Assured Produce

Crop Specific Protocol

CHINESE CABBAGE,
PAK CHOI AND CHOI SUM

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Acknowledgements ................................................................. 4
1. General introduction .......................................................... 6
2. Planning and records ......................................................... 6
3. Site Selection ................................................................. 6
   3.1 Site history .............................................................. 6
   3.2 Rotation ....................................................................... 7
4. Site management .............................................................. 8
   4.1 Soil mapping .............................................................. 8
   4.2 Soil management ....................................................... 8
   4.3 Soil fumigation ......................................................... 8
   4.4 Substrates ................................................................... 8
   4.5 Drilling and transplanting ........................................... 8
5. Variety selection .............................................................. 10
   5.1 Choice of variety ...................................................... 10
6. Nutrition ....................................................................... 11
   6.1 Nutrient requirement ............................................... 11
7. Irrigation ................................................................... 12
8. Crop protection ............................................................ 13
   8.1 The basic approach to crop protection ....................... 13
   8.2 Plant protection product choice ............................. 13
   8.3 Advice on the use of pesticides ................................ 13
   8.4 Application of pesticides .......................................... 13
   8.5 Records of application ............................................ 13
   8.6 Protective clothing/equipment .................................. 13
   8.7 Pesticide storage ...................................................... 13
   8.8 Empty pesticide containers .................................... 13
   8.9 Pesticide residues in fresh produce ......................... 13
   8.10 Pest, disease, physiological disorders and weed control .. 14
9. Harvesting and storage .................................................. 25
   9.1 Hygiene ................................................................... 25
   9.2 Post-harvest treatments ........................................... 25
   9.3 Post-harvest washing ............................................... 25
10. Pollution control and waste management .................................................. 26
11. Energy efficiency ...................................................................................... 26
12. Health & Safety ......................................................................................... 27
13. Conservation issues .................................................................................. 27
Appendix 1 Minor pests ................................................................................. 28
Appendix 2 Fertiliser requirements for Mature oriental brassicas (kg/ha) .......... 30
Appendix 3 Minor field and storage diseases ................................................... 31
Appendix 4 Nitrogen index based on previous cropping ................................. 33
Appendix 5 Pesticides currently approved for use on outdoor Chinese cabbage (Brassica campestris pekinensis) ................................................................. 34
Appendix 6 Specific off-label approvals for outdoor Chinese cabbage (Brassica campestris pekinensis) ................................................................. 35
Appendix 7 Pesticides currently approved for use on outdoor Pak Choi, Choi Sum (Brassica campestris chinensis) ............................................................. 37
Appendix 8 Specific off-label approvals for outdoor Pak Choi (Brassica campestris chinensis) ................................................................. 38
Appendix 9 Specific off-label approvals for outdoor Choi Sum (Brassica campestris chinensis) ................................................................. 40
Appendix 10 Guidelines on minimising pesticide residues ............................... 42
Appendix 11 Control Points: Chinese Cabbage, Pak Choi and Choi Sum ........... 43
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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 "strongly recommended" (in bold type) will be verified during the Assured Produce assessment and their compliance will form a part of the certification/approval decision. The score required for these "strongly recommended" control points can be found on the final page of this document and in the checklists produced by Assured Produce licensed certification bodies.

Disclaimer and trade mark acknowledgement

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

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

Notes:

EC Review: Major withdrawal of pesticide products

All pesticide information quoted in this Crop Specific protocol was last updated in January 2007.

The EC Review of pesticides registered in or before 1993 will not be completed until 2008 at the earliest. There was a major withdrawal of pesticide products in 2003 as a result of the Review and several active substances approved for minor uses were not supported by crop protection companies. Certain uses of some of these substances can continue in the UK because they are covered by 'Essential Use' derogations. Some active substances have also failed to achieve Annex 1 listing (e.g. simazine) and some additional Essential Uses have been granted until 31 December 2007. There may be other withdrawals or revocations.

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

Long Term Arrangements for Extension of Use ( LTAEU )

The PSD have decided it is no longer possible to maintain the Long Term Arrangements for Extension of Use ( LTAEU ) in their current format and are gradually replacing these Arrangements with Specific Off-Label Approvals (SOLAs). These replacement SOLAs will be shown on the PSD website when they become available.
Growers can continue to use approvals under the LTAEU until such time that all relevant SOLAs have been issued by PSD, and until the arrangements are withdrawn by PSD - At that time growers must ensure that they have access to the relevant SOLA notice of approval. In order to comply with current legislation, you should download a SOLA onto your personal computer or retain a paper copy before using any SOLA.

A list indicating the SOLAs which have been requested is available from the PSD website using the following link:

http://www.pesticides.gov.uk/food_safety.asp?id=1576

Growers should check with their advisers, manufacturers, the Assured Produce website 'Newsflashes' and the PSD website (www.pesticides.gov.uk)

Approval status

Although it is a legal requirement to adhere to the label recommendations i.e. in an approved manner, "off-label" use may be approved under extrapolation from another label or off-label recommended crop. These are referred to as the so-called "Long Term Arrangements for Extension of Use" (LTAEU). Full details of use under these arrangements are given in the Generic Guidance Notes.

The current LTAEU permits extrapolation from kale to Mature Oriental Brassicas (intended for harvest > 8 true leaves), the group includes the traditional barrel shaped Chinese Cabbage (Brassica campestris var pekinesis) and Pak Choi & Choi Sum (Brassica campestris var chinesis).

