Assured Produce

Crop Specific Protocol

FENNEL

(CROP ID: 41)

January 2009

Control Document No: 00025/09

Acknowledgements

Assured Produce gratefully acknowledges the contribution of all consultees in the preparation of this protocol, particularly Charles Bransden of B. E. Bransden and Sons Ltd and Chris Wallwork of UAP for providing up to date pesticide data.

Preface

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

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

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

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

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

Disclaimer and trade mark acknowledgement

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

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

Notes:

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 Products containing substances which have been revoked are shown on the PSD website (http://www.pesticides.gov.uk).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

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

There may be changes for the following reasons:

- 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)**

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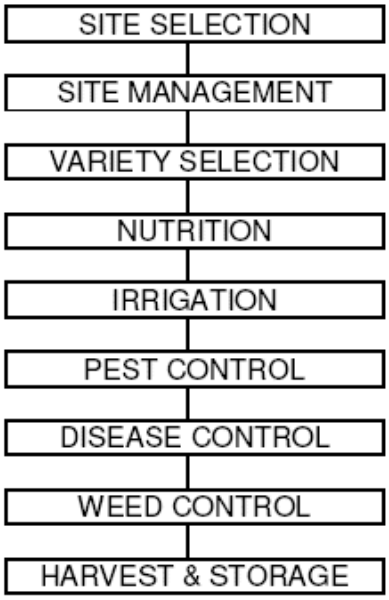
1 General introduction

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

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



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

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

2 Planning and records

See Generic Standards and/or Generic Guidance Notes.

3 Site selection

3.1 Site history

See Generic Standards and/or Generic Guidance Notes.

3.2 Rotations

Crop rotation

A good rotation of crops is essential to help reduce the build-up of pests and diseases and it demonstrates a general concern for the maintenance of soil fertility.

A minimum of three years break between Fennel (as a stem vegetable - *Foeniculumn vulgare var Dulce*) crops is desirable but, due to site/irrigation availability, this may not be feasible so a break of 24 months from harvesting and build up to sowing will minimise carry-over of *Septoria* spores, *Pythium* and *Phytophthora* .

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.

5.2 Seed quality

See Generic Standards and/or Generic Guidance Notes.

5.3 Seed treatments and dressings

See Generic Standards and/or Generic Guidance Notes.

5.4 Plants and nursery stock

5.4.1 Pesticide applications made at source

Any chemical control of pests and diseases which can be applied at the propagation stage should be used:

a. to target the problem directly, and
b. to minimise usage in the field at a later date.

Any treatments used must be agreed with the purchaser and accurate records of application must be kept and kept as part of that crops' continuing pesticide records, to ensure maximum dose / frequency rules observed.

5.4.2 Plant health quality certification

It is unusual in the UK to raise Bulb Fennel for transplanting outdoors. It can be done, the significant limiting factor is premature bolting due to sometimes unavoidable stresses in the transplanting sequence. This may have to change to allow for the distinct shortage of safe, legal herbicides, if the crop is still to have a place in the U.K but if so; or for protected culture:

Producers must satisfy themselves that their transplants are grown in hygienic conditions to ensure that they are planted out in a pest and disease free condition.

Plant raisers must be registered with DEFRA Plant Health and Seeds Inspectorate under the EU Marketing Scheme. The major plant raisers have also produced, and abide by, their own stringent code of practice.

The propagation area must be clean and tidy. The seed trays must be sterilised prior to each use.

Only propagators who are registered with the DEFRA Plant Health and Seeds Inspectorate must be used and a contract specifying hygiene and pesticide requirements held.

The protocol author is not aware of any persons commercially growing perennial Fennel as a leafy herb, nor annual fennel as baby bulbs or leafy herb. He would appreciate contact via the A.P Directorate if there are other any producers, to assist in the development / maintenance of this protocol.

6 Nutrition

A soil analysis for phosphorus, potassium, magnesium and pH is essential prior to deciding on the composition and quantity of base fertiliser to apply.

Use the minimum rates possible, based on ADAS soil indices, to bring the soil to a level considered to be suitable for a Fennel crop. Typical major nutrient requirements are listed in Appendix 1 and the figures are expressed in kilograms of plant food per hectare.

Fennel is not particularly responsive to nitrogen until the crop has reached 5 true leaves, usually after about a month from direct drilling, so minimal nitrate levels are needed in the base dressing. However, use of slower release nitrogen products needs care, as the conversion in the soil depends on temperature and bacterial activity. In these instances advice should be sought on incorporation prior to drilling or planting, and the correct rates to employ. If trickle irrigation is used, consider the relative merits of fertigation, but be aware that once again the speed of release is considered. Also be aware of the catch22 situation if relying totally on fertigation: if a long period of wet weather occurs, the bizarre need to irrigate in order to fertigate may be necessary with consequent cost / waste / waterlogging implications. Top dressings can subsequently be used as needed, reducing the risk of leaching. Little and often is desirable to maintain even growth without luxury uptake. Fennel is particularly prone to quality defects caused by uneven growth spurts. Premature bolting can often be linked to inappropriate levels, or imbalance of available Nitrogen against freely available moisture. It is vital to balance N levels with soil moisture availability.

