



**Assured Produce**

**Crop Specific Protocol**

**ONIONS (BULB AND SHALLOTS)**

**(CROP ID: 52)**



**January 2008**

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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<sup>®</sup> and all trademark rights are hereby acknowledged.

### Notes:

Pesticides with 'Essential Use' derogations that expired 31 December 2007 can no longer be used or stored.

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 Products containing substances which have been revoked are shown on the PSD website (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

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

There may be changes for the following reasons:

- the deadline for use of NPE formulations has been extended to 31 August 2008, see <http://www.pesticides.gov.uk/approvals.asp?id=2122>
- Pesticides with NPE formulations must be used up by 31 August 2008. In many cases products will be replaced by new non-NPE formulations.
- At re-registration stage after Annex 1 listing there may be: reductions of dose rates; changes in timings and/or number of applications for some products.

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

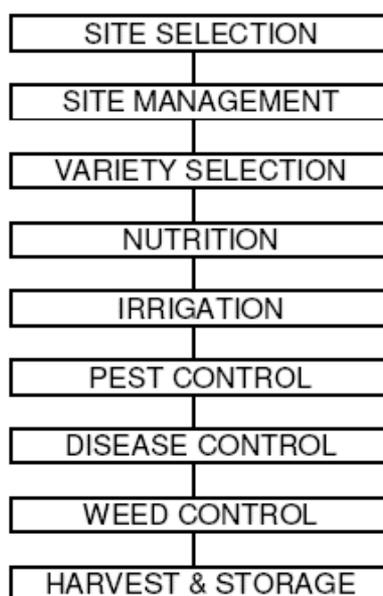
For pesticides on-label, only active substances are shown.

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

## 1 General introduction

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

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



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

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

## 2 Planning and records

See Generic Standards and/or Generic Guidance Notes.

## 3 Site selection

### 3.1 Site history

Soil type and latitude have a major influence on the production system that can be used and on the quality of resulting bulbs.

The most suitable soil types are sandy loam to sandy clay loam, very fine sandy loam (silts), and some peat-based soils.

The crop produces a coarse rooting system and whilst requiring a degree of firmness for good root/soil contact, the soil must be free from compaction and well drained. Irrigation is an essential requirement for production on sand-based soils (excluding silts).

### 3.2 Rotations

#### 3.2.1 Rotation and crop siting

Rotation has a role in minimising disease problems but may not prevent the build up of two major soil-borne diseases over the course of time. It is generally accepted that the minimum rotation should be 1 in 4 years and ideally up to 6 years.

*It is recommended that onion crops should be separated by a minimum distance of 800 m when production is based on different systems - i.e. sets, spring drilled and overwinter crops. Isolation reduces the spread of wind-dispersed leaf diseases. However, this may only be possible to a limited extent in commercial practice.*

### 3.3 Choice of production system

Bulb Onions can be produced in a number of different ways:

- i. **Over-wintered**, either seed direct-drilled in August for harvest the following June or increasingly as sets planted in late September/October for harvest the following June/July.
- ii. **Spring planted** sets for harvest in July/August.
- iii. **Spring drilled** from seed for harvest late August/September.
- iv. **Spring drilled** varieties, raised as **multi seeded modules** propagated under glass in February for planting in April. Now very much in decline.

Shallots are generally produced in two ways:

- i. **Spring planted** sets for harvest in June/July.
- ii. **Spring drilled** from seed for harvest in July/August.

*The choice of cultivar within each section currently has only a minor influence on disease susceptibility. Although varieties with claimed Downy Mildew resistance are likely to be commercially available within the next 2 years. Leaf diseases are encouraged by increasing population density and by humid conditions. Over-wintering types are the most susceptible to leaf diseases with spring-drilled being the least susceptible. Soil type as well as requirements for continuity of production will influence choice of production system. Choice of variety should be made with reference to NIAB information. Larger bulb size, from lower plant populations has assisted reduction of foliar disease incidence.*

### 3.4 Latitude

Bulbing is influenced by day length and hence site selection is influenced by latitude. In general terms, direct drilling is more successful for crops produced south of the Humber. Further north crops are more generally established from sets or modules.

## 4 Site management

See Generic Standards and/or Generic Guidance Notes.

## 5 Variety selection

### 5.1 Choice of variety or rootstock

See Generic Standards and/or Generic Guidance Notes.

It is **strongly recommended** that varietal yield, quality and storage characteristics are utilised to optimise the performance of onion crops.

### 5.2 Seed quality

See Generic Standards and/or Generic Guidance Notes.

### 5.3 Seed treatments and dressings

It is **strongly recommended** that the need for specific seed applied pesticides is justified and documented.

### 5.4 Plants and nursery stock

#### Propagation

For transplanting Bulb Onions, modular trays are generally used; normally with 308 to 345 cells per tray with 5 seeds per cell.

*There is presently no alternative to using peat compost but 5-8% sand is often used to improve drainage and the weight of the cell. This technique is however less than 0.1% of total bulb onion production.*

High nitrogen compost is recommended with a high nitrogen and phosphate feed prior to transplanting.

#### Propagators

It is **strongly recommended** that growers producing transplants are registered with DEFRA's Plant Health and Seeds Inspectorate under the EU Plant Health Regulations.

It is strongly recommended that the propagators only use the pesticides agreed with the producer/purchaser, keep accurate detailed records of pesticide application and these should be confirmed on receipt of delivery. Propagators should accept the responsibility to produce plants free from pest and disease.

#### Set producers

It is strongly recommended that Onion and Shallot sets are approved under the NAK-T inspection scheme or a similar inspection system, prior to despatch.

It is strongly recommended that set producers are registered under the EU Marketing scheme and the sets carry the appropriate plant passport. All sets should be drenched, where justified, with an approved fungicide, and dried prior to despatch. Some fungicide treatments control neckrot that can cause serious post-harvest losses.

## 6 Nutrition

Bulb Onions require a fertile soil with adequate reserves of the major nutrients nitrogen, phosphate, potash and magnesium. Application of fertiliser (see Appendix 1) should be on the basis of regular soil analysis, ideally preceding each crop. Soil pH is important and should be in the range 6.5 - 7.0. Bulb Onions and Shallots are

most responsive to phosphate and less responsive to nitrogen than leafy vegetables.

*Nitrogen application should be minimised where possible and ideally based on residual nitrogen sampling in conjunction with the 'Well-N' prediction model, developed by HRI. This will ensure adequate nitrogen without excess that could lead to leaching into ground water. Late application from bulbing onwards should be avoided.*

Trace elements are commonly applied particularly on sands and high pH silts. A guide to deficiency risk with reference to soil type is outlined in the table below.

Soil Type	Deficiency Risk					
	Magnesium	Manganese	Copper	Zinc	Iron	Boron
Sand	High	High	High	Moderate	Moderate	Low
Sandy Loam	High	High	Moderate	Moderate	Moderate	Moderate
Silt	Moderate	High	Moderate	Low	Low	Low
Peat	High	High	Moderate	Low	Low	Moderate

## 7 Irrigation

Adequate soil moisture is usually present for crop establishment of spring-drilled seed and planted sets. Irrigation is essential for predictable establishment of overwintering drilled onions, although these are increasingly produced from sets.

There is a marked growth response to irrigation on all light soils during dry periods. It leads to an increase in leaf number and size, which maximises bulb size and yield.

Late irrigation can produce softer bulbs and increases bacterial incidence, and should be avoided. Where available, an irrigation scheduling system should be used to ensure efficient use of water resources.

## 8 Crop Protection

### 8.1 The basic approach to crop protection

Bulb Onions are subject to a number of disease problems and it is a guiding principle that pesticide inputs should be minimised through prevention rather than cure.