Existing SOLA's which stipulate Chinese cabbage are specifically for the traditional barrel shaped (Brassica campestris var pekinesis), these products are not permitted on Pak Choi & Choi Sum (Brassica campestris var chinesis).
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.

```
SITE SELECTION
SITE MANAGEMENT
VARIETY SELECTION
NUTRITION
IRRIGATION
PEST CONTROL
DISEASE CONTROL
WEED CONTROL
HARVEST & STORAGE
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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

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

3.1 Site history

3.1.1 Climate
The crop can be grown throughout the UK, although wetter areas in the West can increase the risk of ringspot. In drier areas of the South and East, irrigation may be required during periods of drought to maintain continuity. Wind can be a problem on light land where soil particle contaminate the head.

3.1.2 Weed status

Perennial weeds such as couch, docks and thistles should be controlled prior to planting/drilling a crop of Mature Oriental Brassicas. 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.

3.1.4 Position

3.1.4.1 Access

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

3.1.4.2 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.

3.1.4.3 Obstacles

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

3.1.4.4 Spraying safety

a. To humans: where possible avoid cropping areas adjacent to schools, housing estates, playing fields etc. where there is a risk of drift from spraying operations. To flora: avoid areas adjacent to wildlife reserves, sites of specific scientific interest. Note the position of any beehives.

b. To watercourses: buffer zones now apply, where the spraying of certain pesticides, when using ground based vehicle mounted/mounted sprayers is prohibited within 5 metres of the top of the bank of the watercourse. Protocol operators should be aware of 'LERAP' regulations introduced in 1999. Further information can be obtained from local NFU offices (see Generic Standards 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

Good drainage is essential. A pH level of 7.0 to 7.3 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. Mature Oriental Brassicas can be grown on a wide range of soil types, but lighter sandier soil types will require irrigation. One should also consider the damage caused by harvesting on heavy soil types. The heavier soil types may also be difficult to obtain a good tilth for drilling in April.

Direct-drilled crops are sensitive to soil surface capping which can reduce and delay germination and disrupt uniformity of emergence, causing uneven maturity at harvest. Drill press wheels, rolling and irrigating after sowing can contribute to this problem, especially on soils of weak structure or low organic matter.

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, with the minimum of cultivation, will help to maintain soil structure. Roots will not penetrate a compacted or smeared soil layer and high yields will not be produced unless the plants can root deeply.

Loss of soil structure in the surface layers, due to excessive soil or inappropriate cultivations, can lead to soil capping and reduced emergence.

Wheelings from pre-sowing or planting cultivations may cause compaction; therefore the bed system is to be commended. In large-scale production the tramline system, where two crop rows are left out for the passage of a tractor with wide tyres, facilitates easy fertiliser applications, spraying, irrigation and harvesting machinery access, in addition to confining wheelings to a designated area.

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. Market for which the crop is grown.
c. Costs of production.
d. Disease control.

Increasing plant population results in reduced plant size and delayed maturity. Sowing

Seedbed

i. Seed can be drilled under glass, polythene tunnels, or polythene protection in the field, from mid-February, for subsequent transplanting to satisfy the earliest markets. Early varieties may tend to bolt under some conditions.

ii. Drilling without protection, for subsequent transplanting, can take place from early April (if the soil conditions are suitable) to end of August for most Mature Oriental Brassicas types. Under poor conditions and low temperature deferred sowing dates are preferable.

The seed should be set at a constant depth of 18-20 mm, to ensure even emergence. Cabbage root fly control may be required (see Appendices 5,6,7,8).

Direct drilling

This system is generally used where crops are grown at close spacing. The method requires greater precision to establish the crop than transplanting.

With direct drilling:

i. land is occupied for a longer period.
ii. expensive hybrid seed requirements are higher.
iii. less labour is involved than with transplanting.
iv. specialised transplanting equipment is not required.
v. unlike transplanting, there is less pressure to establish the crop in mid-summer, possibly in dry conditions.

Vacuum or belt drills cause less damage to the seed than cell wheel drills. Ground wheel drive is superior to unit wheel drive allowing drilling to continue when the soil surface is wet. Adjustable land wheel drive may be required on some bed systems.

4.5.2 Drilling into soils liable to cap

Minimum pressure should be applied over the rear wheels of the drill. Also certain drill accessories should be considered, such as:

a. Anti-capping wheels: Twin rear wheels which run on each side of the row with a 25 mm gap between, so that the soil is not compressed directly over the seed.

b. Cage wheels: They have expanded metal surfaces instead of the standard steel band.

c. Small rakes: Fitted behind each rear wheel to loosen the consolidated topsoil without disturbing the seed.

Shallow drilling, together with pre-drilling irrigation if necessary, is preferable to drilling deeper to reach moist soil. Avoid deep drilling on soils liable to cap.
Chemicals for the control of Cabbage root fly may be applied simultaneously at drilling (see Appendix 5.6.7.8)

4.5.3 Transplanting

Propagation.

The majority of the transplanted crop is grown from glasshouse raised modular transplants or small peat blocks. Transplanting is a major aid in crop scheduling. The modular trays, the most common size having cells of 14 ml volume containing peat compost, enable the propagator to have complete control over plant growth.

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
- Are free from pest and disease
- Are fully soaked and primed with nitrogen immediately prior to planting

Plants should be given a high nitrogen feed prior to despatch. Growers should ensure that the modules are at maximum water holding capacity at planting. Water should be applied immediately post planting.

Propagators

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

It is strongly recommended that to comply with the requirement for due diligence throughout the food distribution chain, details of all pesticides need to be agreed and recorded by the propagator and passed to the grower. Applications of liquid feeds should be treated similarly. (See Generic Standards 5.4.1)

4.5.4 Early production under covers

Wide sheets, 10-14 metre wide, of fleece type materials are the most common for of covering

The activity of herbicides under covers can be erratic. This may be due to high light intensities and warmth causing accelerated breakdown of the herbicide or possibly by the drying out of the soil surface. It is important that individual herbicides are applied to a very moist soil, or on soil moistened before the crop is covered with film, in order to improve the performance of the herbicide

Physiological problems soon arise if covers are left on too long. Covers should be removed on a dull day or in the late afternoon period.

Disposal of crop cover

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

5. Variety selection

5.1 Choice of variety

None of the current commercially important varieties have resistance to all the five major diseases, (ringspot, Alternaria, light leaf spot, white blister and club root). Varieties differ in their susceptibility
to powdery mildew.

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

Many varieties in current commercial use are hybrids.

### 6. Nutrition

#### 6.1 Nutrient requirement

**Macro-nutrients**

Excessive use of macro-nutrients is not only wasteful, but can be costly and have a detrimental effect on groundwater quality.

Nitrogen in particular must be tailored accurately to the precise needs of the 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 a health risk to drinking water and exaggerates eutrophication.

It is strongly recommended a nitrogen prediction model or soil sampling is used as they can be an efficient aid to nitrogen management.

If it is not possible to undertake a soil analysis, a soil nitrogen index should be used, which takes into account the previous crop and its manuring (See Appendix 4).

On intensive brassica land, where samples are being taken frequently for soil nitrate determination, it is cheap and economical to simultaneously analyse for pH, phosphate, potassium and magnesium. Otherwise in the absence of crop failure, fields should be sampled and analysed every three years. Interim nutrient status can be evaluated using a balance sheet method.

It is strongly recommended that when planning fertiliser applications, soil type and variety are taken into consideration. Nutrients should be applied according to soil analysis. Typical fertiliser recommendations are given 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 salt levels 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 well cultivated into the soil.

**Nitrogen top dressing**

Often applied as ammonium nitrate, calcium nitrate, calcium ammonium nitrate but sulphate of ammonia is sometimes used.
Where nitrogen top dressings are broadcast over the crop there is a risk of scorch and subsequent Botrytis infection. To minimise this risk, application should be made when the crop is dry or very wet so that as little as possible sticks to the foliage. Top dressing is normally undertaken at cotyledon stage on the drilled crop.

Nitrate Vulnerable Zones

Certain vegetable production areas within the U.K. may be located in designated nitrate vulnerable zones (NVZs). These are areas where growers are asked to observe a programme of measures, designed to reduce nitrate loss from the land and help reduce nitrate levels in water. Guidelines set out in the Code for Good Agricultural Practice for the Protection of 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 210 kg/ha of total nitrogen averaged over the farm area each year. All farmers within the NVZs have been required to implement these measures from 19 December 2002.