Nitrate fertilisation will require greater sophistication over the next few years to address the concerns of run-off and leaching into watercourses, and to minimise nitrate levels in the harvested crop. Product choice is expanding, and consideration should be given to more slow release compounds. The use of Ammonium Nitrate or similar quick release materials should preferably be avoided.

Techniques are available to establish nitrate levels in soil and leaves (e.g. Merckoquant® test strips and the independent Nitrachek 404® colorimeter) but, as levels of available nitrate can change rapidly due to environmental conditions, no absolute thresholds for treatment have yet been established. The testing requirements for glasshouse grown winter lettuce have given rise to an H.D.C. developed improved Nitrate testing protocol. Growers may wish to make themselves aware of the new techniques.

Regular use of such equipment on a field-by-field basis by an experienced agronomist will however enable more accurate decisions to be taken on rates of nitrogen to be applied.

Available N must be measured prior to crop establishment and monitored during the growing season or effective use made of N level calculations and predictors.

Other methods of application, such as direct injection, slow release compounds and nitrification inhibitors are being developed and such techniques should always be investigated in an effort to make efficient use of nitrogen.

Timing of the application of organic FYM, where used, must be carefully considered as nitrate release can be unpredictable and may lead to excessive crop uptake or leaching through the soil. FYM should not be applied

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in the autumn. FYM should not be applied to glasshouse soils.

Increasingly, crop nutrient requirements must be, as far as practicable, known throughout the crop's life, and in NVZs particularly, that N levels in the plant and soil at harvest are monitored and recorded, at least for one representative crop annually. This last may become part of due diligence procedures.

7 Irrigation

See Generic Standards and/or Generic Guidance Notes.

8 Crop protection

8.1 The basic approach to crop protection

Introduction

The guiding principle is that pesticide inputs should be minimised through prevention rather than cure. An integrated approach should be adopted to achieve this involving the following management steps.

Good management and planning

a. *Careful site selection to avoid potential or previous problems thereby enhancing plant health.*
b. *Sensible crop rotations to avoid build-up of problems.*
c. *Inclusion of resistant varieties (where available) in cropping programmes whilst respecting the need to meet the required quality parameters and eating requirements.*
d. *Establish the need to take corrective action by regular monitoring referring to thresholds where established. This should be carried out by trained staff. The effect of prevailing weather conditions should also be considered.*

Cultural preventative techniques

a. *Good crop and field hygiene, promoting crop health by maximising nutrient availability through soil analysis and accurate application to avoid excess nutrient application.*
b. *Utilise irrigation as a control measure wherever appropriate and feasible, especially cutworm control in July and August.*
c. *Enable biological and natural methods of pest control to flourish in the crop environment.*

Corrective action

If management and cultural practices fail to prevent or control pests, the following approach should be adopted:

a. Where corrective action is required, additional biological and natural methods of pest and disease control (if available) should be considered first.
b. If chemical control is needed, the following points should be considered, whilst ensuring effective control is achieved:

- Use the least toxic and persistent product.
- Use the most selective product to reduce the impact on naturally occurring beneficial organisms.
- Use minimum effective dose rate.
- Use appropriate application methods with effectively maintained equipment, and spot-treating wherever possible.
- Exceeding the recommended dose rate is wasteful, gives no benefit in terms of control, and is also illegal under COPR.

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All crop residues from previous Fennel crops should be thoroughly destroyed or ploughed-in as soon as cropping is complete. Over-wintering slugs can be a problem on residual roots, getting roots onto the surface in the autumn to aid predator / frost access has been found to be useful. Doing this as part of establishing an overwintering mulch break crop such as barley, phacelia, mustards et al, gives cover for birdlife and thus further control of pests

The use of pest monitoring and forecasting techniques should be adopted where possible as an adjunct to crop inspection, especially for carrot fly and turnip moth.

Field margins can provide a reservoir of insect predators, including ladybird larvae, hoverflies, ground beetles etc. Care must be taken to avoid spray drift from the crop into these areas. Ensure LERAPS are observed where appropriate, S.F.P., E.L.S and H.L.S. rules must also be taken into account

8.2 Plant protection product choice

See Generic Standards and/or Generic Guidance Notes.

