Assured Produce

Crop Specific Protocol

SPINACH

(CROP ID: 27)

February 2009

Control Document No: 00046/09

Acknowledgements

Assured Produce gratefully acknowledges the contribution of all consultees in the preparation of this protocol, particularly David Norman.

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.

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 Products containing substances which have been revoked are shown on the PSD website (http://www.pesticides.gov.uk).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 the PSD website (www.pesticides.gov.uk) their advisers, manufacturers and the Assured Produce website 'Newsflashes'.

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 have been used up by 31 August 2008. In many cases products have been replaced by new non-NPE formulations.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)**

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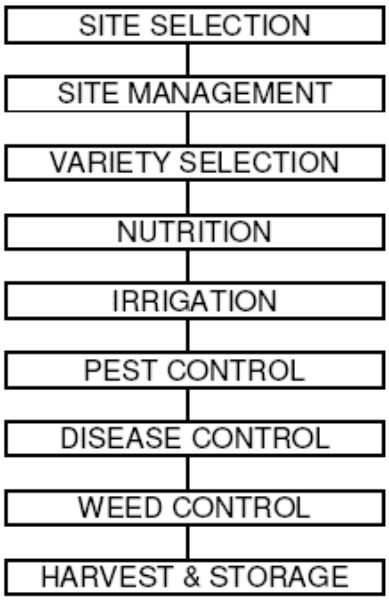
1 General Introduction

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.

Background information

Spinach has increased in popularity in recent years, especially eaten raw as a constituent freshly prepared bagged leafy salads. It is harvested in the UK from the end of April until the beginning of November. Spinach will withstand a few degrees of frost but will not produce good, marketable yields of high quality if it encounters consistently wet conditions.

Spinach will grow on a wide variety of soils but generally prefers light, easily worked, free draining soils. Wet heavy soils are not suited to Spinach as they cause soiling of the product and Spinach is particularly intolerant of waterlogging.

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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

It is important to implement a rotational strategy into Spinach production. An ideal rotation would be one year in three.

Continuous Spinach will lead to a build up of pests and diseases.

Over-wintered Spinach is occasionally grown to enable supplies to be available before Spring sown Spinach is ready for harvesting. It is important that the over-wintered crop is not placed in close proximity to the spring Spinach otherwise cross transfer of disease may take place.

It is important to destroy old Spinach crops rapidly and effectively in order to avoid a carryover of diseases such as downy mildew.

4 Site management

See Generic Standards and/or Generic Guidance Notes.

5 Variety selection

See Generic Standards and/or Generic Guidance Notes.

6 Nutrition

6.1 Nutrient requirement

Recommendations for the applications of phosphate, potash and magnesium should be based on recent soil analysis.

Nitrogen - Spinach is a fast growing crop and requires adequate supplies of nitrogen. Growers should take into account the amount of residual nitrogen in the soil. This may be considerable say following a leafy crop such as lettuce, especially when combined with high temperatures that will encourage nitrogen mineralisation.

Assessing mineral nitrogen is a useful *guide* to available soil nitrogen. However analysis must be undertaken close to drilling as the amount of available nitrogen will depend upon factors like the soil temperature, the moisture content of the soil and the levels of organic matter in the soil.

Nitrates

Unfortunately, under conditions of low light levels and slow growing conditions, Spinach is particularly prone to accumulating nitrates in the stems and leaves. Because of this growers **must** be aware of the EC maximum

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nitrate levels in Spinach that presently exist. For fresh Spinach they are as follows: -

Harvest period Fresh spinach	**Maximum nitrate content** **(mg NO_3 /kg fresh product)**
1 st October to 31 st March	3000
1 st April to 30 th September	2500

There are moves within the EC which mean that these limits may change. If this happens, the derogation may longer apply to spinach produced in this country. It is essential that growers view the Assured Produce web site at regular intervals to check whether there has been any alteration to the maximum nitrate content and also in respect as to whether there has been any alteration to the derogation which currently exists.