Farmers located within the existing NVZs designated in 1996 have been required to adhere to a lower limit of 170 kg/ha total N per year for spreading manure on arable land since 19 December 2002. From 19 December 2006, farmers located in the new NVZs will also be required to adhere to this lower limit.

iv. Do not apply fertiliser or manures when the soil is waterlogged, 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.

vi. Keep adequate farm records, including cropping, livestock numbers and the use of organic manures and nitrogen fertilisers.

Trace elements

These should only be applied when deficiencies are evident according to analysis, with crop growth and development appearing to be reduced. In the absence of adverse symptoms, a healthy looking crop may not need foliar application of trace elements. On most soils trace element problems are unlikely.

Magnesium

Magnesium deficiency will soon become evident as an interveinal chlorosis. In the case of soils deficient in magnesium, a quick release form of magnesium such as kieserite should be incorporated into the seedbed at least three weeks before planting. Foliar sprays of magnesium sulphate are also effective in correcting a slight deficiency. Care must be taken when applying magnesium sulphate solutions during periods of very hot weather.

pH

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

7. Irrigation

The greatest response is likely to be obtained by achieving rapid establishment by irrigating immediately pre-sowing of direct-drilled crops and (after planting out) with transplanted crops.
Crop Specific Protocol - Chinese Cabbage, Pak Choi, Choi Sum

Mature Oriental Brassicas prefer growing in warm, moist conditions so the ability to irrigate the crop is essential. Methods of applying irrigation are equally important as damaged by the use of large droplets from a rain gun encourage opportunist infections. Bruising and rain splash detract from the market value of the produce and encourage disease spread. Sprinkler irrigators, either as static lines or mounted on a boom which moves within the crop, are preferred and will generally give better results.

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.

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 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 advisors 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 11

8.10 Pest, disease, physiological disorders and weed control

8.10.1 Pest control

The main principle, 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 give good 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 e.g. 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 it is 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 weighed up against efficacy and longevity of treatment. Use the least toxic product where possible.
vi. Resistance is building within aphid populations particularly peach potato aphid to many insecticides. It is important to alternate the use of different active ingredients to enable the best chance of control within the existing range of actives.
vii. Use the minimum effective dose rates, normally being that recommended. Do not reduce dose rate for peach potato aphid.
viii. Consider 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, hover flies, ground beetles etc. However consider the implication of buffer zone restrictions on certain chemical uses.
x. Carefully consider also the anticipated harvest date when selecting the appropriate product. Ensure you have enough time for the harvest interval to elapse prior to harvesting.
For various reasons 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 8.10.1.1 reviews the main crop 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 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; their numbers can be reduced by insecticides applied to other crops in the rotation.

Forecasting/monitoring

Present monitoring methods include counting eggs laid at the stem base of brassica to predict the size of the next generation and non-selective water traps to catch adult flies. The 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 HRI computer prediction model, will give a more reliable monitoring system.

Control methods:

Direct-drilled crops

Treatment should be delayed until late April or the two rough leaf stage, if this is later. Apply a currently approved insecticide as listed in Appendices 5,6,7,8,9.

On crops drilled after mid-April an insecticide should be applied before or at drilling. Band spray at seedling emergence.

Plant propagation

a. **Pre-planting drenches:** Chlorpyrifos can be used as a pre-planting drench on block and module raised plants. Chlorpyrifos should not be used to treat blocks/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 liquor is required. Where chlorpyrifos drenches has been used, subsequent applications of pesticides in the glasshouse or in the field should be delayed until adequate wax has formed on plant leaves.

b. **Seed treatment with chlorpyrifos (Gigant®):** It is recommended that growers consider the use of this treatment as the levels of active ingredient used are minimal resulting in considerably lower operational exposure and much less active ingredient incorporated into the soil than with other control systems.

It is **strongly recommended** that growers consider the use of seed treatments in preference to module drenches or granule treatments for the control of Cabbage Root Fly.

Transplanted crops

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

a. Where, due to planting delays, copious irrigation has been applied after treatment and considerable time has elapsed before planting which may have led to the 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 are 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.

Treatment methods

Granules

Band treatment using deterrent / stench agents gives some protection and is recommended for all granules, but recommendations may specify the exact method to be used, (e.g., surface band or bow wave, width of band etc.). Applicators must be calibrated in the field before use.

Sprays

Several insecticides are currently approved (see Appendices 5,8), however, 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 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.

**Cultural control:** Damage to young plants is common and most crops suffer quickly. Crops must be walked regularly and treated immediately. Avoid double cropping. Avoid using last years land for the same crop. Use deterrent sprays and crop covers to minimise reinestation.

**Chemical control** If damage is severe, or seedlings are growing slowly, use deltamethrin, alpha cypermethrin and spinosad for control. Tefluthrin seed dressing is an option for Pak Choi and Choi Sum

8.10.1.3 Cabbage aphids

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

There are two species of aphid which are of commercial relevance to the crop:

**Peach potato aphid** (*Myzus persicae*)

Of importance, particularly in warmer, drier seasons, this aphid can be present in fairly high numbers affecting marketable quality. It doesn't normally form dense colonies but overwinters as adult and in mature 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. Levels of resistance to many chemical actives are increasing. The pest is an important vector of many plant viruses. Provided good contact can be made with the pest, the use of nicotine is recommended.
**Cultural control:** Most aphid infestations develop from colonies that overwinter on old brassica crops and autumn sown oilseed rape. Plough in or otherwise destroy these.

Aphid population 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 risk associated with the various field-walking techniques are being determined by HRI/ADAS currently.

**Mealy grey aphid** (*Brevicoryne brassicae*)

A widespread pest, which checks the growth of young plants resulting in wilting and possible mortality, particularly in dry conditions. On older plants leaves curl up and marketable quality 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.

**Chemical control:** Numerous insecticides are currently approved for use and should be selected from the list in Appendices 5,6,7,8,9. Select insecticides with the least harmful effect on beneficial insects and avoid broad-spectrum insecticides. For these reasons foliar sprays should be chosen for cabbage aphid control. Some synthetic pyrethroids, despite their reputations, often kill a wide range of beneficial predators.

Alternate insecticides from different chemical groups, in order to avoid build-up of aphid resistance. Weather conditions and time of year should be taken into account when selecting the aphicide.

Current work at HRI is focussing on the development of 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 late July - early August.

**8.10.1.4 Cabbage caterpillars**

Caterpillars of many species attack brassicas and may appear at almost any time between mid-May and October, although the degree of infestation varies from season to season. The damage caused depends upon the species responsible. Some species larvae, 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 undersides 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 predators; some of these numerous predators are capable of destroying every caterpillar in the population. Also some caterpillar species only have one generation per year and thus if the feeding is at low levels on the vegetative parts of the plant chemical control may not be necessary.

**Chemical control:** Check crops regularly and apply insecticides when caterpillars found. See list of currently approved insecticides in Appendices 5,6,7,89. Some treatments applied for flea beetle will give incidental control.

**8.10.1.5 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.

Some treatments applied for flea beetle will give incidental control.

### 8.10.1.6 Pollen beetle

Adults, dispersing principally from oilseed rape, can contaminate the crop in summer.

**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 slightly above the crop level will adequately indicate the level of this pest. Ensure old crop is destroyed prior to flowering.

**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 brassicas. Pyrethroids should be particularly considered because of their subsequent repellent effect. Re-inspect crops frequently.

Some treatments applied for flea beetle will give incidental control.