#### 8.1.1 Non-chemical methods

See Generic Standards and/or Generic Guidance Notes

#### 8.1.2 Integrated crop management

An integrated approach should be adopted using the following steps:

##### 8.1.2.1 Good management and planning

- a. *Careful site selection to avoid potential or previous problems.*
- b. *Sensible crop rotation to avoid build up of soil-borne problems or disease carry over from one crop to the next.*

#### Cultural preventative techniques

- a. *Good crop and field hygiene to minimise spread of soil borne problems by cultivation equipment*

*etc. This is particularly important with the increasing trend to contract onions 'green' from clean sand land. There is therefore a greater risk of transporting disease more widely with machinery.*

- b. *Avoiding spread of onion waste except on farms unlikely to be involved in onion production.*
- c. *Minimise wind blown debris from harvesting and grading operations. Crop residues should be ploughed in as soon as possible. Waste trailers must be sheeted at all times in transit.*

### **Corrective action**

Where control of pests/diseases is still required the following approach should be adopted:

- a. Establish the need to take corrective action by regular monitoring and reference to forecasting techniques, when available.
- b. Consider effect of prevailing weather conditions.
- c. Where action is required, as a principle, the possibility of using biological or natural methods should be considered first. If chemical control is needed the following points should be considered, subject to achieving effective control:
  - use the least toxic and persistent product.
  - use the most selective product to reduce the impact on naturally occurring beneficial organisms.
  - use the minimum effective dose rate.
  - use appropriate application methods with properly maintained equipment.

It is **strongly recommended** that the minimum number of chemical applications are made to achieve good control, for example in controlling downy mildew and leaf spot ( *Botrytis squamosa* ).

N.B. exceeding the dose rate is illegal under COPR.

## **8.2 Plant protection product choice**

See Generic Standards and/or Generic Guidance Notes.

### **Approved uses not included on the product label**

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

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

In the case of products with older approval an electronic approval may not be available. In these cases growers should contact the PSD Information Services Branch for details of the approved conditions of use.

Contact details are: [p.s.d.information@psd.defra.gsi.gov.uk](mailto:p.s.d.information@psd.defra.gsi.gov.uk) tel. 01904 455775

## **8.3 Advice on the use of pesticides**

See Generic Standards and/or Generic Guidance Notes.

## **8.4 Application of pesticides**

See Generic Standards and/or Generic Guidance Notes.

## 8.5 Records of application

See Generic Standards and/or Generic Guidance Notes.

## 8.6 Protective clothing/equipment

See Generic Standards and/or Generic Guidance Notes.

## 8.7 Pesticide storage

See Generic Standards and/or Generic Guidance Notes.

## 8.8 Empty pesticide containers

See Generic Standards and/or Generic Guidance Notes.

## 8.9 Pesticide residues in fresh produce

See Generic Standards and/or Generic Guidance Notes.

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

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

**The key targets are -**

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

**See Appendix 10 for the pesticide targets and guidelines on this crop.**

## 8.10 Pest, disease and weed control

### 8.10.1 Pest control

#### 8.10.1.1 Bean seed fly (*Delia florilega/Delia platura*)

Attack by the bean seed fly is often confused with onion fly attack. This pest is more prevalent on winter crops sown in August when seed treatment with tefluthrin is a routine treatment south of the Wash. Occasionally an application of chlorpyrifos (note: no approval for the use of chlorpyrifos on shallots) may be necessary for control of second and subsequent fly generations as tefluthrin is only typically persistent enough to control the first generation.

*The need for control of both bean seed fly and onion fly by seed treatment should be based on previous experience.*

### 8.10.1.2 Stem and bulb eelworm (*Ditylenchus dipsaci*)

Eelworm attack is initiated by wet conditions. Control measures are influenced by soil type and local considerations.

Routine control measures are most likely to be necessary on very fine sandy loams and on heavier sandy clay loams, again based on previous knowledge of the area/field.

*This pest also affects sugar beet and will survive on certain host weeds. Affected fields will remain so for many years even in the absence of onion crops. Avoidance of such fields is, therefore, the first consideration.*

*Control measures are appropriate only to drilled crops and are not usually necessary on sets or modules although occasional problems can occur.*

The only effective chemical control measure is oxamyl (SOLA 1890/06) applied in the seed furrow strictly according to manufacturer's recommendation. The lowest rate consistent with effective control should be used, based on local and field experience. **Please ensure that the use of oxamyl is permitted by your Produce Marketing Organisation prior to application as many restrict use.**

Stem and bulb eelworm can cause serious losses in both field and store. Early field infection will cause foliage distortion followed by death of seedlings and resultant bare patches in fields (only in very serious cases will an entire field be uniformly infected). The margin of such patches invariably contains less infected bulbs with characteristically distorted foliage and soft bulbs when mature. Infected bulbs deteriorate rapidly in the initial drying process; the effects are exacerbated by stage 1 temperatures (25 - 30°C).

Stem and bulb eelworm can be spread to previously uninfected fields by contaminated bean seed and care should be taken to use only certified seed if beans are grown in the rotation

*It has to be emphasised that infection can still occur after oxamyl and aldicarb treatment (especially after heavy rain) and avoidance of problems based on local experience is of paramount importance. Good drainage is also essential, as localised 'wet' areas will encourage build up of eelworms.*

### 8.10.1.3 Thrips (*Thrips tabaci*)

*Thrips are a pest of variable incidence. Control measures must be based on regular monitoring when the weather conditions are appropriate for attack. More commonly known as 'thunderflies'; thrips are most likely to attack onions from June to August. The need for treatment should be judged on appearance of the orange nymphs as well as the symptoms on the plant.*

This pest multiplies in the growing centre of the plant and leaves appear with silvery flecking and leads to distortion in more serious cases.

A certain level of flecking is acceptable before treatment is necessary; noting that control approaching harvest is of importance. Adult thrips can feed for a considerable period under skins of bulbs during storage causing downgrading in quality.

When treatment is considered necessary use deltamethrin, lambda-cyhalothrin, spinosad or dimethoate (see Appendix 6). A repeat application may be necessary depending on prevailing weather conditions.

### 8.10.1.4 Onion fly (*Delia antiqua*)

Onion fly is rarely a problem, although it can occur in eastern counties south of the Wash. Control is, therefore, only necessary where problems are known to occur. Onion fly damage is caused by larvae boring into the base

plate followed by secondary breakdown of tissues either in the field or during storage.

There are no resistant varieties available but production from direct drilling in the spring is more susceptible to attack. Control measures for onion sets have not proved necessary. Control measures for direct drilling is by seed dressing with tefluthrin, or use of chlorpyrifos where necessary. Aldicarb, when used to control stem nematodes, also gives some control.

## **8.10.2 Disease control**

### **8.10.2.1 White rot (*Sclerotium cepivorum*)**

A persistent soil-borne disease that infects soils for many years, this disease is the most serious threat to onion growing in many parts of the world where the climate is suitable.

Its long persistence (in order of 100+ years) is reflected in local knowledge and many fields are of known infection status. Incidence is not confined to onion growing areas and source often relates to cottage gardens where onion waste has been composted in the past.

The disease initially infects roots and spreads back into the bulb causing destruction of tissue from the base upwards. This destruction is accompanied by a white cotton wool-like fungal growth. Early infection causes bulbs to completely rot in the field and later infections cause the total collapse of bulbs in store. Progress of infection is checked at the initial drying stage (28 - 30°C) but continues when the store is cooled.

There is development of control measures but it is therefore essential to:

*Note infection areas on farm maps and not only avoid such areas but also where possible avoid spreading contaminated soil to other parts of the farm, particularly with cultivation equipment.*

*Monitor crops to ensure that any occurrence of infection is recorded. Premature yellowing of foliage in patches is the most usual indicator.*

*Make every attempt to avoid harvest of infected bulbs. Field population of resting spores (sclerotia) can be reduced by hand collection of infected bulbs but this is recommended only for small areas where such action is practical.*

*If contracting green onions from 'clean' sand land or elsewhere, ensure that any equipment hired from other onion growing areas is transported totally free of soil.*

*SOLA for use of tebuconazole (see appendix 3). Tebuconazole if applied early will give partial control of field infections.*

### **8.10.2.2 Fusarium base rot (*Fusarium oxysporum f.sp. cepae*)**

This disease can cause isolated problems in warm wet seasons and has increased in incidence in recent years. Various species are involved not all of which are pathogenic. *Fusarium* can also be isolated as a secondary pathogen, often where waterlogging has initially caused death of the root system.