Approved uses not included on the product label

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

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

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

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

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

8.10 Pest, disease, physiological disorder and weed control

8.10.1 Pest control

8.10.1.1 Carrot fly (*Psila rosae*)

Carrot fly is a sporadic pest of Fennel but, in an area where *Umbelliferae* are grown intensively, a population of flies will usually establish in 2-3 years and thereafter infestation will become regular and heavy. The fly has two full generations a year, adults for the first generation emerge from the soil at the end of April. Eggs are laid in the soil around young plants during May and June from which larvae hatch and bore into the roots and crown bases of the plants. By mid July few first generation adults remain.

A second generation of adults emerges during August and egg laying extends through until September. Damage from the second generation is not generally as serious as that from the first because the period of adult emergence is protracted, giving a lower population to lay eggs at any one time. There may be a partial third generation especially in East Anglia if it has been a warm summer. Especially in years like 2006, where the weather pattern gave rise to dramatic increases levels of second and third generation Carrot fly activity. The greater activity may have been possible to anticipate if all predictive and monitoring techniques were in place from 1st generation onwards.

Fennel plants are at greater risk when they are small as fewer larvae are needed to cause root damage, causing typical symptoms of wilting and yellowing of leaves, this causes stress and premature bolting. Larger plants can withstand bigger populations of larvae and can grow away from damage without visible symptoms. The larvae only damage the root, not the edible bulb part or leaves. It is prudent to try to prevent resting levels of pests such a carrot fly to build up.

Cultural control: *Regular monitoring of carrot fly activity is essential and yellow sticky traps are available for this purpose. They do not indicate absolute levels of the pest so no thresholds have been set. They do however need an experienced entomologist to identify the catches.*

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Good crop rotation and, if possible, siting crops away from previous umbelliferous crops, will help to delay the build up of large populations. Carrot flies do not fly large distances and it takes 2-3 years for a damaging population to establish. Carrot flies spend much time in vegetation around the edges of fields so keeping hedgerows suitably trimmed in 'A' shape encourages populations of insect eating birds and nesting sites.

Crop covers are increasingly used to prevent air borne pests infecting crops. Fennel (var dulce) leaves can only support the lightest fleeces unless supported on frames or wires, when a young plant. Mature plants can support conventional covers.

When no crop exists, the flies can complete their life cycles on hedgerow umbellifers so regular crops of Fennel in one area will usually lead to a population reaching pest status.

Crops planted after June are usually at less risk from attack than the early crops.

No data yet exists on resistant Fennel varieties.

Chemical control: There are currently no soil applied approved products. Carrot fly control can be achieved using programmed treatments of lambda cyhalothrin. SOLA expires 13 November 2009. These applications should only be applied where carrot fly activity has been forecast, and timed accordingly.

8.10.1.2 Carrot willow aphid (*Cavariella aegopodii*)

This pest overwinters as an egg on the bark of willow trees and hatches out in a winged form to infest Fennel, Carrot, Celery and Parsnip crops during May. Peak infestation lasts until early July when another winged generation emerges to re-infest willows and hedgerow umbellifers.

The aphid itself is not a major pest of Fennel but can cause significant damage in areas where Celery and Carrots are grown intensively by transmitting carrot motley dwarf virus. Control measures should be instigated immediately the pest is seen during regular crop inspections.

Cultural control:*As it is not possible to eliminate the aphid's alternative host plants, no practical cultural methods are suitable. Hover fly and ladybird larvae can eat large numbers of aphids and their presence is to be encouraged (see below).*

Chemical control: A number of materials are effective against aphids and those currently approved are listed in Appendix 2 for Fennel as a stem vegetable and Appendix 8 for Fennel as a leafy herb.

If possible pirimicarb should be chosen, which is specific highly active against aphids and does not harm bees or ladybirds. Hoverfly larvae, which predate aphids will however be affected.

8.10.1.3 Cutworms

These pests are the caterpillars of several species of noctuid moths, the most common being the turnip moth (*Agrotis segetum*). The young caterpillars hatch in June and July, feed on the foliage for up to a week and then descend to the soil to feed on the underground parts of the plant. A severe attack of cutworm indicates the grower has not been vigilant in crop inspections at the right time.

Cutworm attacks are most severe in hot dry summers. Routine treatment is not required, is largely ineffective and is environmentally unacceptable.

Cultural control:*Young cutworm caterpillars are easily drowned so heavy rain effectively controls some attacks. In dry weather, regular irrigation, essential for good Fennel crops, is effective in reducing damage especially when used in conjunction with trapping. Minimum individual applications of 10 mm*

are necessary to dislodge and drown the young larvae. As Fennel (var Dulce) requires, from 30 days, 30 mm water weekly, a 3-day cycle of 10 mm is effective..