### 8.10.1.7 Slugs

Slugs damage brassica seedlings and established plants on medium to heavy-textured soils in wet seasons.

**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 5+10 for a current list of approved molluscicides. Metaldehyde has been shown to preserve populations of ground beetles that are beneficial in other areas of pest control.

### 8.10.1.8 Cabbage whitefly (*Aleyrodes proletella*)

An occasional pest, damage is caused by the adults and the white scale-like larvae living on the undersides of the leaves and sucking the sap. Where large numbers present plant vigour may be reduced. Up to five generations a year may occur as adults over-winter on the undersides of the leaves. Severe infestations produce a sticky secretion that attracts a black-sooty mould

Destroy over wintering 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.

### 8.10.1.9 Cabbage stem weevil (*Ceutorhynchus quadridens*)
A widely distributed but sporadic pest which attacks all cruciferous crops. The larvae feed in stems and petioles of plants that may subsequently wilt.

Treatments applied for flea beetle will give incidental control.

8.10.1.10 Beneficial organisms

Beneficial organisms include predators, parasitoids and myco-pathogens. 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.

Myco-pathogens

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.

8.10.1.11 Deterrents and barrier methods
As part of an integrated pest control policy it is desirable that growers fully exploit barrier methods to prevent re-infestation of crops. Such practices minimise the number of pesticide re-treatments and reduce the pesticide residue risk.

Chemical deterrents are a new area for research which growers should adopt.

**8.10.2 Disease control**

**Introduction**

Oriental brassicas are 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 correct identifications of diseases, and use of a disease forecasting system where applicable, are an important element in minimising fungicide use.

Most of the major fungi cause spots or blemishes rendering the crop unmarketable. These diseases are prevalent in the main production areas in most seasons. The spread of oil-seed rape growing, especially spring sown and proliferation of rape volunteers on set-aside land have aided disease spread.

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 (when they become available).

**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 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 regular supply of water where possible.

d. Through good agronomy, provide good growing conditions, ie. avoid poorly drained soils, the presence of imposition or soil pans.

**Chemical control:**
a. Regularly field walk and monitor the crop for diseases, in conjunction with monitoring pests, to establish the need to take corrective action and 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 are being developed at HRI for Alternaria and Ringspot.*

b. *In the field, it is strongly recommended that fungicides are not applied on a routine protective prophylactic basis.*

c. *Where fungicidal control is needed, 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 5m of the top of the bank of water courses is approved*

d. *Carefully consider anticipated harvest date and ensure the selected chemical has an appropriate harvest interval.*

### 8.10.2.1 Club root (*Plasmodiophora brassica*)

This effects all vegetables of the brassica 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 and wilt whilst the plant may be stunted or even die. This disease is of considerable significance in some 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. *Wide rotation as possible in vulnerable areas.*

ii. *Soil tests can give a guide to potential infection. Sample at least 3 - 4 months before anticipated planting date, to allow change of cropping.*

iii. *Liming to maintain a soil pH 7.0-7.3 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 limed separately.*

iv. *High pH levels (>7.5) can give rise to minor nutrient problems.*

v. *In dry times, plants suffering from a small infestation can be brought to marketable yield by copious irrigation.*

vi. *It is essential to use disease-free modules.*

vii. *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 drilled crops in the field.

With *Rhizoctonia* in the field the stem base becomes hard, brown and shrunken and the plants usually break off later in the season. *Pythium* is best controlled at propagation in the glasshouse with fungicides used pre-sowing or pre-planting as preventative treatments. For both diseases treatment in field crops is impractical.
Cultural control:

i. **Good glasshouse hygiene is essential.**

ii. **Good management as outlined previously in Section 8.10.2 (Introduction).**

iii. **Use plastic modular trays rather than polystyrene because when the surface coating wears off polystyrene trays, roots and fungi can penetrate the polystyrene and become a “reservoir” of disease. Plastic trays can be sterilised more easily and effectively.**

Chemical control: Fungicides currently approved for use in propagation both as pre-sowing drenches or pre-planting treatments listed in Appendices 5,6,7,8,9.

8.10.2.3 Downy mildew (**Peronospora parasitica**)  

This disease is endemic in propagation under glass but in the field infections only become significant when mild wet weather conditions prevail in late autumn. This fungus is both air- and soil-borne and may affect young plants via the roots. Spores are produced on infected plants and are distributed by air currents or rain splash, re-infecting plants via the leaves. 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.

Cultural control:

i. **Good glasshouse hygiene is essential.**

ii. **Good management as outlined in Section 8.10.2 (Introduction) is essential.**

iii. **Varieties vary in susceptibility - Therefore choose the more resistant varieties, provided they give the other agronomic features required.**

iv. **Increase rotation.**

Chemical control:

i. In propagation, routine treatment, both on a preventative and eradicant basis, is essential.

ii. Currently approved products are listed in Appendix 5,6,7,8,9

iii. Preferably alternate fungicides from differing chemical groups to avoid development of resistant strains.

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

Usually seed- and air-borne, these fungi are also soil-borne following the incorporation of infected crop residues. All brassica crops including oilseed rape and cruciferous weeds are potential sources of the disease.

Symptoms range from small discrete black spots (which can be confused with those of powdery mildew and ringspot) to circular zonate spots, up to 12 mm in diameter. The latter have greyish, brown or almost black centres, which the case of A. brassicicola may be covered with sooty spores. In the field, spots caused by the two species are indistinguishable. The spots may be surrounded by chlorotic haloes and severely affected leaves may show extensive yellowing. With ageing the centre of the spot appears thin, dry and papery and may fall out giving a ‘shot-hole’ appearance. Elongated dark brown lesions are found on stems and leaves. The influx of **Alternaria** normally coincides with the harvest of the oilseed rape crop in July.

**Alternaria can be controlled by seed treatments on young plants in propagation. These treatments use very small amounts of fungicide compared to overall applications. In the field, the disease is favoured by warm moist conditions and spreads by wind-borne spores.**

Cultural control:

i. **Good glasshouse hygiene is essential.**
ii. Good 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.

v. Collect intelligence about problems in oilseed rape crop.

Chemical control:

i. Currently approved seed treatments are listed in Appendix 5, 6, 7, 8.

Chemical control: Currently approved fungicides are listed in Appendices 5, 6, 7, 8.

8.10.2.5 Ring spot (Mycosphaerella brassicicola)

This disease is both seed-borne and soil-borne through plant debris in the soil. Infection and disease development is dependent on high humidity and temperatures of 10-20°C. Traditionally troublesome in the wetter southwest but now endemic in all main production areas. Periods of frequent rainfall appear to be critical for epidemic development.

The disease first appears on lower leaves as small circular necrotic, brown or purplish-black spots that gradually enlarge to 1.5 cm in diameter. As the ringspots develop, concentric rings of dead tissue are formed, surrounded by a narrow water-soaked area or yellow halo. With age, the ringspots appear grey with the distinctive fruiting bodies of the fungus arranged in concentric rings mainly on the upper leaf surface. Severely affected leaves quickly become yellow and prematurely wither.

The ringspot lesions are grey when dry, but are black and have a water-soaked appearance when wet. Yield may not be affected but quality is drastically reduced.

Cultural control:

i. Isolate out-door plant beds.

Cultural control: A minimum of four years rotation on infected fields. Do not grow outdoor plant beds adjacent to infected sites.

Chemical control: Currently approved fungicides are listed in Appendices 5, 6, 7, 8, 9

8.10.2.6 Canker (Phoma lingam)

This disease is both seed-borne and soil-borne from infected debris. The fungus produces well-defined spots, with ashen-grey centres, on the upper side of the leaf. On the brassica stems, near the base and on the tap root, brown or purplish areas develop, which turn black.

Cultural control: A minimum of four years rotation on infected fields. Do not grow outdoor plant beds adjacent to infected sites.

Chemical control: Currently approved fungicides are listed in Appendices 5, 6, 7, 8, 9

8.10.2.7 Root rot (Phytophthora porri)

This soil-borne fungus disease is occasionally seen on heavier or poorly drained soils. It attacks the stalk or butt and progresses into the head. Rotted tissue is brown to grey with a distinctive pungent odour. Cavities form in the stalk tissue. Bacterial soft rot often follows.
Cultural control: Avoid wet heavy, poorly structured soils. Avoid alliums in the rotation.

Chemical control: None available.

8.10.2.8 Grey mould (Botrytis cinerea)

A fungal disease that appears on the leaves as a grey growth or soft brown rot, it is usually associated with damage or the retention of dead and decaying lower leaves. The disease is spread by wet weather and high humidity. Botrytis can be difficult to control.

Cultural control: Avoid lush soft growth from excess nitrogen.

Chemical control: Currently approved fungicides are listed in Appendices 5,6,7,8,9. Fungicides applied for Alternaria control should give some control.