Growers must monitor the nitrate content of their Spinach and information about this and the laboratory used should be available. The frequency of monitoring will depend on the quantity and continuity of the Spinach grown. Samples should be sent to a laboratory participating in FAPAS. The Food Standards Agency recommend that a method based on hot water extraction (BS EN12014-2/1997) should be used.

A project funded by HDC and undertaken by Warwick HRI has demonstrated a suitable method for monitoring nitrate levels at farm level. Details of this may be obtained from the HDC. This method can be used to supplement the monitoring carried out by the grower using accredited laboratories.

A guideline is given in the Industry Code of Practice which is included in this document.

Growers must demonstrate that they follow the Industry Code of Good Practice in order to minimise the nitrate content of Spinach grown.

To minimise the amount of nitrates present in Spinach, the NFU, working with DEFRA, LACOTS and Consultants, have prepared an Industry Code of Practice. All Spinach growers must follow this Code of Practice. **It is a requirement of the Food Safety Act, the controlling Act for the contaminants in Food Regulation, that a grower must be able to provide written records that they have complied with the Code** .

Potash and phosphate

The requirements for potash and phosphate are given in Appendix 2.

Magnesium

Magnesium deficiency will soon become evident in Spinach as a chlorosis following the fine veins in the leaves. In the case of soils deficient in magnesium, a quick release form of magnesium such as kieserite should be incorporated into the seedbed at least three weeks before planting. Foliar sprays of magnesium sulphate are also effective in correcting a slight deficiency. Leaf tissue tests can quickly estabioish if magnesium leaf levels are low enough to require foliar applications of magnesium. Care must be taken when applying magnesium sulphate solutions during periods of very hot weather.

7 Irrigation

Spinach prefers growing in warm, moist conditions so the ability to irrigate the crop is essential. Methods of applying irrigation are equally important as the soft, delicate leaves of Spinach can be damaged by the use of large droplets from a rain gun. Sprinkler irrigators, either as static lines or mounted on a boom which moves within the crop, are preferred and will generally give better results.

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8 Crop protection

8.1 The basic approach to crop protection

See Generic Standards and/or Generic Guidance Notes.

8.2 Plant protection product choice

See Generic Standards and/or Generic Guidance Notes.

Approved uses not included on the product label

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

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

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

Contact details are: p.s.d.information@psd.defra.gsi.gov.uk tel. 01904 455775

8.3 Advice on the use of pesticides

See Generic Standards and/or Generic Guidance Notes.

8.4 Application of pesticides

See Generic Standards and/or Generic Guidance Notes.

8.5 Records of application

See Generic Standards and/or Generic Guidance Notes.

8.6 Protective clothing/equipment

See Generic Standards and/or Generic Guidance Notes.

8.7 Pesticide storage

See Generic Standards and/or Generic Guidance Notes.

8.8 Empty pesticide containers

See Generic Standards and/or Generic Guidance Notes.

8.9 Pesticide residues in fresh produce

See Generic Standards and/or Generic Guidance Notes.

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

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

8.10 Pest, disease and weed control

8.10.1 Pest control

8.10.1.1 Aphids

Aphid attacks can occur at any time during the growing season but it is during the summer months that these attacks are likely to be more serious. *Aphis fabae*, the black bean aphid and *Myzus persica*, the peach potato aphid, are the most likely species to be found on spinach.

Cultural control: at the present time there is no successful cultural control of aphids. As with disease minimisation, it is wise not to allow crop residues to linger after harvest.

Chemical control: products based on pirimicarb are effective and have the advantage of not affecting certain predators such as ladybirds.

8.10.1.2 Bean seed fly (*Delia platura*)

This opportunist pest can cause considerable damage to the germinating Spinach crop in late May and early June. However, it can be a problem throughout the season.