Avoid planting Fennel into land which has previously been left very weedy as the moths are attracted to the dense cover to lay eggs.

Chemical control: Spray timing is critical as large caterpillars are much more difficult to kill than small young ones. Base any treatments on warnings from subscribed forecasting systems or trapping, and use high volumes of water on to dry soil in warm weather. Preferably do not allow soils to dry out. If proved necessary by threshold tests and predictive methods, late afternoon chemical application followed by overnight irrigation will help to ensure target is reached, but is not ideal.

Currently approved products are listed in Appendix 2. When choosing products check the harvest interval is adequate for the growth stage of the crop.

8.10.1.4 Slugs

Due to mild winters, slugs have become an increasingly important pest of Fennel as they start to infest the crop in early autumn, therefore early control is essential.

They thrive in soil which is wet from high rainfall or irrigation. Slugs can be a serious pest in the high humidity microclimate under a maturing crop canopy. Previous cropping should be taken into account, and where for instance high levels of brassica roots are remaining in the soil, the crop history should be investigated for potential carryover problems.

Cultural control:*Large amounts of weed or debris from the previous crop will encourage slugs to breed leading to large population increases therefore do not allow decaying vegetation to accumulate, especially 'robust' roots from previous brassica crops for instance - ensure trash is well broken up.. .*

Slugs tend to live in hedgerows and migrate into crops at night so it is advisable to leave a good strip of fallow weed free land between the hedge and crop.

Trapping systems do exist but they are suitable for small scale uses only. Biological control methods are being investigated at present but are not as yet sufficiently developed for commercial use. An effective threshold test using slug traps/baits must be used..

Chemical control: Slug pellets containing metaldehyde or ferric phosphate (see Appendix 5) are effective.

In the first instance, if monitoring is good enough, only the fallow strip around the edge of the field should need treatment. This is important in Fennel because broadcasted pellets can lodge between the leaf stems of the crop causing contamination. This is not acceptable even if the harvest interval (if applicable) is adhered to. Band treatment between rows prior to canopy closure may be effective, and is environmentally the best way. Wildflower mixtures to attract Thrush populations should be considered for field edges.

8.10.1.5 Caterpillars

Caterpillars rarely reach sufficient numbers to assume pest status in Fennel.

Cultural control:*As no specific species attack Fennel, it is not necessary to consider any preventative measures. Silver Y moth larvae can cause problems but is a very rare visitor, and good agronomy will flag up the risk.*

Chemical control: Regular crop inspection will usually identify any caterpillar infestations which are generally localised.

A pyrethroid product will control most caterpillars and spot treatments may be considered if the infestation is not heavy. Currently approved products are listed in Appendix 2 for Fennel as a stem vegetable and Appendix 8 for Fennel as a leafy herb..

8.10.2 Disease control

All crop residues from previous Fennel crop should be thoroughly destroyed or ploughed-in as soon as cropping is complete.

The use of disease monitoring and forecasting techniques should be adopted where available as an adjunct to crop inspection, thus minimising fungicide use. Pythium or Phytophthora at the young plant stage can cause severe crop losses.

Cultural control: A good soil structure with 3% organic matter, will help to reduce the incidence of these diseases. Poor soil structures, due to over cultivation, often leads to disease problems. Some seaweed based products help to increase beneficial micro organisms. Stale seedbed preparation with free draining tilth will help reduce disease. Attention to method, and frequency, of irrigation of seedbeds to avoid saturated, anaerobic conditions which favour onset of root diseases is recommended.

Chemical control: A metalaxyl-based product may give some control. Only approved for use on Fennel as a Leaf Herb

8.10.2.1 Other diseases

Sclerotinia can build up in soils where Fennel is cropped regularly.

Botrytis rarely infects Fennel. Treatments for leaf spot should also control *Botrytis* .

For carrot motley dwarf virus control measures see Section 8.10.1.2.

Bacteria soft rots may occur in the autumn, especially if the bulbs have grown too soft. This often results from the poor control of irrigation and nutrition, i.e. usually excessive nitrogen combined with high soil moisture.

Control methods - once present there is no control.

8.10.3 Weed control

8.10.3.1 Cultural

The usual good husbandry practices such as rotation and stale seedbed should be observed to ensure that as few weed seeds as possible remain in the soil at planting. It should be of paramount importance to ensure Fennel grown as a stem vegetable is sited on clean ground. Use of stale seedbed techniques, and care taken to eradicate perennial weeds will pay dividends. This is critical, as typically a direct-drilled Fennel crop is in the ground for anything up to 5 months. The maturing crop has a particularly dense canopy, there are no effective legal post emergence herbicides, even if the target weed could be reached by the herbicide, and hand weeding becomes impossible. In hot years such as 2003, 2006 late germinating weeds such as Black Nightshade can romp away unseen until it is too late to save the crop, and also build unfortunate levels of weed seeds to plague subsequent cropping. You **must** walk Fennel crops prior to canopy closure to identify need for hand rogueing. Similarly, the microclimate caused by the canopy can give any weed species a more tropical growth rate. Basically, if you don't start off clean, and keep it clean, don't grow fennel as a direct-drilled crop. Use could be made of block raised plants to shorten the days in the ground, planting through mulch or other weed suppression / reduction techniques.