*Fusarium* can persist in soil for some years but limited experience of its behaviour/occurrence in the UK has shown recurring problems. *Fusarium* can occur after high rainfall periods and bacterial infection often follows in such circumstances.

*Fields with good drainage and freedom from sub-surface pans (or compaction) will minimise problems. There are no chemical treatments.*

### **8.10.2.3 Downy mildew (*Peronospora destructor*)**

Downy mildew is a serious foliar disease that commonly requires routine treatment. The disease is readily spread by air-borne spores and encouraged by warm humid conditions, closely following the infection criteria of potato blight.

*Maintaining 500 m separation between overwinter (most susceptible) and spring crops will minimise cross-infection.*

*Infected crop debris should be ploughed in as soon as possible after harvest to minimise any carryover.*

*Use of weather based prediction models can help in targeting fungicide use and is advised where available.*

Treatment should be based on routine monitoring so that infection can be identified at an early stage. In addition, a routine spray programme is necessary to ensure adequate control using currently approved fungicides (see Appendix 7). It is preferable to alternate chemical groups to avoid the risk of resistant strains developing.

### **8.10.2.4 Leaf spot (*Botrytis squamosa*)**

Leaf spot is a disease that affects the foliage in cool wet conditions. It most seriously affects either seedlings of overwintered varieties in the autumn or the foliage of spring-planted varieties, particularly closer to harvest.

This disease will require treatment in occasional seasons only. The risk of infection increases with increasing crop density.

*Development work is in progress to predict infection conditions (as with downy mildew).*

Treatment is usually combined with downy mildew control in overall fungicide programmes and should be based on routine monitoring. Disease incidence is more tolerable than downy mildew since the disease is less progressive and less likely to cause serious crop loss.

Currently approved fungicides are listed in Appendix 7, and the choice is judged on prevailing weather conditions. Onion foliage becomes more susceptible to infection as harvest approaches and as the density of the crop canopy increases. Early infection of the outer leaves can affect skin retention in store.

### **8.10.2.5 Leaf blotch (*Cladosporium allii-cepae*)**

Leaf blotch is a disease that occurs when the combination of temperature and long periods of leaf wetness allows germination and penetration of the fungus. In such years infection can result in complete defoliation. Symptoms are bleached elliptical eyespots on the leaves that spread parallel to the leaf veins and can destroy entire leaves.

Routine control measures for this disease are not normally necessary.

Treatment should be based on routine monitoring so that infection can be identified at an early stage. Once identified use of propiconazole (see appendix 7) should give control.

### **8.10.2.6 Neck rot (*Botrytis allii*)**

Neck rot infection can result in serious losses in store from bulbs that become progressively unmarketable. Infection normally begins in the neck area and progresses downwards into the scale tissue, which turns grey brown. Eventually grey spore masses can be seen around the top half of the bulb. Infection can also initiate

from physically damaged areas on the bulb.

*Effective control is based on prevention, combined with good store management. It is necessary to follow the correct storage procedure as detailed in Section 9.*

The disease can occur in the field if infection is initiated during the season. Early field infection cannot be controlled by store management and can cause serious losses.

Effective control has been achieved using HY-TL (thiram/thiabendazole) seed treatment or tebuconazole and/or thiophanate-methyl drench treatment for sets. Note: thiophanate-methyl drenching is not approved in the UK but sets treated in the EU may be imported. Any disease which survives treatment can spread in the growing crop in conducive weather conditions viz. periods of wet and cool.

It is essential that crops are not left in windrows for more than 48 hours as any spores spread at harvest by mechanical topping will begin to germinate in neck tissue and infection is progressively more difficult to control by store management.

*A monoclonal antibody test for detecting presence of neck rot before harvest has been developed for HRI Wellesbourne with funding from DEFRA and HDC. Where a potential problem is suspected, use of this diagnostic test 2-3 weeks prior to harvest can aid decisions on storage parameters.*

Field control of this disease may occasionally be necessary, subject to an evaluation of infection conditions early in the season. This has to be the sole means of guidance since it is not possible to identify the disease on foliage in the field.

*Avoiding spread from the previous season's crops is important. Where refrigerated stores are being emptied late in the season, when the new season's crop is established (April - June), every effort must be made to minimise wind blow of debris. The new season crop should be planted as far away from cold stores as practical, ideally a minimum of 500 m. If appreciable levels of neck rot are identified in store, these lots should be marketed before emergence of the new season's crop.*

#### **8.10.2.7 Black rot (*Aspergillus niger*)**

*Aspergillus niger* is commonly present on onions in the field and will often be present on bulb onion crops as they are loaded to store. No field symptoms are expressed. This disease causes tissue breakdown, progressing downwards from the neck. Infection is accompanied by dense black spore masses.

Whilst a common cause of deterioration in warmer climates the disease is rarely a problem in UK conditions. It is however encouraged by high temperatures (30 - 35°C) such as may exist in store, especially if accompanied by high humidity levels.

*Avoidance of problems with black rot is achieved by correct store management and adherence to the storage regimes outlined in Section 9.*

#### **8.10.2.8 Blue mould (*Penicillium spp*)**

*Penicillium spp.* cause blue moulds to develop on bulbs in store, between the skin and scale tissue. These blue moulds are mostly of a secondary nature but can be associated with a physiological disorder known commonly as watery skin. In such cases scale tissue and inner skins become brown and 'watery'. This favours *Penicillium* which then sporulates freely.

*Penicillium* is common on stored bulbs but mostly at low levels that do not cause marketing or storage problems.

Potential problems can be minimised by adherence to storage procedures in Section 9. High humidities in store, irrespective of temperature, will increase incidence and level of *Penicillium* infections.

#### **8.10.2.9 Other bacterial pathogens**

A number of bacteria species will cause either foliar dieback in the field or deterioration during storage. Field and store symptoms can be linked but the absence of visual effects in the field may still result in storage problems.

Bacterial diseases are initiated in the field and spread principally by water splash. Wet seasons, are therefore more likely to result in storage losses.

The main pathogens are detailed as follows:

##### ***Pseudomonas gladioli pv. allicola***

This disease can cause serious problems in store since the bulb's scale tissue 'soft' rots completely but the outer skins retain the rotten tissue. Once the crop is moved, the bulbs split and cause loss of quality by down grading of adjacent bulbs. Up to 40% infection has been recorded.

The disease is temperature sensitive and where problems are anticipated, can be minimised by reduced drying temperatures.

*Work at HRI has resulted in a prediction system based on serological agglutination techniques. It is therefore possible to test bulbs at harvest. This technique is now available as a specific test kit from Adgen.*

##### ***Erwinia spp***

*Erwinia* infects over a wide temperature range and tends to affect single scales within a bulb. When cut these bulbs reveal one scale of firm tissue that has turned brown.

Infection of bulbs is linked to the dieback of single leaves in the mature plant. Infection then spreads back to the scale at the base of the affected leaf. Incidence of this disease varies according to season, and levels rarely exceed 2-3%. Infection is normally more prevalent in late harvest drilled crops.

##### ***Lactobaccillus spp***

These bacteria cause water soaking and an odour characteristic of vinegar. This bulb disease is very temperature sensitive and becomes increasingly active above 30°C. It has not been a problem since adopting the now accepted drying and storage procedures detailed in Section 9.

##### ***Secondary bacteria***

A range of secondary bacteria can follow on damaged or previously infected tissue. In wet seasons root death is often followed by soft rotting bacterial infection. It is not unusual in most seasons to find occasional plants which have died with soft rot symptoms but these are not normally associated with storage disorders.

## **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.

## 9.4 Maleic hydrazide (MH)

It is accepted, and clarified by HDC-funded trials at HRI Kirton, that as an aid to the maintenance of quality, it is necessary to apply maleic hydrazide pre-harvest as a growth suppressant at 10% leaf fallover. It is **strongly recommended** that all sprout suppressant treatments are justified.