8.10.2.9 Black rot (Xanthomonas campestris)

This is a bacterial disease, sometimes found in wet cool summer months.

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 and a characteristic ring of vascular tissue can be seen when the stalks of affected plants are cut crosswise. The disease can develop very rapidly in warm damp conditions.

Control: Plant debris is a source of infection together with cruciferous weeds (eg. shepherd’s purse). Quick removal or soil incorporation of crop residue is advised. Where the disease is identified a rotational break of at least two years should be practised.

Seed testing: Major seed lots are batch tested. A negative result does not guarantee complete freedom from the disease but more usually subsequent disease expression is economically not significant.

If batches of seed are infected, hot water treatment is the only approved method of control but the can affect seed vigour.

8.10.2.10 Virus diseases

a. Turnip Mosaic virus is probably the most severe virus that attacks brassicas. Dark necrotic rings and spots on the older leaves of plants associated with severe stunting are the typical symptoms.

b. Cauliflower Mosaic virus is much more common. The symptoms are vein clearing etc. followed by vein banding with stunted growth and distorted leaves. Affected plants are usually very susceptible to frost injury. Cauliflower and turnip mosasics often infect the same plant. The mealy cabbage aphid and the peach cabbage aphid spread both viruses. Aphicides will not prevent introduction of virus but will restrict subsequent spread.

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

Chemical control: Control aphids, especially in outdoor plant beds or early in the life of direct-drilled crop. Currently approved aphicides listed in Appendix 5,6,7,8,9.

8.10.3 Physiological disorders

Tip burn
Tip burn can be a serious problem to Chinese Cabbage when it affects the internal leaves. Margins become brown and papery. There is no post harvest development, however the tissue is vulnerable to bacterial secondary infections. The disorder is due to a poor distribution of calcium within the plant even when the total calcium uptake is satisfactory.

**Cultural control:** Calcium sprays can prevent tip burn in outer tissues. Reduced nitrogen supply and slower growth help reduce the problem. Windbreaks and transpiration control can also help.

**Black speck/pepper spot**

This is a result of the collapse of tissues surrounding the stomata of inner and outer leaves. Lesions can develop further during storage. There is varietal variation.

**Cultural control:** Manganese sprays are beneficial. Controlled atmosphere stores are beneficial.

### 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 lines 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. Approved herbicides are given in Appendix 9. Select a herbicide that controls 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.

#### 9.3.1 Storage disorders

Poor handling and inadequate control of storage conditions can all lead to the rapid spread of fungal and bacterial disorders.
a. **Grey mould** (*Botrytis cinerea*): This most common spoilage organism causes a brown soft rot. It is easily recognised by the surface growth of grey mycelium and spores. Damage at harvest increases the incidence of this disease.

b. **Dark leaf spot** (*Alternaria brassicicola*): This air-borne fungus causes grey or black lesions that become dry and leathery in store. At low levels of infection it is unlikely lesions will be seen on the trimmed head when they are put into store, but spores, which germinate during storage, may be present on the heads.

c. **Ringspot** (*Mycosphaerella brassicicola*): This fungi must be controlled in the field, so that heads taken into store are free from any fungal lesions, which may lead to secondary *Botrytis* infection.

d. **Phytophthora a rot** (*Phytophthora porri*): This soil-borne pathogen becomes active during wet weather. In store the disease spreads rapidly, therefore, heads should be harvested when dry and without contact with the soil. Ensure cut heads are not windrowed, soil is not collected in bins, or that infection is spread by sticking knives into the soil.

e. **Bacterial soft rot** (*Pseudomonas marginalis*): This very soft watery rot. Infection generally begins at sites of mechanical damage. In store these rots spread very quickly. As free water on the surface of the head encourages the development of bacterial rots, thoroughly dry off any surface moisture at the beginning of storage and maintain an adequate airflow within the store during storage.

f. **Leaf necrosis**: These symptoms frequently cannot be removed by trimming and their extent is only evident when the head is cut open during processing. The use of colloquial names and the often vague descriptions, make identification and comparisons of the various disorders difficult. However, four clearly distinguishable necrosis symptoms occur.

g. **Pepper spot** (*Black speck or spotted necrosis*): The most serious and widespread of these disorders is characterised by the development of very small superficial black spots less than 1 mm in diameter which appear randomly distributed over the leaf surfaces. The spots typically, but not invariably, appear first on the outer leaves of the heads and progress inwards during storage. The symptoms are rarely seen in growing crops. In each spot necrosis starts in the stomatal guard cells and spreads to a few surrounding epidermal cells. Pepper spot is a physiological disorder, not associated with any fungus, bacteria or virus. Incidence and severity varies considerably between growing sites and from season to season.

h. **Large necrotic leaf spot** (*Black Spot*): After pepper spot, this is the most common necrosis problem of stored brassicas. The large brown or black lesions may be 5 to 10 mm in diameter and frequently coalesce to form irregular discoloured areas. Tissue in the centre of the spots becomes sunken and eventually collapses to leave a brown, papery membrane.

This disorder is the result of infection, usually early in the growing season, by aphid borne turnip mosaic virus. Therefore, prompt control of aphids with a systemic insecticide, whilst not preventing, may help to slow down spread of the disease (see Appendix 5,6,7,8,9).

i. **Vein streak**: Similar to pepper spot and appears as superficial brown or black markings on the epidermis along the leaf midrib and petiole, occasionally spreading out along the larger veins. This infrequent physiological disorder rarely causes a serious problem.

j. **Internal tipburn**: The margins of the inner heartleaves, especially round the vein endings, become papery and a discoloured grey or brown.

Varieties vary in susceptibility, although some evidence suggests that damage correlates with high levels of nitrogen fertilisers and large head size.

k. **Oedema**: This condition is rare on Pak Choi and Choi Sum.

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### 10. Pollution control and waste management

See Generic Standards and/or Generic Guidance Notes.

### 11. Energy efficiency

See Generic Standards and/or Generic Guidance Notes.
12. Health & Safety

See Generic Standards and/or Generic Guidance Notes.

13. Conservation issues

See Generic Standards and/or Generic Guidance Notes.
Appendix 1 Minor pests

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 brassica families. Although rarely damaging the crop is an effective host 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*)

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 apicalis*)

Both species are widely distributed, occasionally damaging. *As large populations can develop in oilseed rape crops. Control measures are only required if damage levels are high; sprays applied for diamond back moth will keep leaf minor 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 young 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 yield. Rare on Chinese brassicas.

**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*

**Turnip gall weevil** (*Ceutorhynchus pleurostigma*)

This localised and sporadic pest frequently found in Southwest England. It attacks late-sown or late-planted brassicas. 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 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 favours 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 pyrethroid sprays have been used for caterpillar control, midge larvae control has been observed.
Appendix 2  Fertiliser requirements for Mature oriental brassicas (kg/ha)

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<thead>
<tr>
<th>Nutrient (kg/ha)</th>
<th>Soil Index</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0</td>
</tr>
<tr>
<td>Nitrogen (N)</td>
<td>250</td>
</tr>
<tr>
<td>Phosphorus (P₂O₅)</td>
<td>200</td>
</tr>
<tr>
<td>Potassium (K₂O)</td>
<td>300</td>
</tr>
<tr>
<td>Magnesium (MgO)</td>
<td>150</td>
</tr>
</tbody>
</table>

Well-rotted farmyard manure at about 25t/ha will provide adequate phosphate and potash at Index 3 for phosphate and potassium without additional fertiliser. All manures should be well incorporated to avoid microbial contact with the crop. At the lower indices the recommended 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 phosphorus and 40 kg/ha for potassium.

Note:

Magnesium should be applied in a readily available for such as keserite.

This table is guide for mineral soils. Varieties vary in their demands.
Appendix 3 Minor field and storage diseases

White blister (Albugo candida)

All the aerial parts of the plant may be affected. The fungus survives in the soil or on plant debris. Initially, small green blisters are produced which later form white patches, at first small and glossy but later turning powdery.

Late in the season the white patches may turn brown. They first appear on the lower surfaces of the leaves and on stems, and marketable quality is reduced.

The strains that attack cruciferous weeds such as shepherds purse are distinct and will not transfer to Mature Oriental Brassicas.

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

Chemical control: Currently approved fungicides listed in Appendix 5,6,7,8,9.

Powdery mildew (Erysiphe cruciferarum)

Powdery mildew is spread by wind-borne spores from affected brassica crops. Disease appears as small patches of thin white fungal growth on either leaf surface and on the stem. In severe attacks, the whole leaf surface is colonised. After frost, the disease may also show discrete black spotting which could be confused with Alternaria symptoms. Disease severe in hot summers as infection is favoured by warm (15-20°C) conditions with periods of high humidity.