Use of contact herbicides prior to sowing the crop will minimise risk of residues and may reduce the

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need for herbicide use later in the crop life. There are currently no post-emergence selective herbicides approved for Fennel as a Stem Vegetable. Mechanical methods of weed control such as tractor-mounted or hand hoeing or hand weeding should be used wherever practical as such methods reduce chemical usage in the crop It is critical to avoid loosening the plant in the ground when hoeing, and hand weeding is preferable to hand hoeing. Fennel does not like being disturbed in the root zone, damage can stress the plant.

8.10.3.2 Herbicides

Growers must establish which species of Fennel they are growing prior to using the appendices as a guide to choice of materials. An up to date website (e.g. PSD, UAP, CSL) must be consulted to ensure legality.

The timing of post-emergence herbicides is critical. Therefore good crop walking is essential. Weeds should be treated at their appropriate growth stage to minimise the use of herbicides. Multiple low doses, if approved, may be more effective, use of this technique should be considered. There are currently no post-emergence selective herbicides approved for Fennel as a Stem Vegetable

9 Harvesting and storage

See Generic Standards and/or Generic Guidance Notes.

Weighing scales on harvesting rigs must be accurate and records must be maintained confirming this, where appropriate. Where any post harvest rinsing / washing, potable water must be used, with records to validate potability available.

10 Pollution control and waste management

See Generic Standards and/or Generic Guidance Notes.

It will be a legal requirement from 2006 that all irrigation tapes, plastic and fleece crop covers are recycled or disposed of to a registered Waste Disposal Operator. For further information check the Defra website: http://www.defra.gov.uk/environment/waste/agforum/.

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

See Generic Standards and/or Generic Guidance Notes.

Appendix 1 Typical nutrients for Fennel

Nutrient (kg/ha)	Soil Index					
	0	**1**	**2**	**3**	**4**	**4 +**
Nitrogen (1)						
Phosphate	200	150	125	100	60	nil
Potash	400	300	300	200	100	nil
Magnesium						
Sands/light loams	90	60	nil	nil	nil	nil
Other soils	60	30	nil	nil	nil	nil

Notes:

(1) 190-250 kg/ha required in total, half applied in the seedbed and half in the form of top dressings.

The protocol author has no knowledge of *Foeniculum vulgare* grown as a perennial leaf herb. He suggests Asparagus Fern as the nearest plant type of food quality which has a similar habit, height, season, etc. as a base for cautious extrapolation of ideas. It is essential to check all data for current legality, and use an approved F.A.C.T.S. qualified adviser.

Appendix 2 Insecticides currently approved for use on Fennel as a stem vegetable

Active Ingredient	Product Features	LERAP Category	Harvest Interval (1)	Hazard Rating	MRL (mg/kg)
nicotine	contact alkaloid insecticide	C	2 days	Toxic Harmful Flammable	none set
rotenone	contact low persistence insecticide	C	1 day	none stated	none set

Notes:

(1) or latest time of application

Due to EC revocations, closure of MRL's, and the new hierarchy system at PSD (leafy herb versus stem vegetable), the utmost care should be taken to check validity and legality of the use of any pesticides, as the situation is certainly not clear. As label recommendations are revised regularly, read a current label before use, check with the agronomist, or check with PSD /CSL etc website.

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Appendix 3 Fungicides currently approved for use on Fennel as a stem vegetable

Active Ingredient	Product Features	LERAP Category	Harvest Interval (1)	Hazard Rating	MRL (mg/kg)
copper ammonium carbonate	protectant copper fungicide only for use on seedlings, semi immersion of seed trays..	C	apply immediately after sowing		none set
potassium hydrogen carbonate	Powdery mildew control,eradicant	Nil	N/a	Irritant	None set
Coniothyrum Minitans strain	Control / prevention of Sclerotinia. For incorporation at least 3 months prior to anticipated Sclerotinia outbreak.	Lerap C	none set	Poison	none set

Due to EC revocations, closure of MRL's, and the new hierarchy system at PSD (leafy herb versus stem vegetable), the utmost care should be taken to check validity and legality of the use of any pesticides, as the situation is certainly not clear. As label recommendations are revised regularly, read a current label before use, or check with PSD website.