*The area treated should be related to the projected marketing dates of the bulbs. Application of MH is not necessary on crops to be marketed prior to the 1<sup>st</sup> December, in so far as can be judged in advance. Crops should be sprayed according to manufacturer's recommendations (see Appendix 5); lower rates normally prove adequate for crops in ambient storage.*

## 9.5 Harvest

Topping of the crop is essential to ensure ease of handling into store and minimising restriction to airflow during the initial and most critical drying phase.

It is a case of individual judgement as to the best harvesting system, depending on soil type, local circumstances and prevailing weather conditions.

Crops are either windrowed after topping for up to 48 hours or lifted directly with adapted potato harvesters and bulk loaded into store. Use of soil extraction equipment prior to elevation into store is essential to maximise airflow and efficiency of drying.

It is **strongly recommended** that trailers are cleaned before they are used to transport onions from the field and their cleaning is recorded.

The maximum loading height accepted in practice is up to 4 m. The maximum quantity that can be loaded at any one time will depend on the airflow specification of the store.

It is **strongly recommended** that stores are cleaned before onions are stored in bulk and this cleaning is recorded.

## 9.6 Storage

*It is an essential prerequisite of bulb onion production that adequate store loading and storage facilities are available. The use of expert management, correct airflow and temperature in properly designed and constructed stores cannot be overemphasised in minimising storage disorders and maximising quality.*

It is **strongly recommended** that controlled storage facilities are capable of achieving temperature and humidity targets set out in the following sections.

### 9.6.1 Drying (stage 1)

Initial drying (stage 1) to be achieved by a minimum 25°C and a maximum of 30°C. 28°C will be the norm but special circumstances may require a slightly lower temperature

(e.g. the incidence of bacterial diseases).

In practice, initial drying requires a minimum airflow of 425 m<sup>3</sup> /hr tonne with suitable fans and ducting system.

Crop drying can be undertaken in boxes but such systems are generally less efficient due to air leakage and greater difficulty in obtaining uniform airflow. The store design must allow recirculation of air to minimise fuel usage and to maintain humidity. Specification of the humidity regime during initial drying will vary according to condition of crop. A target duct range 50-65% relative humidity (RH) is normally accepted.

An important point in minimising storage problems and achieving quality is that these specifications are combined with a maximum Stage I drying time of 3 days (ideally 60 hours) from initial loading of the store. The specifications become more important with later harvests. Some relaxation is acceptable, however, for early crops harvested in ideal conditions and not scheduled for long-term storage.

### **9.6.2 Curing (stage 2)**

After initial drying to a 'rustle dry' condition, it is necessary to maintain temperature and control humidity to cure skins and complete the drying of neck tissue (stage 2).

Stage 2 is accomplished using intermittent ventilation at 25°C with humidity control by sensors amongst the onions. It is necessary to ventilate when humidity exceeds 75% RH at the top of the stack and continue until humidity is reduced to 65% RH. Airflow specification is 170 m<sup>3</sup> /hr tonne. Curing normally takes 2-4 weeks. Once all moisture has been removed from the bulb neck, it is possible to begin temperature reduction.

### **9.6.3 Cooling (stage 3)**

Cooling is accomplished gradually, ensuring that the stored crop does not fall below average ambient temperature (unless refrigeration facilities are available). Automatic control is advised; using a differential setting such that ventilation is initiated when outside temperature is 3°C or more below crop temperature. An override prevents overcooling and more sophisticated stores incorporate automatic vents to mix internal/external air. These also control the duct temperature for cooling and humidity in the earlier stages.

Stores should be insulated such that, when outside conditions are unfavourable, it is possible to close up with the minimum heat loss. Minimum temperature in ambient stores should be 5-8°C dependent on location and average ambient conditions.

Refrigerated storage is ideal since crop temperature is independent of outside conditions. It is possible to cool crops more rapidly after completion of curing and normally switch over to refrigeration at 10-12°C crop temperature.

Refrigeration at 0-1°C is essential for bulbs scheduled to be marketed from February to end of May/Early June. Controlled Atmosphere is necessary for storage beyond this period. Actual change over date will vary accordingly to season.

## **9.7 Storage disorders**

Where attributable to a specific pest or disease, storage disorders are reviewed in the appropriate Sections 8.10.1 and 8.10.2 previously. This section covers those factors where specific diseases or pests are not implicated.

### **9.7.1 Watery Scale**

Watery scale is caused by a build-up of carbon dioxide (CO<sub>2</sub>) a natural respiratory by product of plant cells.

CO<sub>2</sub> normally diffuses out of the onion through the skin, neck or root base of the bulb. In bulbs which are thick or leathery skinned the diffusion of CO<sub>2</sub> through the skin is greatly reduced leading to a build-up of CO<sub>2</sub> under the skin. At levels in the skin above 7% CO<sub>2</sub> suffocates the cells in the outer scales causing the cell walls to break down and turning outer scales translucent. Watery scale is a progressive physiological disorder and affected bulbs typically continue to deteriorate in store.

### 9.7.2 Softness

Different varieties of Bulb Onions differ in firmness but all become increasingly soft with time in store. Softness is not a major problem given adherence to storage procedures in Section 9, and the interaction of choice of variety, inherent storage life, and availability of refrigeration.

Softness is usually associated with internal movement towards sprouting and bruising. Softer bulbs are more easily damaged, (seen as translucent areas on outer scales).

### 9.7.3 Compression damage

This results in deformation of bulbs and hence a more irregular shape.

It is a factor of season, bulb maturity, and sometimes variety rather than height of storage. Compression can occur in box storage as well as bulk storage although generally less so. In either case, affected bulbs can be found from 30 cm deep in the stack and below.

Compression damage will be worse if the bulbs are harvested very early and in association with wetter seasons and late maturity. Some bulb deformation can result in the field where bulbs are growing in close proximity to each other. Compression damage is self-correcting to a degree when the pressure is released, whether caused in field or store.

### 9.7.4 Skin retention

A number of factors affect skin retention and it is essential that 'lots' or batches are handled at the correct temperature and humidity relative to ambient conditions. No firm specification can be given but guidelines to minimise skin loss are as follows:

correct variety choice.

control of foliar diseases.

correct timing of harvest.

correct drying and storage procedure.

avoiding high temperatures and low humidities prior to grading.

## 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 and Safety

See Generic Standards and/or Generic Guidance Notes.

### **13 Conservation issues**

See Generic Standards and/or Generic Guidance Notes.

**Appendix 1 Typical application rates for nutrients (kg/ha)**

Nutrient (kg/ha)	Soil Index					
	0	1	2	3	4	4+
Nitrogen - mineral soils						
Spring established	175	125	75	25	0	0
Overwintered*	100	100	60	30	0	0
Phosphate						
All soils	200	150	100	50M	0	0
Potash			150 (2-)			
All soils	250	200	100 (2+)	0	0	0
Magnesium	150	100	0	0	0	0

**Notes:**

\* Seedbed N is only required on mineral soils. Spring topdressing of up to 100kg/ha nitrogen may be required.

Nitrogen index is defined by:

- a. previous cropping, or
- b. residual mineral nitrogen sampling, which is the preferred option

## **Appendix 2 Soil Nitrogen Supply (SNS) indices based previous cropping and rainfall**

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

### Appendix 3 Seed/set treatments currently approved for use on Bulb Onions and Shallots

Active Ingredient	Product Features	Approval Type	Harvest Interval <sup>(1)</sup>	LERAP Category	Hazard Rating	MRL (mg/kg)
tebuconazole <sup>(2)</sup>	a fungicidal seed dressing: used for the control of white rot.	SOLA 2407/04  1968/06	none stated	none stated	Harmful	none set
tebuconazole <sup>(2)</sup>	a fungicidal set dip treatment used for control of white rot. <b>No approval for use on shallot sets.</b>	SOLA's 1403/05 1877/03	none stated	none stated	Harmful	none set
tefluthrin <sup>(2)</sup>	a soil acting pyrethroid insecticide for control of bean seed fly and onion fly.	SOLA 0546/05	none stated	none stated	Irritant	none set
thiabendazole* + thiram <sup>(2)</sup>	a fungicidal seed dressing: used for control of damping off diseases.	SOLA 1299/02	none stated	none stated	Harmful Irritant	*LOD 0.05
thiram	a fungicidal seed dressing: used for control of damping off diseases.	Full & SOLA 2391/05	none stated	none stated	Irritant	none set

#### Appendix 4 Nematicides currently approved for use on Bulb Onions and Shallots

Active Ingredient	Product Features	Approval Type	Harvest Interval <sup>(1)</sup>	LERAP Category	Hazard Rating	MRL (mg/kg)
oxamyl	soil applied systemic oxime carbamate nematicide and insecticide	SOLA 1890/06	apply at sowing	none stated	Toxic	0.01 LOD

**Notes:**

(1) or latest time of application.