Cultural control: Attacks from the bean seed fly often follow where trash has been incorporated into the soil. The flies are attracted to decaying organic material. Attacks from this pest have increased proportionally with the amount of Spinach being grown, and in particular with the lack of crop rotation. It is important not to follow too closely behind an area where trash has recently been incorporated.

Chemical control: Seed treatment with 'Force ST', a 200g/l tefluthrin product offers a high degree of control against this pest.

8.10.1.3 Caterpillars

These are an occasional pest on Spinach. Silver Y caterpillars are sometimes a problem. These caterpillars can be monitored successfully using pheromone traps.

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Cultural control: there is no cultural control for caterpillars. Covering crops with fine netting will restrict the access of the pest.

Chemical control: approved formulations of cypermethrin or deltamethrin are effective in controlling caterpillars. Bacillus thuringiensis and diflubenzuron will also control caterpillars. Both materials are more specific to caterpillars than pyrethoids and generally, less harmful to preditors, but as they are slow acting they may not always be suitable for a fast growing crop such as Spinach.

A new SOLA for the spinosad 'Tracer' has recently been issued. This material has the advantage of being kind to predators.

8.10.1.4 Beet leaf miner (*Pegomya hyoscyami*)

The larvae of the mangel fly will attack Spinach. Although there is a spring hatch, the most serious problem usually occurs in August and September. The fly larvae mines the Spinach leaves, often leaving the product unsaleable.

Cultural control: there is no cultural control available

Chemical control: there are no approved pesticides currently available.

8.10.1.5 Slugs

Slugs are not generally a problem in spinach production. Late summer drilled crops are the ones most likely to be affected.

Cultural control: Selection of 'slug free'fields is important. Infestations can often be determined by test baiting. The disposal of all trash after harvest is important as this avoids a food source for both slugs and snails. This can be achieved most satisfactorily with a crop burner.

Chemical control: Many metaldehyde and methiocarb and ferric phosphase based pellets slug are approved for use on spinach. However it is rarely necessary to apply an overall treatment. Occasionally, a section of the crop near a grass headland may warrant treatment.

8.10.2 Disease control

8.10.2.1 Downy mildew *(Peronospora farinosa)*

Downy mildew is one of the most serious diseases of Spinach. It can spread with devastating speed and can result in complete loss of crop if climatic conditions are favourable to the development of the disease.

Plant breeding has provided resistance to a number of strains or races of D.Mildew. At the present time, cultivars that have resistance to races 1-10 are available. The problem is that that D. Mildew is a very diverse pathogen and it is an impossible task for the plant breeder to keep ahead of the diversification of the disease.

Description: the Americans call spinach downy mildew 'blue mould'. This is, in fact, quite an accurate description of the disease. Pale yellow blotches appear on the upper surface of the leaf and fluffy grey- blue patches can be found on the under surface of the leaf. The fluffy patches on the underside of the leaf contain the airborne spores of the disease.

Cultural control: choosing cultivars which have resistance to races of D.Mildew1-10.

Avoiding growing spring Spinach next to an over-wintered Spinach crop will reduce the chance of disease

spread. A well-drained open site is preferred as this is less likely to favour the development and spread of the disease. Avoid over-watering which will create a humid atmosphere and encourage conditions which will encourage the development of the disease. Perhaps most important of all is to ensure that as soon as harvesting is completed, the crop debris is removed either by ploughing or burning. Lowering populations can help increase the air movement within the crop and this can help reduce the risk of the rapid spread of the disease.