Cultural control: If suitable, apply nitrogen as dictated by soil analysis and computer prediction (Heavy applications of nitrogen favours disease development). In dry growing seasons, plants under water stress appear to be more susceptible, particularly shallow-rooted varieties, therefore, if available, irrigate accordingly.

Chemical control: Fungicides only warranted on the more susceptible varieties in high-risk years. Currently approved fungicides are listed in Appendix 7.

Light leaf spot (Pyrenopeziza brassicae)

This soil-borne fungus comes from infected debris and is also spread by rain splash and wind from neighbouring infected brassica crops, particularly oilseed rape.

Lesions are initially superficial, developing mainly on the upper surface of the older leaves and producing a diffuse silvery appearance. Young lesions show little discoloration but become paler in the centre and bleach with age. Individual spots may merge to produce large bleached patches, particularly on the lower leaves. Around the edge of the lesion, black speckling and concentric rings of white spore droplets can be found. Spread and development are favoured by cold wet conditions.

Cultural control: Infected crop residues should be carefully and quickly ploughed in. Adopt a minimum 4 year rotation if possible to reduce the risk of carry-over on debris.

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

Rhizoctonia (Rhizoctonia solanii)

A bottom rot with black sunken lesions in the midribs. Small irregular lesion scan occur on the head finally coalescing to result in a head rot.

A soil borne disease which persists by sclerotia and is spread by wind/rain splash. Optimum disease development is at 25-30oC.
Cultural control: Soil sterilisation of the seed-bed followed by careful field husbandry and crop rotation will minimise attacks.

Sclerotinia (Sclerotinia minor, Sclerotinia sclerotiorum)

Initially watersoaked, pinkish-brown lesions develop. A white fungal mycelium develops and black sclerotia develop within the tissue.

The fungus survives as a resting body (the sclerotia) in soil debris. Optimum disease development occurs at 20°C but it can continue at 0°C and therefore is important in stored Chinese Cabbage.

Cultural control: Use clean seed. Control weeds, particularly crucifers.

Cercosporella (Pseudocercosporella capsellae)

Small dark lesions appear on outer leaves, and coalesce to give a finely branched appearance. Finally lesions become rounded brown spots with well-defined darker margins.

Cultural control: Use crop rotation. Note that turnip, rape and radish harbour the disease. Weeds must be controlled. Use clean seed. Disease development is reduced by refrigeration but development will continue down to 4°C.

Erwinia (Erwinia caratovora caratovora, E caratovora atroseptica)

A soft water soaked rot develops becoming slimy. Secondary infection results in a disagreeable odour.

Soil born bacteria invade outer tissues during warm wet weather. Infection can occur after harvest through cut surfaces.

Cultural control: Field and harvest hygiene are important. Copper sprays can give some protection

Pseudomonas (P marginalis marginalis, P cichorii)

P cichorii produces a slightly sunken brown lesion. Infected tissue remains firm, Disease development is quickest at 26°C and can continue at 5°C.

P marginalis marginalis produces a slimy soft rot similar to Erwina. Decay will continue at 0°C. It causes losses in the field and in store after cool moist weather.
### Appendix 4 Nitrogen index based on previous cropping

Based on DEFRA Fertiliser Recommendations (RB 209)

<table>
<thead>
<tr>
<th>Nitrogen Index 0</th>
<th>Nitrogen Index 1</th>
<th>Nitrogen Index 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cereals</td>
<td>Beans</td>
<td>Any crop in field receiving large frequent dressings of FYM or slurry.</td>
</tr>
<tr>
<td>Forage crops removed</td>
<td>Forage crops grazed</td>
<td></td>
</tr>
<tr>
<td>Leys (1-2 year) cut</td>
<td>Leys (1-2 year) grazed, high nitrogen.</td>
<td>Long leys, high nitrogen</td>
</tr>
<tr>
<td>Leys (1-2 year) grazed, low nitrogen</td>
<td>Long leys, low nitrogen</td>
<td></td>
</tr>
<tr>
<td>Maize</td>
<td>Oilseed Rape</td>
<td>Lucerne</td>
</tr>
<tr>
<td>Permanent pasture - poor quality, matted</td>
<td>Peas</td>
<td>Permanent pasture - average</td>
</tr>
<tr>
<td>Sugar Beet</td>
<td></td>
<td>Permanent pasture - high nitrogen.</td>
</tr>
<tr>
<td>Vegetables receiving less than 200 kg/ha N</td>
<td>Vegetables receiving more than 200 kg/ha N</td>
<td></td>
</tr>
<tr>
<td>Rotational Set-aside</td>
<td>Potatoes</td>
<td></td>
</tr>
</tbody>
</table>
### Appendix 5 Pesticides currently approved for use on outdoor Chinese cabbage (Brassica campestris pekinesis)

<table>
<thead>
<tr>
<th>Active Ingredient</th>
<th>Product Features</th>
<th>LERAP Category</th>
<th>Harvest Interval</th>
<th>Hazard Rating</th>
<th>MRL (mg/kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>propamocarb hydrochloride</td>
<td>A general purpose protective carbamate fungicide during propagation.</td>
<td>none stated</td>
<td>none stated</td>
<td>none stated</td>
<td>none set</td>
</tr>
<tr>
<td>iprodione</td>
<td>As a seed treatment only, dicarboximide fungicide</td>
<td>none stated</td>
<td>none stated</td>
<td>irritant</td>
<td>5.0</td>
</tr>
<tr>
<td>nicotine</td>
<td>a general purpose non-persistent, contact alkaloid insecticide,</td>
<td>none stated</td>
<td>2 days</td>
<td>toxic</td>
<td>none set</td>
</tr>
<tr>
<td>chlorpyrifos</td>
<td>A broad spectrum contact organophosphate</td>
<td>A</td>
<td>not stated</td>
<td>harmful</td>
<td>0.5</td>
</tr>
<tr>
<td>pirimicarb</td>
<td>a contact, fumigant and trans-laminar carbamate insecticide</td>
<td>none stated</td>
<td>3 days</td>
<td>harmful</td>
<td>none set</td>
</tr>
<tr>
<td>metaldehyde</td>
<td>A molluscicide bait for control of slugs and snails</td>
<td>none stated</td>
<td>0 days</td>
<td>nil</td>
<td>none set</td>
</tr>
<tr>
<td>ferric phosphate</td>
<td>A molluscicide bait for control of slugs and snails</td>
<td>none stated</td>
<td>0 days</td>
<td>nil</td>
<td>none set</td>
</tr>
</tbody>
</table>

**Notes:**

Not all products containing these active ingredients may be currently approved for use on Chinese cabbage. 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 Specific off-label approvals for outdoor Chinese cabbage (Brassica campestris pekinesis)

<table>
<thead>
<tr>
<th>Product</th>
<th>MAPP</th>
<th>Active</th>
<th>SOLA</th>
<th>Expires</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aliette 80 WG</td>
<td>11213</td>
<td>80% fosetyl aluminium</td>
<td>0149/04</td>
<td>31-Dec-07</td>
</tr>
<tr>
<td>Aliette 80 WG</td>
<td>13130</td>
<td>80% fosetyl aluminium</td>
<td>3524/06</td>
<td>31-Dec-08</td>
</tr>
<tr>
<td>Alpha propachlor 50 SC</td>
<td>04873</td>
<td>500g/L propachlor</td>
<td>2424/00</td>
<td>31-Dec-13</td>
</tr>
<tr>
<td>Alpha Trifluralin 48 EC</td>
<td>07406</td>
<td>480 g / l trifluralin</td>
<td>3579/06</td>
<td>31-Dec-07</td>
</tr>
<tr>
<td>Bandu</td>
<td>10994</td>
<td>2.5% deltamethrin</td>
<td>0363/07</td>
<td>31-Dec-13</td>
</tr>
<tr>
<td>Bandu</td>
<td>10994</td>
<td>2.5% deltamethrin</td>
<td>2297/05</td>
<td>31-Dec-08</td>
</tr>
<tr>
<td>BASF Dimethoate 40</td>
<td>00199</td>
<td>40% dimethoate</td>
<td>0389/94</td>
<td>31-Dec-08</td>
</tr>
<tr>
<td>Butisan-S</td>
<td>11733</td>
<td>500g metazachlor</td>
<td>0344/05</td>
<td>31-Dec-08</td>
</tr>
<tr>
<td>Centium 360 SC</td>
<td>11607</td>
<td>36% clomazone</td>
<td>1031/04</td>
<td>31-Dec-13</td>
</tr>
<tr>
<td>Clayton Pirimicarb 50 SG</td>
<td>09221</td>
<td>50% pirimicarb</td>
<td>3464/06</td>
<td>31-Dec-13</td>
</tr>
<tr>
<td>CleanCrop Decathlon</td>
<td>12834</td>
<td>25g/L deltamethrin</td>
<td>1528/06</td>
<td>31-Dec-08</td>
</tr>
<tr>
<td>Cleancrop Pyrimet</td>
<td>10619</td>
<td>100g cypermethrin</td>
<td>2225/03</td>
<td>31-Dec-07</td>
</tr>
<tr>
<td>Contest</td>
<td>10216</td>
<td>15% alpha cypermethrin</td>
<td>2265/05</td>
<td>31-Dec-08</td>
</tr>
<tr>
<td>Cuprolylt</td>
<td>00604</td>
<td>50% CuOCl2</td>
<td>0115/01</td>
<td>31-Dec-13</td>
</tr>
<tr>
<td>Cyren</td>
<td>11028</td>
<td>480 g / l chlorpyrifos</td>
<td>0237/05</td>
<td>31-Dec-08</td>
</tr>
<tr>
<td>Dacthal W-75</td>
<td>11323</td>
<td>75% chlorothal dimethyl</td>
<td>1552/06</td>
<td>31-Dec-13</td>
</tr>
<tr>
<td>Danadim</td>
<td>11550</td>
<td>40% dimethoate</td>
<td>0808/06</td>
<td>31-Dec-08</td>
</tr>
<tr>
<td>Danadim Progress</td>
<td>12208</td>
<td>40% dimethoate</td>
<td>0682/05</td>
<td>31-Dec-08</td>
</tr>
<tr>
<td>Decimate</td>
<td>11008</td>
<td>22.5% chlorothal dimethyl, 21.6% propachlor</td>
<td>1247/06</td>
<td>31-Dec-08</td>
</tr>
<tr>
<td>Decis</td>
<td>07172</td>
<td>2.5% deltamethrin</td>
<td>1843/00</td>
<td>31-Dec-08</td>
</tr>
<tr>
<td>Decis</td>
<td>07172</td>
<td>2.5% deltamethrin</td>
<td>1849/00</td>
<td>31-Dec-08</td>
</tr>
<tr>
<td>Decis protech</td>
<td>11502</td>
<td>1.5% deltamethrin</td>
<td>0526/04</td>
<td>unstipulated</td>
</tr>
<tr>
<td>Devrinol</td>
<td>09374</td>
<td>450 g / l naphropamide</td>
<td>3010/06</td>
<td>31-Dec-13</td>
</tr>
<tr>
<td>Devrinol</td>
<td>09374</td>
<td>450 g / l naphropamide</td>
<td>3012/06</td>
<td>31-Dec-13</td>
</tr>
<tr>
<td>Difcor 250 EC</td>
<td>12361</td>
<td>250g difenoconazole</td>
<td>1490/05</td>
<td>29-Mar-08</td>
</tr>
<tr>
<td>Dipel DF</td>
<td>11184</td>
<td>3.2% Bt kuristaki</td>
<td>0739/04</td>
<td>31-Dec-08</td>
</tr>
<tr>
<td>Dow shield</td>
<td>10988</td>
<td>20% clopyralid</td>
<td>2637/06</td>
<td>31-Dec-13</td>
</tr>
<tr>
<td>Fernpath Torate</td>
<td>11033</td>
<td>20% clopyralid</td>
<td>2577/06</td>
<td>31-Dec-13</td>
</tr>
</tbody>
</table>

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All SOLAs are conditional on the extant approval of the specific product.
## Appendix 6 Specific off-label approvals for outdoor Chinese cabbage (Brassica campestris pekinesis) (Cont’d)

<table>
<thead>
<tr>
<th>Product</th>
<th>MAPP</th>
<th>Active</th>
<th>SOLA</th>
<th>Expires</th>
</tr>
</thead>
<tbody>
<tr>
<td>Folicur</td>
<td>11278</td>
<td>250g tebuconazole</td>
<td>1874/03</td>
<td>unstipulated</td>
</tr>
<tr>
<td>Fubol Gold WG</td>
<td>10184</td>
<td>64% mancozeb, 4% metalaxyl-M</td>
<td>3643/06</td>
<td>31-Dec-13</td>
</tr>
<tr>
<td>Fubol Gold WG</td>
<td>10184</td>
<td>64% mancozeb, 4% metalaxyl-M</td>
<td>1221/05</td>
<td>31-Dec-08</td>
</tr>
<tr>
<td>Fusilade 250 EW</td>
<td>10525</td>
<td>25% flazifop-p-butyl</td>