(2) SOLA - See Appendix 9 for the specific product and expiry date

LOD - MRL set at limit of determination

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

**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 will be replacing these Arrangements as from 31st December 2006. After this time replacement SOLA's to ensure continued use of pesticide products on shallots will be available (see table above or Appendix 9).

### Appendix 5 Sprout suppressants currently approved for use on Bulb Onions and Shallots

Active Ingredient	Product Features	Approval Type	Harvest Interval <sup>(1)</sup>	LERAP Category	Hazard Rating	MRL (mg/kg)
maleic hydrazide	a pyridazinone plant growth regulator.	Bulb onions - Full  Shallots - SOLAs (various) see App 9.	4 - 7 days  (product related)	none stated	Irritant	15

### Appendix 6 Insecticides currently approved for use on Bulb Onions and Shallots

Active Ingredient	Product Features	Approval Type	Harvest Interval <sup>(1)</sup>	LERAP Category	Hazard Rating	MRL (mg/kg)
chlorpyrifos	contact and ingested OP: insecticide and acaricide. Dangerous to aquatic life and bees. <b>No approval for use on shallots</b>	Full	21 days	A	Harmful Irritant Flammable	Bulb Onions 0.2 Shallots LOD 0.05
deltamethrin <sup>(2)</sup>	a pyrethroid insecticide with contact and residual activity. Extremely dangerous to fish or aquatic life and bees.	SOLAs Various see App. 9.	none stated	A	Harmful Flammable Irritant	0.1
dimethoate <sup>(2)</sup>	contact and systemic OP insecticide and acaricide.	SOLA 1348/06	7 days	A	Harmful Flammable Irritant	LOD 0.02
lambda cyhalothrin <sup>(2)</sup>	Pyrethroid insecticide.	SOLAs Various see App. 9.	21 days	A	Harmful Flammable Irritant	LOD 0.02
nicotine	non-persistent alkaloid insecticide.	Full	2 days	none stated	Toxic	none set
spinosad	A selective insecticide derived from naturally occurring soil fungi	Full (bulb onions) SOLA 3646/06 (shallots)	7 days	B		0.1 UK temp MRL

#### Notes:

<sup>(1)</sup> or latest time of application

<sup>(2)</sup> SOLA - see Appendix 9 for the specific product and expiry dates

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

#### 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 will be replacing these Arrangements as from 31 December 2006. After this time replacement SOLA's to ensure continued use of pesticide products on shallots will be available (see table above or Appendix 9).

### Appendix 7 Fungicides currently approved for use on Bulb Onions and Shallots

Active Ingredient	Product Features	Approval Type	Harvest Interval <sup>(1)</sup>	LERAP Category	Hazard Rating	MRL (mg/kg)
azoxystrobin	strobilurin fungicide for control of downy mildew and <i>Botrytis</i> . Both full and SOLA approvals expire on 01/07/08	Full (bulb onion) SOLA 1724/06 (shallots)	2 weeks	None	None	LOD 0.05
chlorothalonil	protectant chlorophenyl for moderate control of botrytis, leaf rot and neck rot.	Full (bulb onion) SOLA's various see App 9 (shallot)	2 weeks	B	Irritant	0.5
chlorothalonil*+ metalaxyl-M**	systemic and protectant for control of downy mildew.	Full	2 weeks	B	Irritant	0.5*# 0.5**
copper oxychloride <sup>(2)</sup>	protectant fungicide and bactericide.	SOLAs 1127/99	2 weeks	none stated	Harmful	none set
dimethomorph + mancozeb*	systemic and protectant for control of downy mildew.	SOLA 2334/04	7 days	none stated	Irritant	0.5* proposed EU MRL 1 1mg/kg from 19/3/08
iprodione	protectant dicarboxylamide with some eradicant activity for control of collar rot, leaf rot and leaf spot  <b>All approvals expires 31/12/08</b>	Full (bulb onion) SOLA 0536/06 (shallots)	1 week	none stated	Irritant	0.2

#### Notes:

(1) or latest time of application

(2) SOLA - see Appendix 9 for the specific product and expiry dates

LOD - MRL set at limit of determination

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

#### Long Term Arrangements for Extension of Use ( LTAEU )

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**Appendix 7 Fungicides currently approved for use on Bulb Onions and Shallots (Cont'd)**

Active Ingredient	Product Features	Approval Type	Harvest Interval <sup>(1)</sup>	LERAP Category	Hazard Rating	MRL (mg/kg)
mancozeb <sup>(2)</sup>	Protectant dithiocarbamate for control of downy mildew	SOLAs various see App.9.	28 days	none stated	Irritant	0.5 proposed EU MRL 1 mg/kg from 19/3/08
propamocarb hydrochloride	semi-systemic protective fungicide for control of <i>Pythium</i> and <i>Phytophthora</i> . Compost or soil drench. <b>No approval for use on shallots</b>	Full	19 weeks	none stated	none stated	none set
propiconazole <sup>(2)</sup>	Systemic, curative and protectant conazole for control of cladosporium.	SOLA 2142/01	4 weeks	none stated	Irritant	LOD 0.05
tebuconazole <sup>(2)</sup>	Systemic conazole for control of white rot as a field treatment.	SOLAs various see App.9.	21 days	none stated	Harmful Irritant	none set

**Notes:**

(1) or latest time of application

(2) SOLA - see Appendix 9 for the specific product and expiry dates

LOD - MRL set at limit of determination

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

**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 will be replacing these Arrangements as from 31 December 2006. After this time replacement SOLA's to ensure continued use of pesticide products on shallots will be available (see table above or Appendix 9).

### Appendix 8 Herbicides currently approved for use on Bulb Onions and Shallots

Active Ingredient	Product Features	Approval Type	Harvest Interval <sup>(1)</sup>	LERAP Category	Hazard Rating	MRL (mg/kg)
bentazone <sup>(2)</sup>	a post emergence contact diazinone herbicide.	SOLA 1631/06	21 days	none stated	Harmful Irritant	LOD 0.1
chloridazon + propachlor <sup>(2)</sup>	residual pre-emergence herbicide. Covers a wide spectrum of broad leaved and grass weeds. Not to be used on soil containing > 10% organic matter. SOLA for post emergence use. <b>No approval for use on shallots</b>	Full & SOLA 1362/98	before 2 true leaves	none stated	Irritant	none set
chloridazon <sup>(2)</sup>	a residual pyridazinone herbicide. Do not use on light sands or where organic matter exceeds 5%.	SOLAs various see App.9.	2 true leaves	none stated	Harmful Irritant	none set
chlorpropham	a residual carbamate herbicide. Limited weed spectrum. SOLA 0084/06 expires 31/12/07. SOLA 3032/05 expires 30/09/07	Full (bulb onion) SOLA's 1952/07 0287/07 (shallot)	before 4 true leaves	none stated	Harmful Irritant Flammable	0.05 LOD

#### Notes:

(1) or latest time of application

(2) SOLA - see Appendix 9 for the specific product and expiry dates

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

#### 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 will be replacing these Arrangements as from 31 December 2006. After this time replacement SOLA's to ensure continued use of pesticide products on shallots will be available (see table above or Appendix 9).