Appendix 4 Herbicides currently approved for use on Fennel as a stem vegetable

Active Ingredient	Product Features	LERAP Category	Harvest Interval (1)	Hazard Rating	MRL (mg/kg)
diquat	non residual bipyridyl contact	c	none stated	Harmful Irritant	none set
glufosinate-ammonium	non selective, non residual phosphinic acid contact herbicide	c	pre crop emergence	Harmful Irritant	none set
glyphosate	translocated non residual phosphonic acid herbicide	c	pre crop emergence	Harmful Irritant	none set
Carfentrazone-ethyl	A triazolinecontact herbicide	c	Precrop emergence, I month before sowing	Irritant, dangerous to the environment	None set

Notes:

(1) or latest time of application.

Due to EC revocations, closure of MRL's, and the new hierarchy system at PSD (leafy herb versus stem vegetable), the utmost care should be taken to check validity and legality of the use of any pesticides, as the situation is certainly not clear. As label recommendations are revised regularly, read a current label before use, or check with PSD website.

Reminder Paraquat and all derivatives:
Has been banned by the EU, and could only be used up from existing growers stocks until 11 July 2008

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Appendix 5 Molluscicides currently approved for use on Fennel as a stem vegetable

Active Ingredient	Product Features	LERAP Category	Harvest Interval (1)	Hazard Rating	MRL (mg/kg)
metaldehyde	Ingested aldehyde. Pellet. Dangerous to birds and animals.	- c	none stated	none stated	none set

Notes:

(1) or latest time of application.

Appendix 6 Soil sterilant currently approved for use on Fennel as a stem vegetable

Active Ingredient	Product Features	LERAP Category	Harvest Interval (1)	Hazard Rating	MRL (mg/kg)
dazomet	methyl isothiocyanate releasing soil fumigant	- c	pre-planting	Harmful	none set

Notes:

(1) or latest time of application.

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Appendix 7 Specific off-label approvals for use on Fennel as a stem vegetable

Number	Product Name	Ingredient	LERAP	Expiry	Harvest Interval
1292/01	Aphox ®	pirimicarb	A	31/12/2013	3 days
0733/2006	Hallmark with Zeon Technology ®	lambda-cyhalothrin	A	31/11/2008	7 days
1430/2007	Stomp 400 sc ®	pendimethalin	C	31/12/2013	prior to planting or drilling

Notes:

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Appendices 8 – 13

Growers are again reminded that the following Appendices 8 - 13 contain pesticides currently "approved" for application to Fennel as a leafy Herb. It is not an exhaustive list, and contains examples of products. You must check a current PSD listing to ensure legality.

You should understand that there are no crop safety assurances implied or given. (For instance, whilst Clopyralid is covered for Fennel Herb under a SOLA, this product is quite effective in killing the crop itself and indeed can be carried over in woody plant residues from previous cropping, or onto subsequent croppings of other umbelliferae, with similar interesting results – so be warned.). The following Appendices contain pesticides legal for use on Fennel as a leafy Herb, by way of:

1) Full Approval for any edible crop

2) SOLA

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Appendix 8 Insecticides currently approved for use on Fennel as a leafy herb

Active Ingredient	Product Features	LERAP Category	Harvest Interval (1)	Hazard Rating	MRL (mg/kg)
Bacillus thuringiensis	bacterial insecticide. SOLA / 2577/02 expires none stated	C	7 days	none stated	none set
deltamethrin	contact and residual pyrethroid: emulsifiable concentrate. Dangerous to bees. SOLA 2322/2005, 0532/2004, 1188/2004 expires 31/12/2013 for herb fennel only,	A	7 days	Harmful Irritant	0.5
fatty acids	soap concentrate insecticide and acaricide	none stated	none stated	none stated	none set
lambda-cyhalothrin	contact pyrethroid: emulsifiable concentrate. Dangerous to bees and other beneficial insects. SOLA 3751/2006 exp 13/11/2009	B	3 days	Harmful	1.0
nicotine	contact alkaloid: liquid unspecified. SOLA 3285/2007 EXP 31/12/2013	C	2 days	Toxic	none set
nicotine (shreds)	contact alkaloid EXP 31/12/2013	C	none stated	Toxic **Part II poison**	none set
pirimicarb	contact and fumigant carbamate: water soluble granules. Selective to aphids. Little effect on beneficial insects. SOLA 3150/2006 exp 31/12/2013	C	3 days	Harmful	none set
pymetrozine	a new azomethine insecticide SOLA 0060/2007 exp 31/10/2011	C	7 days	Harmful	1.0
diflubenzuron	selective, persistent, contact and stomach acting 1321/2005 exp 31/12/2013	B	7 days	Dangerous to environment	none set
spinosad	SOLA 2039/2007 Exp 30/04/2013	B	3 Days		None set
Abamectin	SOLA 0430/2007 Exp 31/12/2013	C	14 Days		None set
Lambda cyhalothrin & pirimicarb	contact pyrethroid: emulsifiable concentrate. Dangerous to bees and other beneficial insects. SOLA 0643/2006 Exp 31/12/2013	A	3 Days	Harmful Dangerous to environment	None set
Cypermethrin	Contact and stomach acting insecticide SOLA 0642/2008 Exp 28/02/2011	A	None set	Harmful , irritant Dangerous to environment	