Chemical control: products bases on metalaxyl M and fosetyl -aluminium have proved effective in suppressing the disease proving the materials are applied at the very first sign of the disease. Recent alterations (July 2001) to the MRL on metalaxyl M means that it is now set at the L.O.D. (0.05). Seed dressings which contain metalaxyl M or metalaxyl M and cymoxanil, help to protect the plant from emergence up to the cotyledon stage against D.Mildew. A new SOLA for the product Previcur Energy , which contains the two actives fosetyl-aluminium and propamocarb hydrochloride has been recently issued and should provide good levels of downy mildew control

8.10.2.2 Seedling diseases

There are a number of soil-borne diseases which affect Spinach. Although frequently referred to as 'damping off' these include the *Pythium* and *Rhyzoctonia* species. In warm, wet soil condition, *Fusarium* species may also contribute to plant death. It is not always easy to identify soil-borne diseases of Spinach and a pathological investigation may well be necessary to pinpoint a particular pathogen. However, a commonality of both *Pythium* and *Rhyzoctonia* is that they often occur in wet soils and are usually more widespread where there is a history of Spinach growing on the same land.

Description: Both *Pythium* and *Rhyzoctonia* can cause collapse and death of the young seedling. *Pythium* is often associated with collapse of the plant at soil level while *Rhyzoctonia* is sometimes indicated by a blackening of the tap root.

Cultural control: Choose well drained sites and try to maintain a rotation. Do not over-water during the germination of the crop.

Chemical control: Treating the seed with thiram gives moderately good control of damping off diseases.

8.10.3 Virus control

8.10.3.1 Cucumber mosaic virus

Although only occasionally seen, cucumber mosaic virus is probably the most important virus to affect the Spinach crop, especially in seasons where there is high aphid pressure.

Description: Yellowing of the younger leaves and in severe cases plant death may take place. Because the trend is to harvest Spinach at a much younger stage of growth, CMV has been seen much less frequently in recent years. The disease is aphid transmitted, especially by *Myzus persicae*

Cultural control: Rapid disposal of trash after harvest is most important. Once a reservoir of infection has established, subsequent eradication of the problem will be difficult.

Chemical control : Good aphid control will greatly lessen the chances of the disease being transmitted.

8.10.3.2 Leaf Spotting Diseases

Spinach suffers from several leaf spotting diseases. The most common of these are *Cladosporium* and *Stemphylium*. Also, occasionally observed is *Colletotrichum* (Anthacnose). These leaf spot diseases exhibit certain similarities in appearance and their identification is best confirmed by an experienced agronomist or laboratory diagnosis by a plant pathologist. An explanatory leaflet on these diseases (FV268) is available from

the Horticultural Development Council.

Cultural control: This is best achieved by good rotation as *Stemphylium* and *Colletotrichum* in particular can survive on spinach debris.. A rotation of two years should be observed if either *Stemphylium* or *Cladosporium* has been identified on a previous spinach crop. Recent work indicates that some of these leaf spot diseases are almost certainly seedborne, certain hot water treatments of the spinach can be very effective on treating *Cladosporium* and reducing the levels of *Stemphylium.*

Chemical control: Following the withdrawal of approval for boscalid and pyraclostrobin, there are no currently approved foliar treatments effective against these leaf spot diseases.

8.10.4 Weed control

Sterilising is sometimes carried out prior to the production of baby and infant Spinach, because of the difficulty of obtaining good weed control by conventional methods. Sterilisation is usually carried out using metham sodium or Basmid®. A list of approved herbicides is provided in appendix 5.

9 Harvesting and storage

See Generic Standards and/or Generic Guidance Notes.

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.

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Appendix 1 Industry Code of Good Practice to minimise nitrate content of UK grown Spinach

Version 2. January 1999

1. Legislative Background

1.1 As part of its programme on agricultural contaminants in food, the European Commission put forward a series of proposals that set maximum limits for contaminants in foods European Commission Regulation (EC) No. 1822/2005 as regards nitrate in lettuce and spinach was published in the Official Journal of the European Union on 9 th of November 2005 sets official maximum limits and details the derogation granted to the UK until 2008. This Regulation is now enforced by the Contaminants in Food (England) Regulation 2005, which came into force on 1 st January 2006.

It is a requirement of the European legislation that, should Member states wish to use the permitted derogation, growers should follow a code of good practice to minimise nitrate content.

