pymetrozine	brussels sprout (outdoor)	31-Oct-11
0788/07	Chess WG	Pymetrozine	brussels sprout (outdoor) (seedling)	31-Oct-11
0788/07	Chess WG	Pymetrozine	cabbage (outdoor)	31-Oct-11
0788/07	Chess WG	Pymetrozine	cabbage (outdoor)(seedling)	31-Oct-11
0788/07	Chess WG	Pymetrozine	calabrese (outdoor)	31-Oct-11
0788/07	Chess WG	Pymetrozine	calabrese (outdoor)(seedling)	31-Oct-11
0788/07	Chess WG	Pymetrozine	cauliflower (outdoor)	31-Oct-11
0788/07	Chess WG	Pymetrozine	cauliflower (outdoor) (seedling)	31-Oct-11
2246/08	Plenum WG	Pymetrozine	collard (outdoor)	31-Oct-11
2081/08	Plenum WG	Pymetrozine	collard (outdoor)	31-Oct-11
2086/06	Tracer	Spinosad	broccoli (outdoor)	30-Apr-13
0849/07	Tracer	Spinosad	broccoli (outdoor)	30-Apr-13
2086/06	Tracer	Spinosad	broccoli (outdoor)(seedling)	30-Apr-13
0319/06	Tracer	Spinosad	brussels sprout (outdoor)	30-Apr-13
0319/06	Tracer	Spinosad	cabbage (outdoor)	30-Apr-13
2086/06	Tracer	Spinosad	calabrese (outdoor)	30-Apr-13
0849/07	Tracer	Spinosad	calabrese (outdoor)	30-Apr-13
2086/06	Tracer	Spinosad	calabrese (outdoor)(seedling)	30-Apr-13
0319/06	Tracer	Spinosad	cauliflower (outdoor)	30-Apr-13

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Appendix 12 Specific off-label approvals for leaf, head and flowerhead brassicas (Cont'd)

SOLA Number	Product	Active Ingredient	Crop	Expiry
1375/07	Alpha Tebuconazole 20 EW	Tebuconazole	broccoli (outdoor)	31-Dec-13
1375/07	Alpha Tebuconazole 20 EW	Tebuconazole	calabrese (outdoor)	31-Dec-13
1375/07	Alpha Tebuconazole 20 EW	Tebuconazole	cauliflower (outdoor)	31-Dec-13
1874/03	Folicur	Tebuconazole	broccoli (outdoor)	31-Dec-13
1874/03	Folicur	Tebuconazole	calabrese (outdoor)	31-Dec-13
1874/03	Folicur	Tebuconazole	cauliflower (outdoor)	31-Dec-13
1371/07	Mitre	Tebuconazole	broccoli (outdoor)	31-Dec-13
1371/07	Mitre	Tebuconazole	calabrese (outdoor)	31-Dec-13
1371/07	Mitre	Tebuconazole	cauliflower (outdoor)	31-Dec-13
1824/08	Orius	Tebuconazole	broccoli (outdoor)	31-Jul-09
1824/08	Orius	Tebuconazole	calabrese (outdoor)	31-Jul-09
1824/08	Orius	Tebuconazole	cauliflower (outdoor)	31-Jul-09
1326/07	Orius 20 EW	Tebuconazole	broccoli (outdoor)	31-Dec-13
1326/07	Orius 20 EW	Tebuconazole	calabrese (outdoor)	31-Dec-13
1326/07	Orius 20 EW	Tebuconazole	cauliflower (outdoor)	31-Dec-13
0546/07	Riza	Tebuconazole	broccoli (outdoor)	31-Dec-13
0546/07	Riza	Tebuconazole	calabrese (outdoor)	31-Dec-13
0546/07	Riza	Tebuconazole	cauliflower (outdoor)	31-Dec-13
2121/07	Nemolt	Teflubenzuron	broccoli (outdoor)	31-Dec-13
2121/07	Nemolt	Teflubenzuron	brussels sprout (outdoor)	31-Dec-13
2121/07	Nemolt	Teflubenzuron	cauliflower (outdoor)	31-Dec-13
2266/08	Biscaya	Thiacloprid	collard (outdoor)	31-Dec-14
2266/08	Biscaya	Thiacloprid	collard (outdoor)(spring greens)	31-Dec-14
3527/06	Basilex	Tolclofos-methyl	broccoli (outdoor)	31-Dec-13
3219/07	Ipifluor	Trifluralin	collard (outdoor)	20-Mar-09

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Appendix 13 Guidelines on minimising pesticide residues

These guidelines have been produced after consultation between crop stakeholders and the Assured Produce crop author. They will be developed over the coming seasons as knowledge on minimising residues develops. Growers should consult with their crop protection adviser to ensure other best practices are not compromised before considering these guidelines. The table below lists the active ingredients that may give rise to crop residues and details potential alternative strategies.

Active ingredient	Target: pest, weed, disease	Current position	Suggested guidelines
cypermethrin deltamethrin	insect pests	Residues very occasionally found in <1% samples	Both deltamethrin and cypermethrin have a zero harvest interval. However, application on the day of harvest can lead to occasional residues being detectable. Whilst these residues are well within current MRLs it is advisable to avoid the application of these insecticides within 3 days of harvest.

Control Document No: 00018/09

Appendix 14 Control Points: LEAF & FLOWERHEAD BRASSICAS

LEAF & FLOWERHEAD BRASSICAS

CS.56.1 You should be able to produce evidence to show that you have taken into consideration soil type and variety when planning fertiliser application -

Protocol reference: Section 6.1

CS.56.2 Do you use a soil nitrogen prediction system such as Soil Nitrogen Supply (SNS) and where applicable Soil Mineral Nitrogen (SMN) to schedule nitrogen applications?

Protocol reference: Section 6.1

CS.56.3 *Deleted 2004*

CS.56.4 *Deleted 2009*

CS.56.5 You should be able to provide evidence to show that you can justify the use of fungicides and do not apply them on a routine prophylactic basis -

Protocol reference: Section 8.10.2 **(Revised 2005)**

CS.56.6 Evidence must be provided to show that polythene crop covers have been disposed of or recycled in the most appropriate manner -

Protocol reference: Section 4.5.4

CS.56.7 Evidence must be provided to show that you ensure harvested product is not contaminated by or exposed to anything that could affect food quality

- Protocol reference: Section 9.4

Control Document No: 00018/09