<td>2231/04</td>
<td>31-Dec-08</td>
</tr>
<tr>
<td>Fusilade Max</td>
<td>11519</td>
<td>125g/L flazifop-p-butyl</td>
<td>2138/03</td>
<td>31-Dec-08</td>
</tr>
<tr>
<td>Gaucho ST</td>
<td>11281</td>
<td>70% imidacloprid</td>
<td>3927/02</td>
<td>31-Dec-08</td>
</tr>
<tr>
<td>Headland Inorganic Liquid copper</td>
<td>07799</td>
<td>437 g / l copper oxychloride</td>
<td>0415/02</td>
<td>31-Dec-07</td>
</tr>
<tr>
<td>Invader</td>
<td>11978</td>
<td>75g/Kg dimethomorph + 667g/Kg mancozeb</td>
<td>3044/06</td>
<td>30-Sep-11</td>
</tr>
<tr>
<td>Marshall 10G</td>
<td>11682</td>
<td>10% carbosulfan</td>
<td>3617/06</td>
<td>31-Dec-13</td>
</tr>
<tr>
<td>No-Fid</td>
<td>11183</td>
<td>74.5 g / l nicotine</td>
<td>3278/06</td>
<td>31-Dec-13</td>
</tr>
<tr>
<td>Orius</td>
<td>12105</td>
<td>250g tebuconazole</td>
<td>1397/05</td>
<td>31-Dec-08</td>
</tr>
<tr>
<td>Pearl Micro</td>
<td>08620</td>
<td>6.25% w/w deltamethrin</td>
<td>0504/04</td>
<td>31-Dec-08</td>
</tr>
<tr>
<td>Plover</td>
<td>11763</td>
<td>250 g / l difenoconazole</td>
<td>0558/05</td>
<td>31-Dec-08</td>
</tr>
<tr>
<td>Posse 10 G</td>
<td>11640</td>
<td>10% carbosulfan</td>
<td>1299/06</td>
<td>31-Dec-08</td>
</tr>
<tr>
<td>Ramrod Flowable</td>
<td>10314</td>
<td>480g/L propachlor</td>
<td>1159/02</td>
<td>31-Dec-13</td>
</tr>
<tr>
<td>Riza</td>
<td>12696</td>
<td>250g tebuconazole</td>
<td>0546/07</td>
<td>31-Dec-13</td>
</tr>
<tr>
<td>Rovral WP</td>
<td>11694</td>
<td>50% iprodione</td>
<td>1065/05</td>
<td>31-Dec-07</td>
</tr>
<tr>
<td>Rovral WP</td>
<td>11694</td>
<td>50% iprodione</td>
<td>1065/05</td>
<td>31-Dec-07</td>
</tr>
<tr>
<td>Signum</td>
<td>11450</td>
<td>26.7% boscalid + 6.7% pyraclostrobin</td>
<td>1595/03</td>
<td>18-Oct-08</td>
</tr>
<tr>
<td>Stalwart</td>
<td>11877</td>
<td>7% nicotine</td>
<td>3288/06</td>
<td>31-Dec-13</td>
</tr>
<tr>
<td>Standon Fosetyl-AL 80WG</td>
<td>10667</td>
<td>80 % w/w fosetyl-aluminium</td>
<td>0366/03</td>
<td>31-Dec-08</td>
</tr>
<tr>
<td>Toppel 10</td>
<td>08772</td>
<td>100g cypermethrin</td>
<td>3133/98</td>
<td>31-Dec-07</td>
</tr>
<tr>
<td>Tracer</td>
<td>12438</td>
<td>480g/L spinosad</td>
<td>3057/05</td>
<td>31-May-09</td>
</tr>
<tr>
<td>Treflan</td>
<td>05817</td>
<td>48% trifluralin</td>
<td>3510/06</td>
<td>31-Dec-07</td>
</tr>
<tr>
<td>Trimaran</td>
<td>11400</td>
<td>48% trifluralin</td>
<td>3541/06</td>
<td>31-Dec-07</td>
</tr>
</tbody>
</table>

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### Appendix 7 Pesticides currently approved for use on outdoor Pak Choi, Choi Sum (Brassica campestris chinensis)

<table>
<thead>
<tr>
<th>Active Ingredient</th>
<th>Product Features</th>
<th>LERAP Category</th>
<th>Harvest Interval</th>
<th>Hazard Rating</th>
<th>MRL (mg/kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>nicotine</td>
<td>a general purpose non-persistent, contact alkaloid insecticide,</td>
<td>none stated</td>
<td>2 days</td>
<td>toxic</td>
<td>none set</td>
</tr>
<tr>
<td>metaldehyde</td>
<td>A molluscicide bait for control of slugs and snails</td>
<td>none stated</td>
<td>0 days</td>
<td>nil</td>
<td>none set</td>
</tr>
<tr>
<td>ferric phosphate</td>
<td>A molluscicide bait for control of slugs and snails</td>
<td>none stated</td>
<td>0 days</td>
<td>nil</td>
<td>none set</td>
</tr>
</tbody>
</table>

**Notes:**

Not all products containing these active ingredients may be currently approved for use on Chinese cabbage. 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 Specific off-label approvals for outdoor Pak Choi (Brassica campestris chinensis)

<table>
<thead>
<tr>
<th>Product</th>
<th>MAPP</th>
<th>Active</th>
<th>SOLA</th>
<th>Expires</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agriguard deltamethrin</td>
<td>10770</td>
<td>2.5% deltamethrin</td>
<td>2307/05</td>
<td>31-Dec-08</td>
</tr>
<tr>
<td>Agriguard Pirimicarb</td>
<td>09620</td>
<td>50% pirimicarb</td>
<td>3000/06</td>
<td>31-Dec-13</td>
</tr>
<tr>
<td>Aliette 80 WG</td>
<td>11213</td>
<td>80% fosetyl aluminium</td>
<td>0149/04</td>
<td>31-Dec-07</td>
</tr>
<tr>
<td>Aliette 80 WG</td>
<td>13130</td>
<td>80% fosetyl aluminium</td>
<td>5524/06</td>
<td>31-Dec-13</td>
</tr>
<tr>
<td>Alpha Propachlor 50 SC</td>
<td>04873</td>
<td>50% propachlor</td>
<td>3037/06</td>
<td>31-Dec-13</td>
</tr>
<tr>
<td>Alpha trifluralin 48 EC</td>
<td>07406</td>
<td>480g/L trifluralin</td>
<td>3579/06</td>
<td>31-Dec-07</td>
</tr>
<tr>
<td>Aphox</td>
<td>10515</td>
<td>50 % w/w pirimicarb</td>
<td>3109/06</td>
<td>31-Dec-13</td>
</tr>
<tr>
<td>Barclay Karaoke</td>
<td>11357</td>
<td>20% clopyralid</td>
<td>2657/06</td>
<td>31-Dec-13</td>
</tr>
<tr>
<td>BASF Dimethoate 40</td>
<td>00199</td>
<td>400 g / 1 dimethoate</td>
<td>0389/94</td>
<td>31-Dec-08</td>
</tr>
<tr>
<td>Butisan-S</td>
<td>11733</td>
<td>500g metazachlor</td>
<td>0344/05</td>
<td>31-Dec-08</td>
</tr>
<tr>
<td>Centium 360 SC</td>
<td>11607</td>
<td>36% clomazone</td>
<td>1031/04</td>
<td>31-Dec-13</td>
</tr>
<tr>
<td>Clayton pirimicarb 50 SG</td>
<td>09221</td>
<td>50% pirimicarb</td>
<td>3464/06</td>
<td>31-Dec-13</td>
</tr>
<tr>
<td>Cleancrop Miricide</td>
<td>11776</td>
<td>50% pirimicarb</td>
<td>3459/06</td>
<td>31-Dec-13</td>
</tr>
<tr>
<td>Contest</td>
<td>10216</td>
<td>15% alpha cypermethrin</td>
<td>2265/05</td>
<td>31-Dec-08</td>
</tr>
<tr>
<td>Cuprolyt</td>
<td>00604</td>
<td>50% CuOCl2</td>
<td>0115/01</td>
<td>31-Dec-13</td>
</tr>
<tr>
<td>Cyren</td>
<td>11028</td>
<td>480 g / 1 chlorpyrifos</td>
<td>0237/05</td>
<td>31-Dec-08</td>
</tr>
<tr>
<td>Dacthal W-75</td>
<td>11607</td>
<td>75% clorothal dimethyl</td>
<td>1552/06</td>
<td>31-Dec-13</td>
</tr>
<tr>
<td>Decimate</td>
<td>11008</td>
<td>22.5% chlorothal dimethyl, 21.6% propachlor</td>
<td>1247/06</td>
<td>31-Dec-08</td>
</tr>
<tr>
<td>Devrinol</td>
<td>09374</td>
<td>450 g / 1 napropamide</td>
<td>3010/06</td>
<td>31-Dec-13</td>
</tr>
<tr>
<td>Devrinol</td>
<td>09374</td>
<td>450 g / 1 napropamide</td>
<td>3012/06</td>
<td>31-Dec-13</td>
</tr>
<tr>
<td>Difcor 250 EC</td>
<td>12361</td>
<td>250g difenoconazole</td>
<td>1490/05</td>
<td>29-Mar-08</td>
</tr>
<tr>
<td>Dipel DF</td>
<td>11184</td>
<td>3.2% Bt kuristaki</td>
<td>0739/04</td>
<td>31-Dec-08</td>
</tr>
<tr>
<td>Dow Shield</td>
<td>10988</td>
<td>20% clopyralid</td>
<td>2637/06</td>
<td>31-Dec-13</td>
</tr>
<tr>
<td>Dursban WG</td>
<td>09153</td>
<td>75% chlorpyrifos</td>
<td>1390/03</td>
<td>31-Dec-08</td>
</tr>
<tr>
<td>Fernpath Torate</td>
<td>11033</td>
<td>20% clopyralid</td>
<td>2377/06</td>
<td>31-Dec-13</td>
</tr>
<tr>
<td>Folicur</td>
<td>11278</td>
<td>250g tebuconazole</td>
<td>1872/03</td>
<td>30-Dec-13</td>
</tr>
<tr>
<td>Force ST</td>
<td>11671</td>
<td>20% tefluthrin</td>
<td>0510/04</td>
<td>31-Dec-08</td>
</tr>
<tr>
<td>Force ST</td>
<td>11752</td>
<td>200 g / 1 tefluthrin</td>
<td>0545/05</td>
<td>31-Dec-08</td>
</tr>
<tr>
<td>Fubol Gold WG</td>
<td>10184</td>
<td>64% mancozeb, 4% metalaxyl-M</td>
<td>3643/06</td>
<td>31-Dec-13</td>
</tr>
<tr>
<td>Fusilade Max</td>
<td>11519</td>
<td>125g/L fluazifop-p-butyl</td>
<td>2138/03</td>
<td>31-Dec-13</td>
</tr>
<tr>
<td>Gaucho ST</td>
<td>11281</td>
<td>70% imidacloprid</td>
<td>3927/02</td>
<td>31-Dec-08</td>
</tr>
<tr>
<td>Govern</td>
<td>12870</td>
<td>75% chlorpyrifos</td>
<td>1674/06</td>
<td>31-Dec-13</td>
</tr>
</tbody>
</table>

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## Appendix 8 Specific off-label approvals for outdoor Pak Choi (Brassica campestris chinensis) (Cont’d)

<table>
<thead>
<tr>
<th>Product</th>
<th>MAPP</th>
<th>Active</th>
<th>SOLA</th>
<th>Expires</th>
</tr>
</thead>
<tbody>
<tr>
<td>Headland Inorganic Liquid Copper</td>
<td>07799</td>
<td>437 g / l copper oxychloride</td>
<td>0415/02</td>
<td>31-Dec-07</td>
</tr>
<tr>
<td>Invader</td>
<td>11978</td>
<td>75g/Kg dimethomorph + 667g/Kg mancozeb</td>
<td>3044/06</td>
<td>30-Sep-11</td>
</tr>
<tr>
<td>Marshall 10G</td>
<td>11682</td>
<td>10% carbosulfan</td>
<td>3617/06</td>
<td>31-Dec-13</td>
</tr>
<tr>
<td>Parapet</td>
<td>12773</td>
<td>75%w/w chlorpyrifos</td>
<td>1587/06</td>
<td>31-Dec-13</td>
</tr>
<tr>
<td>Permasect C</td>
<td>11121</td>
<td>10% cypermethrin</td>
<td>2589/05</td>
<td>31-Dec-07</td>
</tr>
<tr>
<td>Phantom</td>
<td>11954</td>
<td>500g pirimicarb</td>
<td>3449/06</td>
<td>31-Dec-13</td>
</tr>
<tr>
<td>Plover</td>
<td>11763</td>
<td>250 g / l difenoconazole</td>
<td>0558/05</td>
<td>31-Dec-08</td>
</tr>
<tr>
<td>Posse 10 G</td>
<td>11640</td>
<td>10% carbosulfan</td>
<td>1299/06</td>
<td>31-Dec-07</td>
</tr>
<tr>
<td>Ramrod Flowable</td>
<td>10314</td>
<td>480g/L propachlor</td>
<td>3130/06</td>
<td>31-Dec-13</td>
</tr>
<tr>
<td>Riza</td>
<td>12696</td>
<td>250g tebuconazole</td>
<td>0545/07</td>
<td>31-Dec-13</td>
</tr>
<tr>
<td>Rovral WP</td>
<td>11694</td>
<td>50% iprodione</td>
<td>1065/05</td>
<td>31-Dec-07</td>
</tr>
<tr>
<td>Sentinel 2</td>
<td>05140</td>
<td>48% propachlor</td>
<td>3084/06</td>
<td>31-Dec-13</td>
</tr>
<tr>
<td>Signum</td>
<td>11450</td>
<td>26.7% boscalid + 6.7% pyraclostrobin</td>
<td>1595/03</td>
<td>18-Oct-08</td>
</tr>
<tr>
<td>Standon Fosetyl-AL 80WG</td>
<td>10667</td>
<td>80 % w/w fosetyl-aluminium</td>
<td>0366/03</td>
<td>31-Dec-08</td>
</tr>
<tr>
<td>Standon Pirimicarb 50</td>
<td>08878</td>
<td>50% pirimicarb</td>
<td>2997/06</td>
<td>31-Dec-13</td>
</tr>
<tr>
<td>Treflan</td>
<td>05817</td>
<td>480g trifluralin</td>
<td>3510/06</td>
<td>31-Dec-07</td>
</tr>
<tr>
<td>Trimaran</td>
<td>11400</td>
<td>480g trifluralin</td>
<td>5541/06</td>
<td>31-Dec-07</td>
</tr>
<tr>
<td>Tripart Sentinel</td>
<td>03250</td>
<td>50% propachlor</td>
<td>5038/06</td>
<td>31-Dec-13</td>
</tr>
</tbody>
</table>

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### Appendix 9 Specific off-label approvals for outdoor Choi Sum (Brassica campestris chinensis)

<table>
<thead>
<tr>
<th>Product</th>
<th>MAPP</th>
<th>Active</th>
<th>SOLA</th>
<th>Expires</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agriguard Pirimicarb</td>
<td>09620</td>
<td>50% pirimicarb</td>
<td>3000/06</td>
<td>31-Dec-13</td>
</tr>
<tr>
<td>Aliette 80 WG</td>
<td>13130</td>
<td>80% fosetyl aluminium</td>
<td>3524/06</td>
<td>31-Dec-13</td>
</tr>
<tr>
<td>Aliette 80 WG</td>
<td>11213</td>
<td>80% fosetyl aluminium</td>
<td>0149/04</td>
<td>31-Dec-07</td>
</tr>
<tr>
<td>Alpha Chlorpyrifos</td>
<td>04821</td>
<td>48% chlorpyrifos</td>
<td>1688/04</td>
<td>31-Dec-07</td>
</tr>
<tr>
<td>Alpha chlorpyrifos 48 EC</td>
<td>04821</td>
<td>480 g / l chlorpyrifos</td>
<td>1688/02</td>
<td>31-Dec-07</td>
</tr>
<tr>
<td>Alpha Propachlor 50 SC</td>
<td>04873</td>
<td>50% propachlor</td>
<td>3037/06</td>
<td>31-Dec-13</td>
</tr>
<tr>
<td>Aphox</td>
<td>10515</td>