1.2 This Code of Good Practice lays out the actions to be taken and monitored by the UK Industry. As knowledge is gained the Code will be revised and updated.

2. Nitrate in plants

2.1 Nitrogen is an essential constituent of proteins on which all life depends. Plants take up most of their nitrogen in the nitrate form before converting it to proteins via amino acids. Energy is required to convert nitrate to amino acids and this is supplied by sunlight through the process of photosynthesis. Thus in winter, when light levels are lower, higher levels of nitrate accumulate in the plant. Older leaves contain more nitrate than younger leaves because the site of nitrate conversion to amino acids is in the actively growing, younger issue. Nitrate is also used by plants to regulate the turgidity of cell sap and therefore will be at lower concentrations when rapid growth is occurring. For these reasons the level of Nitrate in plant leaves varies considerably, both over time and between leaves of different ages.

3. Background to action by UK industry

3.1 This second version of the Code of Good Practice has been written to include the most likely actions, using present scientific knowledge which should minimise nitrate content.

The code forms part of the Spinach protocol of the Assured Produce Scheme to which the majority of Spinach growers belong. Multiple retailers will require their suppliers under Food Safety Act contractual agreements to follow the code together with its monitoring requirements.

4. Monitoring of nitrate levels

4.1 A considerable programme of monitoring of nitrate levels in Spinach will be carried out. Samples for testing will be taken at harvest, during the distribution chain and at retails outlets.

4.2 The UK Monitoring Programme for Nitrate in Lettuce and Spinach began in May 1996 in accordance with Article 3 of Commission Regulation (EC) No. 194/97 and will continue. The samples are representative of production and geographic distribution of growers in the UK. Samples are taken by Trading Standards officers and analysed by the appropriate public analysts. All the analysts participating in the Monitoring Programme meet the criteria laid down by European Commission paper (doc. VI/4800/96) 'Guidelines for Laboratories Carrying Out the Determination of Nitrate in Lettuce and Spinach: EC Monitoring Programme' and have demonstrated satisfactory performances for nitrate analyses in the Food Analysis Performance Assessment Scheme (FAPAS). The results of the present Monitoring Programme will be reported to the European Commission.

4.3 Multiple retailers will be monitoring samples of Spinach taken from their distribution depots. The major retail groups account for some 70-80% of all Spinach sold.

4.4 Grower monitoring. All major marketing and co-operative groups together with growers should carry out monitoring as detailed later in this Code of Good Practice.

4.5 The Food Standards Agency Contaminants Division will collect and co-ordinate all the monitoring results so that a large and representative sample of nitrate levels in UK Spinach will be compiled.

5. Cultural advice to growers

5.1 This cultural advice has been prepared using research knowledge acquired to date including that from other EU member states particularly the Netherlands. All growers should follow this cultural advice. It is a requirement of the Food Safety Act, the controlling Act for the Contaminants in Food Regulation that a grower must be able to provide written records that they have complied with this code and they will be required to provide this for LACOTS (Local Authorities Coordinating Body On Trading Standards) personnel if requested to do so. It will be a legal offence which may lead to prosecution if a grower fails to provide the information required. It is advised growers incorporate this code into their HACCP programmes to ensure compliance.

5.2 Light maximisation

The objective is to maximise light availability. Outdoor crops are naturally subject to the "weather". However, growers who use woven or polythene covers in their early plantings (February to May) should make every effort to maximise light availability, and particular attention should be paid to the gram weight of the cover material used. Consideration must be given to allowing a period of natural light (no covers) prior to harvest. New material should be used where there is doubt as to adequate light transmission through existing cover material.

5.3 Soil nutrients

5.3.1 Analysis of the soil mineral nitrogen (SMN) levels, which includes both nitrate and ammonium N, is a useful predictive tool particularly when used in conjunction with the appropriate fertilizer prediction models, and can be used for all Spinach crops.