**Appendix 8 Herbicides currently approved for use on Bulb Onions and Shallots (Cont'd)**

Active Ingredient	Product Features	Approval Type	Harvest Interval <sup>(1)</sup>	LERAP Category	Hazard Rating	MRL (mg/kg)
chlorthal dimethyl	residual benzoic acid herbicide. Controls wide range of broad leaved weeds. Do not use on organic soils.	Full (bulb onion) SOLA 1550/06 (shallot)	not restricted	none stated	Harmful	none set
chlorthal dimethyl + propachlor	residual herbicide mix.	Full (bulb onion) SOLA 2147/07 (shallot)	young plant	none stated	Harmful Irritant	none set
clopyralid	contact: translocated piclorinic herbicide for post emergence use against compositae weeds. Do not use in ambient temperatures > 20C.	Full (bulb onion) SOLA's various see App 9 (shallot)	6 weeks	none stated	none stated	none set
cycloxydim	contact: post emergence control of grass weeds. No control of annual meadow grass.	Full (bulb onion) SOLA's various see App 9 (shallot)	6 weeks	none stated	Irritant	none set
ethofumesate <sup>(2)</sup>	residual: used post emergence for control of annual grasses and chickweed. Care required on light soil.	SOLA's various see App. 9.	12 weeks	none stated	Flammable	LOD 0.05
fluazifop-p-butyl	contact: used post emergence for control of grass weeds and volunteer cereals. No control of annual meadow grass.	Full (bulb onion) SOLA 3271/06 (shallot)	4 weeks	none stated	Irritant Flammable	none set

**Notes:**

(1) or latest time of application

(2) SOLA - see Appendix 9 for the specific product and expiry dates

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

**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 will be replacing these Arrangements as from 31 December 2006. After this time replacement SOLA's to ensure continued use of pesticide products on shallots will be available (see table above or Appendix 9).

**Appendix 8 Herbicides currently approved for use on Bulb Onions and Shallots (Cont'd)**

Active Ingredient	Product Features	Approval Type	Harvest Interval <sup>(1)</sup>	LERAP Category	Hazard Rating	MRL (mg/kg)
fluroxypyr <sup>(2)</sup>	contact: used post emergence for control of various broad leaved weeds.	SOLA 0986/04	11 weeks	none stated	Flammable	LOD 0.05
glyphosate	contact: used pre drilling or pre emergence. Translocated, non-residual, broad spectrum.	Full	pre-emergence	none stated	Flammable	LOD 0.1
ioxynil	contact: used post emergence to cover a wide spectrum of weeds.	Full	2 weeks	none stated	Harmful Irritant	0.2
linuron <sup>(2)</sup>	residual + contact: used pre and post emergence. Gives little residual effect on soil with more than 10% organic matter.  SOLAs expire 31/12/08	SOLA  1755/04 1748/02	56 days	B	Irritant	LOD 0.05
paraquat	contact: used pre emergence covering a broad weed spectrum.  <b>All approvals expire 11/7/08</b>	Full	pre-emergence	none stated	Toxic Harmful Irritant	LOD 0.05
pendimethalin <sup>(2)</sup>	residual: used pre and post emergence. Persistent.	Full & SOLAs various see App 9	before 2 true leaves visible	none stated	Irritant	LOD 0.05

**Notes:**

<sup>(1)</sup> or latest time of application

<sup>(2)</sup> SOLA - see Appendix 9 for the specific product and expiry dates

LOD - MRL set at limit of determination

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

**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 will be replacing these Arrangements as from 31 December 2006. After this time replacement SOLA's to ensure continued use of pesticide products on shallots will be available (see table above or Appendix 9).

**Appendix 8 Herbicides currently approved for use on Bulb Onions and Shallots (Cont'd)**

Active Ingredient	Product Features	Approval Type	Harvest Interval <sup>(1)</sup>	LERAP Category	Hazard Rating	MRL (mg/kg)
propachlor	residual: controls germinating weeds for 6-8 weeks. Used pre and post emergence up to young plant stage.	Full (bulb onion) SOLA's various see App.9. (shallot)	young plant	none stated	Harmful  Irritant	none set
propaquizafop	foliar systemic: applied post emergence for control of annual and perennial grass weed.	Full (bulb onion) SOLA's various see App 9 (shallot)	4 weeks	none stated	Flammable	none set
prosulfacarb	residual thiocarbamate herbicide for use pre and post crop emergence	SOLA 3775/07	before 5 true leaves	B	Irritant	none set
tepraxloxydim	Foliar systemic: control of annual and perennial grass weed inc. annual meadow grass. Do not apply between 1 Nov & 31 Mar. <b>Approval expires 30/11/07</b>	Full (bulb onion) SOLA 4021/06 (shallot)	4 weeks	none stated	Irritant	0.05 UK Temp MRL

**Notes:**

(1) or latest time of application

(2) SOLA - see Appendix 9 for the specific product and expiry dates

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

**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 will be replacing these Arrangements as from 31 December 2006. After this time replacement SOLA's to ensure continued use of pesticide products on shallots will be available (see table above or Appendix 9).

### Appendix 9 Specific off-label approvals (SOLA) for Bulb Onions & Shallots

SOLA Number	Product name	Active Ingredient	Approval	Expiry
1724/06	Amistar	Azoxystrobin	shallot (outdoor)	31-Dec-11
0434/07	Dipel DF	Bacillus thuringiensis var. kurstaki	shallot (outdoor)	31-Dec-13
1631/06	Basagran SG	Bentazone	shallot (outdoor)	13-Jul-11
2570/01	Better DF	Chloridazon	shallot (outdoor)	31-Dec-13
1819/02	Lidazone 65 WG	Chloridazon	shallot (outdoor)	31-Dec-13
1296/06	Ashlade CP	Chloridazon/propachlor	shallot (outdoor)	31-Dec-13
2923/05	Agriguard Chlorothalonil	Chlorothalonil	shallot (outdoor)	28-Feb-11
2939/05	Bravo 500	Chlorothalonil	shallot (outdoor)	31-Dec-13
2058/07	Bravo 500	Chlorothalonil	shallot (outdoor)	29-Feb-08
2931/05	Bravo 720	Chlorothalonil	shallot (outdoor)	31-Dec-13
0992/07	Cleancrop Rio	Chlorothalonil	shallot (outdoor)	28-Feb-11
2949/05	Jupital	Chlorothalonil	shallot (outdoor)	31-Dec-13
2887/05	Repulse	Chlorothalonil	shallot (outdoor)	31-Dec-13
2052/07	Sonar	Chlorothalonil	shallot (outdoor)	31-Dec-13
1952/07	Comrade (10181)	Chlorpropham	shallot (outdoor)	31-Aug-08
0827/07	Jupitar 40 EC	Chlorpropham	shallot (outdoor)	31-Dec-13
1550/06	Dacthal W75	Chlorthal-dimethyl	shallot (outdoor)	31-Dec-13
2147/07	Decimate (11008)	Chlorthal-dimethyl/propachlor	shallot (outdoor)	30-Sept-08
3314/07	Barclay Karaoke	Clopyralid	shallot (outdoor)	30-Apr-09
2636/06	Dow Shield	Clopyralid	shallot (outdoor)	31-Dec-13
3316/07	Fernpath Torate	Clopyralid	shallot (outdoor)	30-Apr-09
1954/06	Glopyr 200 SL	Clopyralid	shallot (outdoor)	31-Dec-13
2544/06	Greencrop Champion	Clopyralid	shallot (outdoor)	31-Dec-13
3332/07	Loncid	Clopyralid	shallot (outdoor)	30-Apr-09
1936/06	Lontrel 200	Clopyralid	shallot (outdoor)	31-Dec-13
1929/06	Pirlid	Clopyralid	shallot (outdoor)	31-Dec-13
1127/99	Cuprokyt	Copper oxychloride	shallot (outdoor)	31-Dec-13
1870/07	Greencrop Pomeroy	Cycloxydim	shallot (outdoor)	31-Aug-08
1875/07	Greencrop Valentia	Cycloxydim	shallot (outdoor)	31-Aug-08