Notes:

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Appendix 9 Fungicides currently approved for use on Fennel as a leafy herb

Active Ingredient	Product Features	LERAP Category	Harvest Interval (1)	Hazard Rating	MRL (mg/kg)
fosetyl aluminium	systemic phosphonic acid fungicide. SOLA 3522/2006 Exp 31/12/2013 SOLA 0868/03 exp31/08/2008	C	14 days	none stated	none set
azoxystrobin	Systemic transliminar and protectant, strobulin fungicide SOLA 1293/2002, expires 31/12/2011	B	14 days	None stated	0.5
iprodione	protectant dicarboximide fungicide.SOLA 0539/04 expires 31/08/2008 SOLA 1757/2008 Exp 31/12/2013	C	7 days	Irritant	10.0
mancozeb	protective dithiocarbamate fungicide SOLA 2529/2005 exp 31/12/2013	none stated	14 days	Irritant	5.0
metalaxyl-M + mancozeb	systemic and protectant fungicide. SOLAs 2447/01, SOLA 2446/01 2142/2003 Exp 31/12/2013	C	before transplanting. 21 days	Irritant	0.5
Propamocarb hydrochloride	Drench,soil or compost applied 0626/2004 Exp 31/12/2013	C	14 Days		None set
Coniothyrium minitrans strain	A fungal parasite of sclerotia in soil	C	None set	Harmful	None set
Copper ammoniumCarbonate 95gl	A protectant copper fungicide	C	None set	Harmful	None set

Notes:

(1) or latest time of application

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Appendix 9 Fungicides currently approved for use on Fennel as a leafy herb (cont'd)

Active Ingredient	Product Features	LERAP Category	Harvest Interval (1)	Hazard Rating	MRL (mg/kg)
Copper oxychloride	A protectant copper fungicide and bactericide SOLA 0157/2008 Exp 31/12/2013	C	7 days	Harmful, dangerous to the environment	None set
Dimethomorph & mancozeb	A systemic and protectant fungicide SOLA 3044/2006 Exp 30/09/2011	B	21 days	Harmful, flammable	None set
Potassium Bicarbonate	An inorganic fungicide	C	None set	None	None set
Metalaxyl m	A phenylamide systemic fungicide SOLA 1507/2005 Exp 30/09/2012	C	7 days	Harmful	None set
Prochloraz	Protectant and eradicant SOLA 0650/2001 Exp 31/12/2013	C	14 days	Harmful irritant, flammable, dangerous to environment	None set
Boscalid & pyraclostrobin	Protectant and systemic fungicide	B	14 days	Harmful, dangerous to environment	None set
Fenhexamid	A protectant hydroxyanilide fungicide	C	3 days	Dangerous to environment	None set
Sulphur	Inorganic protectant fungicide	C	None set	Irritant	None set

Notes:

(1) or latest time of application

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Appendix 9 Fungicides currently approved for use on Fennel as a leafy herb (Cont'd)

Active Ingredient	Product Features	LERAP Category	Harvest Interval (1)	Hazard Rating	MRL (mg/kg)
propamocarb hydrochloride	translocated carbamate hydrochloride. Soluble concentrate. SOLA 1972/99. SOLA 1971/99 SOLA 0626/04	none stated	prior to planting out. 14 days	Irritant	none set
sulphur	inorganic protectant fungicide. 3652 / 02 exp 31/12/2013	none stated	none stated	none stated	none set
tebuconazole	systemic conazole fungicide. New SOLA 1873/04	none stated	14 days	Harmful Irritant	none set
potassium hydrogen carbonate	Powdery mildew control, eradicant	none stated	Nil		None set
fenhexamid 500g/kg	Protectant fungicide 0026/2005 exp 321/05/2011	C	3 days	Irritant	None set
Boscalid pyraclostrobin	Protectant and systemic 1984/2004, exp 18/10/2008	B	14 days	Irritant	

Notes:

(1) or latest time of application.