<td>50 % w/w pirimicarb</td>
<td>3109/06</td>
<td>31-Dec-13</td>
</tr>
<tr>
<td>Bandu</td>
<td>10994</td>
<td>2.5% deltamethrin</td>
<td>2297/05</td>
<td>31-Dec-08</td>
</tr>
<tr>
<td>Barclay Karaoke</td>
<td>11357</td>
<td>20% clopyralid</td>
<td>2657/06</td>
<td>31-Dec-13</td>
</tr>
<tr>
<td>BASF Dimethoate 40</td>
<td>00199</td>
<td>400 g / l dimethoate</td>
<td>0389/94</td>
<td>31-Dec-08</td>
</tr>
<tr>
<td>Butisan-S</td>
<td>11733</td>
<td>500g metazachlor</td>
<td>0344/05</td>
<td>31-Dec-08</td>
</tr>
<tr>
<td>Centium 360 SC</td>
<td>11607</td>
<td>36% clomazone</td>
<td>1031/04</td>
<td>31-Dec-13</td>
</tr>
<tr>
<td>Clayton pirimicarb 50 SG</td>
<td>09221</td>
<td>50% pirimicarb</td>
<td>3464/06</td>
<td>31-Dec-13</td>
</tr>
<tr>
<td>CleanCrop Decathlon</td>
<td>12834</td>
<td>25g/L deltamethrin</td>
<td>1527/06</td>
<td>31-Dec-13</td>
</tr>
<tr>
<td>Cleancrop Miricide</td>
<td>11776</td>
<td>50% pirimicarb</td>
<td>3459/06</td>
<td>31-Dec-13</td>
</tr>
<tr>
<td>Contest</td>
<td>10216</td>
<td>15% alpha cypermethrin</td>
<td>2265/05</td>
<td>31-Dec-08</td>
</tr>
<tr>
<td>Cuprokylt</td>
<td>00604</td>
<td>50% CuOCl2</td>
<td>0115/01</td>
<td>31-Dec-13</td>
</tr>
<tr>
<td>Cyren</td>
<td>11028</td>
<td>480 g / l chlorpyrifos</td>
<td>0237/05</td>
<td>31-Dec-08</td>
</tr>
<tr>
<td>Dacthal W-75</td>
<td>11323</td>
<td>75% chlorothal dimethyl</td>
<td>1552/06</td>
<td>31-Dec-13</td>
</tr>
<tr>
<td>Decimate</td>
<td>11008</td>
<td>22.5% chlorothal dimethyl, 21.6% propachlor</td>
<td>1247/06</td>
<td>31-Dec-08</td>
</tr>
<tr>
<td>Decis</td>
<td>07172</td>
<td>2.5% deltamethrin</td>
<td>2318/05</td>
<td>31-Dec-08</td>
</tr>
<tr>
<td>Devrinol</td>
<td>09374</td>
<td>450 g / l napropamide</td>
<td>3010/06</td>
<td>31-Dec-13</td>
</tr>
<tr>
<td>Devrinol</td>
<td>09374</td>
<td>450 g / l napropamide</td>
<td>3012/06</td>
<td>31-Dec-13</td>
</tr>
<tr>
<td>Difcor 250 EC</td>
<td>12361</td>
<td>250g difenoconazole</td>
<td>1490/05</td>
<td>29-Mar-08</td>
</tr>
<tr>
<td>Dipel DF</td>
<td>11184</td>
<td>3.2% Bt kuristaki</td>
<td>0739/04</td>
<td>31-Dec-08</td>
</tr>
<tr>
<td>Dow Shield</td>
<td>10988</td>
<td>20% clopyralid</td>
<td>2637/06</td>
<td>31-Dec-13</td>
</tr>
<tr>
<td>Dursban WG</td>
<td>09153</td>
<td>75% chlorpyrifos</td>
<td>1390/03</td>
<td>31-Dec-08</td>
</tr>
<tr>
<td>Fernpath Torate</td>
<td>11033</td>
<td>20% clopyralid</td>
<td>2377/06</td>
<td>31-Dec-13</td>
</tr>
<tr>
<td>Follicur</td>
<td>11278</td>
<td>250g tebuconazole</td>
<td>1872/03</td>
<td>30-Dec-13</td>
</tr>
<tr>
<td>Force ST</td>
<td>11671</td>
<td>20% tefluthrin</td>
<td>0510/04</td>
<td>31-Dec-08</td>
</tr>
<tr>
<td>Fubol Gold WG</td>
<td>10184</td>
<td>64% mancozeb, 4% metalaxyl-M</td>
<td>3643/06</td>
<td>31-Dec-13</td>
</tr>
<tr>
<td>Fusilade Max</td>
<td>11519</td>
<td>125g/L fluazifop-p-butyl</td>
<td>2138/03</td>
<td>31-Dec-13</td>
</tr>
<tr>
<td>Gaucho ST</td>
<td>11281</td>
<td>70% imidacloprid</td>
<td>3927/02</td>
<td>31-Dec-08</td>
</tr>
<tr>
<td>Govern</td>
<td>12870</td>
<td>75% chlorpyrifos</td>
<td>1674/06</td>
<td>31-Dec-13</td>
</tr>
</tbody>
</table>

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Appendix 9 Specific off-label approvals for outdoor Choi Sum (Brassica campestris chinensis) (Cont’d)

<table>
<thead>
<tr>
<th>Product</th>
<th>MAPP</th>
<th>Active</th>
<th>SOLA</th>
<th>Expires</th>
</tr>
</thead>
<tbody>
<tr>
<td>Headland Inorganic Liquid Copper</td>
<td>07799</td>
<td>437 g / l copper oxychloride</td>
<td>0415/02</td>
<td>31-Dec-07</td>
</tr>
<tr>
<td>Invader</td>
<td>11978</td>
<td>75g/Kg dimethomorph + 667g/Kg mancozeb</td>
<td>3044/06</td>
<td>30-Sep-11</td>
</tr>
<tr>
<td>Marshall 10G</td>
<td>11682</td>
<td>10% carbosulfan</td>
<td>3617/06</td>
<td>31-Dec-13</td>
</tr>
<tr>
<td>Parapet</td>
<td>12773</td>
<td>75% w/w chlorpyrifos</td>
<td>1587/06</td>
<td>31-Dec-13</td>
</tr>
<tr>
<td>Permasect C</td>
<td>11121</td>
<td>10% cypermethrin</td>
<td>2589/05</td>
<td>31-Dec-07</td>
</tr>
<tr>
<td>Phantom</td>
<td>11954</td>
<td>500g pirimicarb</td>
<td>3449/06</td>
<td>31-Dec-13</td>
</tr>
<tr>
<td>Plover</td>
<td>11763</td>
<td>250 g / l difenoconazole</td>
<td>0558/05</td>
<td>31-Dec-08</td>
</tr>
<tr>
<td>Posse 10 G</td>
<td>11640</td>
<td>10% carbosulfan</td>
<td>1299/06</td>
<td>31-Dec-07</td>
</tr>
<tr>
<td>Ramrod Flowable</td>
<td>10314</td>
<td>480g/L propachlor</td>
<td>3130/06</td>
<td>31-Dec-13</td>
</tr>
<tr>
<td>Riza</td>
<td>12696</td>
<td>250g tebuconazole</td>
<td>0545/07</td>
<td>31-Dec-13</td>
</tr>
<tr>
<td>Rovral WP</td>
<td>11694</td>
<td>50% iprodione</td>
<td>1065/05</td>
<td>31-Dec-07</td>
</tr>
<tr>
<td>Signum</td>
<td>11450</td>
<td>26.7% boscalid + 6.7% pyraclostrobin</td>
<td>1595/03</td>
<td>18-Oct-08</td>
</tr>
<tr>
<td>Standon Fosetyl-AL 80WG</td>
<td>10667</td>
<td>80 % w/w fosetyl-aluminium</td>
<td>0366/03</td>
<td>31-Dec-08</td>
</tr>
<tr>
<td>Standon Pirimicarb 50</td>
<td>08878</td>
<td>50% pirimicarb</td>
<td>2997/06</td>
<td>31-Dec-13</td>
</tr>
<tr>
<td>Treflan</td>
<td>05817</td>
<td>480g trifluralin</td>
<td>3510/06</td>
<td>31-Dec-07</td>
</tr>
<tr>
<td>Trimaran</td>
<td>11400</td>
<td>480g trifluralin</td>
<td>3541/06</td>
<td>31-Dec-07</td>
</tr>
</tbody>
</table>

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Appendix 10 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.

<table>
<thead>
<tr>
<th>Active ingredient</th>
<th>Target: pest, disease, weed</th>
<th>Current position</th>
<th>Suggested guidelines</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deltamethrin</td>
<td>Flea beetles &amp; caterpillars</td>
<td>0 day harvest interval, no max dose</td>
<td>Do not use more than 2 application per week</td>
</tr>
<tr>
<td>Chlorpyrifos</td>
<td>Cutworm, flea beetles</td>
<td>At transplanting / within 4 days of planting</td>
<td>Adhere to the SOLA latest timing requirement</td>
</tr>
<tr>
<td>Boscalid</td>
<td>Botrytis</td>
<td>14 day harvest interval, do not use between 1 Nov and 31 April</td>
<td>21 day harvest interval</td>
</tr>
<tr>
<td>Iprodione</td>
<td>Botrytis</td>
<td>28 day harvest interval Oct-Feb, otherwise 7 days</td>
<td>14 day harvest interval summer period</td>
</tr>
</tbody>
</table>
## Appendix 11 Control Points: Chinese Cabbage, Pak Choi and Choi Sum

<table>
<thead>
<tr>
<th>Control Point</th>
<th>Description</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CS.86 CHINESE CABBAGE</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CS.86.1</td>
<td>Can you produce evidence to show that you have taken into consideration soil type and variety when planning fertiliser application - Protocol reference: Section 6.1</td>
<td>1</td>
</tr>
<tr>
<td>CS.86.2</td>
<td>Do you use a nitrogen model or soil sampling as an efficient aid to nitrogen management - Protocol reference: Section 6.1</td>
<td>1</td>
</tr>
<tr>
<td>CS.86.3</td>
<td>Do you consider the use of seed treatments in preference to module drenches or granule treatments for the control of Cabbage Root Fly - Protocol reference: Section 8.10.1.1</td>
<td>1</td>
</tr>
<tr>
<td>CS.86.4</td>
<td>Can you provide evidence to show that you use the minimum number of sprays necessary for control of ringspot, Alternaria and white blister - Protocol reference: Section 8.10.2</td>
<td>3</td>
</tr>
<tr>
<td>CS.86.5</td>
<td>Is all polythene waste disposed of or recycled in the most appropriate manner - Protocol reference: Section 4.5.4</td>
<td>1</td>
</tr>
<tr>
<td>CS.86.6</td>
<td>Do the propagators used adhere to the UK Plant Raisers Code of Practice</td>
<td>1</td>
</tr>
<tr>
<td>CS.86.7</td>
<td>Is your plant raiser registered with DEFRA Plant Health and Seeds Inspectorate</td>
<td>1</td>
</tr>
<tr>
<td><strong>CS.85 PAK CHOI</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CS.85.1</td>
<td>Can you produce evidence to show that you have taken into consideration soil type and variety when planning fertiliser application - Protocol reference: Section 6.1</td>
<td>1</td>
</tr>
<tr>
<td>CS.85.2</td>
<td>Do you use a nitrogen model or soil sampling as an efficient aid to nitrogen management - Protocol reference: Section 6.1</td>
<td>1</td>
</tr>
<tr>
<td>CS.85.3</td>
<td>Do you consider the use of seed treatments in preference to module drenches or granule treatments for the control of Cabbage Root Fly - Protocol reference: Section 8.10.1.1</td>
<td>1</td>
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<tr>
<td>CS.85.4</td>
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<td>3</td>
</tr>
<tr>
<td>CS.85.5</td>
<td>Is all polythene waste disposed of or recycled in the most appropriate manner - Protocol reference: Section 4.5.4</td>
<td>1</td>
</tr>
<tr>
<td>CS.85.6</td>
<td>Can you demonstrate that chlorpyrifos is not applied later than cotyledon stage - Protocol reference: Section 8.9</td>
<td>3</td>
</tr>
<tr>
<td>CS.85.7</td>
<td>Do the propagators used adhere to the UK Plant Raisers Code of Practice?</td>
<td>1</td>
</tr>
<tr>
<td>CS.85.8</td>
<td>Is your plant raiser registered with DEFRA Plant Health and Seeds Inspectorate</td>
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</tr>
</tbody>
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## Appendix 11 Control Points: Chinese Cabbage, Pak Choi and Choi Sum (Cont’d)

<table>
<thead>
<tr>
<th>CS.84 CHOI SUM</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>CS.84.1 Can you produce evidence to show that you have taken into consideration soil type and variety when planning fertiliser application - Protocol reference: Section 6.1</td>
<td>1</td>
</tr>
<tr>
<td>CS.84.2 Do you use a nitrogen model or soil sampling as an efficient aid to nitrogen management - Protocol reference: Section 6.1</td>
<td>1</td>
</tr>
<tr>
<td>CS.84.3 Do you consider the use of seed treatments in preference to module drenches or granule treatments for the control of Cabbage Root Fly - Protocol reference: Section 8.10.1.1</td>
<td>1</td>
</tr>
<tr>
<td>CS.84.4 Can you provide evidence to show that you use the minimum number of sprays necessary for control of ringspot, Alternaria and white blister - Protocol reference: Section 8.10.2</td>
<td>3</td>
</tr>
<tr>
<td>CS.84.5 Is all polythene waste disposed of or recycled in the most appropriate manner - Protocol reference: Section 4.5.4</td>
<td>1</td>
</tr>
<tr>
<td>CS.84.6 Can you demonstrate that chlorpyrifos is not applied later than cotyledon stage - Protocol reference: Section 8.9</td>
<td>3</td>
</tr>
<tr>
<td>CS.84.7 Do the propagators used adhere to the UK Plant Raisers Code of Practice</td>
<td>1</td>
</tr>
<tr>
<td>CS.84.8 Is your plant raiser registered with DEFRA Plant Health and Seeds Inspectorate -</td>
<td>1</td>
</tr>
</tbody>
</table>