#### Notes:

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

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

All SOLAs are conditional on the continued approval of the specific product

**Appendix 9 Specific off-label approvals (SOLA) for Bulb Onions & Shallots (Cont'd)**

SOLA Number	Product name	Active Ingredient	Approval	Expiry
1880/07	Marnoch Clodim	Cycloxydim	shallot (outdoor)	31-Aug-08
1971/07	Standon Cycloxydim	Cycloxydim	shallot (outdoor)	31-Aug-08
1613/07	Bandu	Deltamethrin	shallot (outdoor)	01-Nov-08
1631/07	Cleancrop Decathlon	Deltamethrin	shallot (outdoor)	01-Nov-08
1698/07	Decis	Deltamethrin	shallot (outdoor)	01-Nov-08
0528/04	Decis	Deltamethrin	shallot (outdoor)	01-Nov-08
1652/07	Decis Protech	Deltamethrin	shallot (outdoor)	01-Nov-08
1158/07	Decis Protech	Deltamethrin	shallot (outdoor)	01-Nov-08
1662/07	Pearl Micro	Deltamethrin	shallot (outdoor)	01-Nov-08
1348/06	Danadim Progress	Dimethoate	shallot (outdoor)	31-Dec-13
3432/07	Invader	Dimethomorph/mancozeb	shallot (outdoor)	30-Sep-12
0153/04	Ethosat 500 (11501)	Ethofumesate	shallot (outdoor)	29-Feb-08
2082/03	Kubist Flo (11167)	Ethofumesate	shallot (outdoor)	29-Feb-08
0520/04	Nortron Flo (08154)	Ethofumesate	shallot (outdoor)	29-Feb-08
3271/06	Fusilade Max	Fluazifop-P-butyl	shallot (outdoor)	31-Dec-13
0986/04	Starane 2	Fluroxypyr	shallot (outdoor)	31-Dec-11
0536/06	Rovral Flo	Iprodione	shallot (outdoor)	31-Dec-08
3756/06	Clayton Lanark	Lambda-cyhalothrin	shallot (outdoor)	13-Nov-09
1287/07	Cleancrop Silo	Lambda-cyhalothrin	shallot (outdoor)	13-Nov-09
0730/06	Hallmark with Zeon Technology	Lambda-cyhalothrin	shallot (outdoor)	13-Nov-09
3256/07	Markate 50	Lambda-cyhalothrin	shallot (outdoor)	28-Jun-11
1755/04	Afalon	Linuron	shallot (outdoor)	31-Dec-08
1748/02	Alpha Linuron 50 SC	Linuron	shallot (outdoor)	31-Dec-08
3418/07	Cleancrop Malahide	Maleic hydrazide	shallot (outdoor)	22-Jul-11
2434/05	Cleancrop Malahide (11066)	Maleic hydrazide	shallot (outdoor)	31-Dec-08
2795/07	Fazor	Maleic hydrazide	shallot (outdoor)	31-Dec-13
2438/05	Fazor (05461)	Maleic hydrazide	shallot (outdoor)	31-Dec-08
2437/05	Fazor (05558)	Maleic hydrazide	shallot (outdoor)	31-Dec-08
2796/07	Fazor (13617)	Maleic hydrazide	shallot (outdoor)	31-Dec-13

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**Appendix 9 Specific off-label approvals (SOLA) for Bulb Onions & Shallots (Cont'd)**

SOLA Number	Product name	Active Ingredient	Approval	Expiry
2439/05	Rouge	Maleic hydrazide	shallot (outdoor)	31-Dec-08
1967/07	Royal MH 180	Maleic hydrazide	shallot (outdoor)	31-Aug-08
3429/07	Source II	Maleic hydrazide	shallot (outdoor)	22-Jul-11
2436/05	Source II (08314)	Maleic hydrazide	shallot (outdoor)	31-Dec-08
3038/05	Dithane 945	Mancozeb	shallot (outdoor)	31-Dec-13
3040/05	Dithane NT Dry Flowable	Mancozeb	shallot (outdoor)	31-Dec-13
2543/06	Penncozeb WDG	Mancozeb	shallot (outdoor)	31-Jun-11
1890/06	Vydate 10G	Oxamyl	shallot (outdoor)	31-Dec-13
1847/07	Agriguard Pendimethalin (10864)	Pendimethalin	shallot (outdoor) (seedling)	31-Aug-08
2375/06	Alpha Pendimethalin 330 EC	Pendimethalin	shallot (outdoor)	31-Dec-08
2365/06	Alpha Pendimethalin 330 EC	Pendimethalin	shallot (outdoor)	31-Dec-08
2640/05	Blazer	Pendimethalin	shallot (outdoor)	31-Dec-08
2106/06	Bunker (12864)	Pendimethalin	shallot (outdoor)	31-Dec-08
2550/05	Claymore (11779)	Pendimethalin	shallot (outdoor)	31-Dec-08
2615/05	Cleancrop Stomp (11778)	Pendimethalin	shallot (outdoor)	31-Dec-08
2610/05	Greencrop Estuary	Pendimethalin	shallot (outdoor)	31-Dec-08
1883/07	Standon Pendimethalin 400 SC	Pendimethalin	shallot (outdoor)	31-Aug-08
1438/07	Stomp 400 SC	Pendimethalin	shallot (outdoor)	31-Dec-13
2878/05	Stomp 400 SC (11777)	Pendimethalin	shallot (outdoor)	31-Dec-08
2311/04	Stomp 400 SC (11777)	Pendimethalin	shallot (outdoor)	31-Dec-08
2541/07	Alpha Propachlor 50 SC (04873)	Propachlor	shallot (outdoor)	31-Jan-09
3082/06	Brasson	Propachlor	shallot (outdoor)	31-Dec-13
3129/06	Ramrod Flowable	Propachlor	shallot (outdoor)	31-Dec-13
3085/06	Sentinel 2	Propachlor	shallot (outdoor)	31-Dec-13
3039/06	Tripart Sentinel	Propachlor	shallot (outdoor)	31-Dec-13
1390/06	Barclay Rebel	Propaquizafop	shallot (outdoor)	31-Dec-13
1568/06	Bulldog	Propaquizafop	shallot (outdoor)	31-Dec-13
1581/06	Cleancrop GYR	Propaquizafop	shallot (outdoor)	31-Dec-13
1713/06	Falcon	Propaquizafop	shallot (outdoor)	31-Dec-13

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**Appendix 9 Specific off-label approvals (SOLA) for Bulb Onions & Shallots (Cont'd)**

SOLA Number	Product name	Active Ingredient	Approval	Expiry
1364/06	Greencrop Satchmo	Propaquizafop	shallot (outdoor)	31-Dec-13
1689/06	Raptor	Propaquizafop	shallot (outdoor)	31-Dec-13
1729/06	Shogan	Propaquizafop	shallot (outdoor)	31-Dec-13
1382/06	Standon Propaquizafop	Propaquizafop	shallot (outdoor)	31-Dec-13
2142/01	Bumper 250 EC	Propiconazole	shallot (outdoor)	30-Nov-09
3775/07	Defy	Prosulfocarb	shallot (outdoor)	01-Aug-10
3646/06	Tracer	Spinosad	shallot (outdoor)	30-Apr-13
1378/07	Alpha Tebuconazole 20 EW	Tebuconazole	shallot (outdoor)	31-Dec-13
1968/06	Bayer UK 226	Tebuconazole	shallot (outdoor)	31-Dec-13
1879/03	Folicur	Tebuconazole	shallot (outdoor)	31-Dec-13
1369/07	Mitre	Tebuconazole	shallot (outdoor)	31-Dec-13
1394/05	Orius	Tebuconazole	shallot (outdoor)	31-Dec-13
1327/07	Orius 20 EW	Tebuconazole	shallot (outdoor)	31-Dec-13
2407/04	Raxil	Tebuconazole	shallot (outdoor)	31-Dec-13
0550/07	Riza	Tebuconazole	shallot (outdoor)	31-Dec-13
0533/04	Force ST (11671)	Tefluthrin	shallot (outdoor)	31-Dec-13
4021/06	Aramo	Tepraloxymid	shallot (outdoor)	31-May-15
1299/02	Hy-TL	Thiabendazole/thiram	shallot (outdoor)	31-Dec-13
2395/05	Agrichem Flowable Thiram	Thiram	shallot (outdoor)	31-Dec-13
2391/05	Thyram Plus	Thiram	shallot (outdoor)	31-Dec-13