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Appendix 10 Herbicides currently approved for use on Fennel as a leafy herb

Active Ingredient	Product Features	LERAP Category	Harvest Interval (1)	Hazard Rating	MRL (mg/kg)
chlorpropham	residual carbamate herbicide 3031/2005 exp 31/12/2013	C	before crop emergence or before planting	Harmful Irritant	none set
glufosinate-ammonium	phosphonic acid contact herbicide Exp 31/12/2013	C	pre crop emergence	Harmful Irritant	none set
glyphosate	translocated non residual phosphonic acid herbicide	none stated	pre-emergence	Harmful Irritant	none set
metamitron	Contact and residual trazinone herbicide 0318/2005 exp 31/12/2013	C	6 weeks	Harmful irritant, dangerous to environment	
diquat	Bipyridal contact herbicide 2388/2006 exp 31/12/2011	C	7 days	as above	none stated
propyzamide	Residual amide herbicide 2650/2005 31/12/2013	C	6 weeks	as above	none stated
Pendimethalin	A dinitroaniline herbicide SOLA 1432/2007 Exp 31/12/2013	C	6 weeks	Irritant, harmful, flammable, dangerous to environment	None stated
Carfentrazone ethyl	A triazolinone contact herbicide	C	N/A	Harmful, dangerous to environment	None stated

Notes:

(1) or latest time of application

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Appendix 10 Herbicides currently approved for use on Fennel as a leafy herb (Cont'd)

Active Ingredient	Product Features	LERAP Category	Harvest Interval (1)	Hazard Rating	MRL (mg/kg)
paraquat + diquat	contact, non-selective, non-residual bipyridyl	-c	pre-emergence	Toxic Harmful Irritant	none set
pendimethalin	residual dinitroaniline, suspension concentrate. SOLA 1927/2005 exp 30/09/2008	none stated	6 weeks	Harmful Irritant	none set
pentanochlor	contact anilide herbicide	none stated	none stated	Irritant	none set
prometryn	contact and residual triazine. Wettable powder. Medium persistence. Apply after crop establishment. SOLA 2081/97	none stated	6 weeks	none stated	none set
trifluralin	soil incorporated dinitroaniline 0074/93 exp 31/12/2007	none stated	pre-drilling	Harmful Irritant	none set
terbacil	Pre-emergence 0082/93 exp 31/12/2007	c	pre-drilling	none stated	none set
propaquizafop	Phenoxy alkanoic acid foliar acting grass herbicide 0148/2002	c	21 days	none stated	none set

Notes:

(1) or latest time of application

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Appendix 11 Molluscicides currently approved for use on Fennel as a leafy herb

Active Ingredient	Product Features	LERAP Category	Harvest Interval (1)	Hazard Rating	MRL (mg/kg)
metaldehyde	ingested aldehyde. Pellet. Dangerous to birds and animals.	C	none stated	none stated	none set
ferric phosphate	organic approval Exp 31/12/2013	C	none stated	none stated	none set

Notes:

(1) or latest time of application

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Appendix 12 Seed Treatments currently approved for use on Fennel as a leafy herb

Active Ingredient	Product Features	LERAP Category	Harvest Interval (1)	Hazard Rating	MRL (mg/kg)
Tefluthrin	Soil acting pyrethroid insecticide seed treatment 0545/2005 exp 31/12/2013	c	none stated	Harmful, irritant, dangerous to environment	none set

Notes:

(1) or latest time of application

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Appendix 13 Seed Sterilants currently approved for use on Fennel as a leafy herb

Active Ingredient	Product Features	LERAP Category	Harvest Interval (1)	Hazard Rating	MRL (mg/kg)
dazomet	methyl isothiocyanate releasing soil fumigant	c	pre-planting	Harmful	none set

Notes:

(1) or latest time of application

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Appendix 14 Control Points: Fennel

CS.41 **FENNEL**

CS.41.1	You must be able to demonstrate knowledge of crop nutrient requirements throughout its life and, in NVZs particularly, N levels should be calculated or measured in the plant and soil at harvest - Protocol reference: Section 6
CS.41.2	You must calculate available N prior to crop establishment and continue to monitor it during the growing season - Protocol reference: Section 6
CS.41.3	You must have records of weighing scale accuracy for the harvesting rig - Protocol reference: Section 9
CS.41.4	All irrigation tapes, plastic and fleece crop covers must be disposed of or recycled in the most appropriate manner - Protocol reference: Section 10
CS.41.5	If using transplants you must have a contract with a propagator who is registered with DEFRA Plant Health and Seeds Inspectorate, specifying hygiene and pesticide requirements - Protocol reference: Section 5.4.2
CS.41.6	**(NEW)** You must walk Fennel crops prior to crop canopy closure to check for Black nightshade and other late germinating weeds, particularly in hot seasons.

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