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**Appendix 9 Specific off-label approvals (SOLA) for Bulb Onions & Shallots (Cont'd)**

SOLA Number	Product name	Active Ingredient	Approval	Expiry
0434/07	Dipel DF	Bacillus thuringiensis var. kurstaki	onion-bulb (outdoor)	31-Dec-13
1631/06	Basagran SG	Bentazone	onion-bulb (outdoor)	31-Jul-11
2570/01	Better DF	Chloridazon	onion-bulb (outdoor)	31-Dec-13
1819/02	Lidazone 65 WG	Chloridazon	onion-bulb (outdoor)	31-Dec-13
0732/97	Pyramin DF	Chloridazon	onion-bulb (outdoor)	31-Dec-13
1362/98	Ashlade CP	Chloridazon/propachlor	onion-bulb (outdoor)	31-Dec-13
1127/99	Cuprokyt	Copper oxychloride	onion-bulb (outdoor)	31-Dec-13
1698/07	Decis	Deltamethrin	onion-bulb (outdoor)	01-Nov-08
1662/07	Pearl Micro	Deltamethrin	onion-bulb (outdoor)	01-Nov-08
1659/07	Pearl Micro	Deltamethrin	onion-bulb (outdoor)	01-Nov-08
1652/07	Decis Protech	Deltamethrin	onion-bulb (outdoor)	01-Nov-08
1631/07	Cleancrop Decathlon	Deltamethrin	onion-bulb (outdoor)	01-Nov-08
1613/07	Bandu	Deltamethrin	onion-bulb (outdoor)	01-Nov-08
1264/07	Delta-M 2.5 EC	Deltamethrin	onion-bulb (outdoor)	01-Nov-08
1158/07	Decis Protech	Deltamethrin	onion-bulb (outdoor)	01-Nov-08
1348/06	Danadim Progress	Dimethoate	onion-bulb (outdoor)	31-Dec-13
3432/07	Invader	Dimethomorph/mancozeb	onion-bulb (outdoor)	30-Sep-12
2082/03	Kubist Flo (11167)	Ethofumesate	onion-bulb (outdoor)	29-Feb-08
0520/04	Nortron Flo (08154)	Ethofumesate	onion-bulb (outdoor)	29-Feb-08
0153/04	Ethosat 500 (11501)	Ethofumesate	onion-bulb (outdoor)	29-Feb-08
0986/04	Starane 2	Fluroxypyr	onion-bulb (outdoor)	31-Dec-11
3756/06	Clayton Lanark	Lambda-cyhalothrin	onion-bulb (outdoor)	13-Nov-09
3256/07	Markate 50	Lambda-cyhalothrin	onion-bulb (outdoor)	28-Jun-11
1287/07	Cleancrop Silo	Lambda-cyhalothrin	onion-bulb (outdoor)	13-Nov-09
0730/06	Hallmark With Zeon Technology	Lambda-cyhalothrin	onion-bulb (outdoor)	13-Nov-09
1755/04	Afalon	Linuron	onion-bulb (outdoor)	31-Dec-08
1748/02	Alpha Linuron 50 SC	Linuron	onion-bulb (outdoor)	31-Dec-08
3040/05	Dithane NT Dry Flowable	Mancozeb	onion-bulb (outdoor)	31-Dec-13
3038/05	Dithane 945	Mancozeb	onion-bulb (outdoor)	31-Dec-13

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**Appendix 9 Specific off-label approvals (SOLA) for Bulb Onions & Shallots (Cont'd)**

<b>SOLA Number</b>	<b>Product name</b>	<b>Active Ingredient</b>	<b>Approval</b>	<b>Expiry</b>
2543/06	Penncozeb WDG	Mancozeb	onion-bulb (outdoor)	30-Jun-11
1890/06	Vydate 10G	Oxymyl	onion-bulb (outdoor)	31-Dec-13
2375/06	Alpha Pendimethalin 330 EC	Pendimethalin	onion-bulb (outdoor)	31-Dec-08
2311/04	Stomp 400 SC (11777)	Pendimethalin	onion-bulb (outdoor)	31-Dec-08
2207/05	Sovereign (11781)	Pendimethalin	onion-bulb (outdoor)	31-Dec-08
2106/06	Bunker (12864)	Pendimethalin	onion-bulb (outdoor)	31-Dec-08
2022/05	Claymore (11779)	Pendimethalin	onion-bulb (outdoor)	31-Dec-08
1438/07	Stomp 400 SC	Pendimethalin	onion-bulb (outdoor)	31-Dec-13
2142/01	Bumper 250 EC	Propiconazole	onion-bulb (outdoor)	30-Nov-09
3775/07	Defy	Prosulfocarb	onion-bulb (outdoor)	01-Aug-10
2407/04	Raxil	Tebuconazole	onion-bulb (outdoor)	31-Dec-13
1968/06	Bayer UK 226	Tebuconazole	onion-bulb (outdoor)	31-Dec-13
1879/03	Folicur	Tebuconazole	onion-bulb (outdoor)	31-Dec-13
1877/03	Folicur	Tebuconazole	onion-bulb (outdoor)	31-Dec-13
1403/05	Orius	Tebuconazole	onion-bulb (outdoor)	31-Dec-13
1394/05	Orius	Tebuconazole	onion-bulb (outdoor)	31-Dec-13
1384/07	Alpha Tebuconazole 20 EW	Tebuconazole	onion-bulb (outdoor)	31-Dec-13
1378/07	Alpha Tebuconazole 20 EW	Tebuconazole	onion-bulb (outdoor)	31-Dec-13
1369/07	Mitre	Tebuconazole	onion-bulb (outdoor)	31-Dec-13
1365/07	Mitre	Tebuconazole	onion-bulb (outdoor)	31-Dec-13
1336/07	Orius 20 EW	Tebuconazole	onion-bulb (outdoor)	31-Dec-13
1327/07	Orius 20 EW	Tebuconazole	onion-bulb (outdoor)	31-Dec-13
0550/07	Riza	Tebuconazole	onion-bulb (outdoor)	31-Dec-13
0548/07	Riza	Tebuconazole	onion-bulb (outdoor)	31-Dec-13
0546/05	Force ST	Tefluthrin	onion-bulb (outdoor)	31-Dec-13
0533/04	Force ST (11671)	Tefluthrin	onion-bulb (outdoor)	31-Dec-13
1299/02	Hy-TL	Thiabendazole/thiram	onion-bulb (outdoor)	31-Dec-13

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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.

Active ingredient	Target: pest, weed, disease	Current position	Suggested guidelines
maleic hydrazide	Plant growth regulator	Residues found regularly between the limit of determination and MRL	<p>Growers should not apply maleic hydrazide to bulb onions/shallots which are destined for marketing prior to 1<sup>st</sup> December, as internal sprouting is rarely significant prior to this date.</p> <p>Use reduced product rates for crops held in ambient storage.</p>

## Appendix 11 Control Points: Onions (Bulb and Shallots)

### CS.52 ONION S (BULB AND SHALLOTS)

CS.52.1 You should utilise varietal yield, quality and storage characteristics to optimise the performance of your onion crop -

Protocol reference: Section 5.1

CS.52.2 You should be able to provide evidence to show that you use the minimum number of fungicide applications necessary for good Downy Mildew and Botrytis control -

Protocol reference: Section 8.1.2

CS.52.3 You should be able to produce evidence to show that you have adequate controlled storage conditions, capable of achieving temperature and humidity targets, as set out in the crop protocol -

Protocol reference: Section 9.6

CS.52.4 You should be able to justify the use of sprout suppressant treatments in your crop -

Protocol reference: Section 9.4

CS.52.5 Where loose onions are transported from the field to store trailers must be cleaned before use and the cleaning recorded - Protocol reference: Section 9.5

CS.52.6 Where onions are stored in bulk, stores must be cleaned before use and this cleaning recorded - Protocol reference: Section 9.5

CS.52.7 Evidence must be provided to show that growers producing transplants are registered with DEFRA's Plant Health Seed Inspectorate - Protocol reference: Section 5.4