5.3.2 Apply only sufficient nitrogen to allow the development of the crop through to harvest. Apply no more than 125 kg/ha of N in the base dressing. Any top dressing, which should not exceed 100 kg/ha of N fertilizer in total, should be made well before harvest, at least 7 days, as late dressings increase levels of nitrate in harvested product.

5.3.3 On soils where nitrate leaching is likely, base dressings of N should be reduced and more top dressings given; these can be as solid fertilizer or as liquid feeds. If liquid feeds are used, there should be no application of Nitrogen made within 7 days of harvest.

5.4 Spinach variety

Although there is variation in nitrate residues between varieties, at present no variety offers a consistent means of achieving the proposed levels. Some varieties exhibit other agronomic shortcomings. Nevertheless this area should be kept under review.

5.5 Post-harvest handling

The interval between harvest and sale should be as short as possible to avoid water loss which would be expected to "concentrate" the nitrate content of the fresh product. An interval of 48 hours should be the targeted maximum. Research into the effect of distribution through the food chain is ongoing and any appropriate results will be incorporated into this code at the subsequent update.

5.6 Nitrate monitoring samples

5.6.1 Sampling and analytical procedures are essential elements of due diligence. Analysis of samples should be carried out by a competent laboratory. To help assess whether a laboratory is competent, the laboratory should be asked to provide

evidence that it is UKAS (United Kingdom Accreditation Service) accredited for nitrate analyses in food. Laboratories Analysis Performance Assessment Scheme) and for their 'z-scores'. Laboratories should be able to demonstrate that they consistently achieve FAPAS z-scores of between +2 and -2 for nitrate analyses. Scores outside this range are not considered satisfactory. A laboratory can be asked for the reasons why they are UKAS accredited for nitrate analyses in food and take part in the nitrate rounds in FAPAS. Laboratories differ in the number and types of chemicals for which they are accredited. For example, a laboratory may be UKAS accredited for pesticides analyses but not for nitrate.

5.6.2 Samples taken immediately prior to harvest for the purposes of monitoring the effectiveness of this code should be taken on a regular basis. A guideline to 'a regular basis' is that samples should be taken every fourteen days during the growing season. This sampling requirement is in addition to any samples demanded by customers or enforcement authorities for their own purposes.

5.7 Records required

5.7.1 The following records must be kept for all crops, and retained for 2 years.

a. Soil analysis results, date and location.
b. Date of nitrogen fertiliser applications per crop, to include base dressings, top dressings and liquid feed. The results of sap testing, or any other such test, if carried out, before the application of a liquid feed. The type and total nitrogen content of fertiliser should be recorded together with application rate.
c. Date of any application of organic manure or soil conditioner with an estimate of total nitrogen applied.
d. Date of planting and variety together with date of harvest.
e. Previous crop grown.

5.7.2 In addition, the following records must be kept for crops being sampled, and analysis results retained for 2 years.

a. Date and time of taking plant samples.
b. Weather conditions on days prior to taking of samples.
c. Results of sample analysis and name of laboratory/analyst performing the analysis.

5.7.3 All these results should be kept by the grower and a copy supplied to, and kept for reference by, the grower-marketing organisation if one is being used. They will be made available to any authorised person, e.g. enforcement officers, on request.

6. Status of this code

This cultural advice has been prepared using research knowledge acquired to date including that from other EC member states particularly the Netherlands. All growers must follow this cultural advice. It is a requirement of EC Regulation No. 194/97 and for operation of the derogation that growers follow Codes of Good Practice. It is advised that growers incorporate this code under their HACCP, or management programmes to ensure they are complying.

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Appendix 2 Fertiliser requirements for Spinach

The following recommendations are based on nutritional requirements for phosphate, potash and magnesium for all Spinach.

Nutrient	**Soil Index**					
	0	1	2	3	4	4+
Nitrogen	125	100	75	50		
Phosphate(P_2O_5)	250	200	150	100	50	nil
Potash (K_2O)	275	225	175(2-) 125(2+)	50	0	nil
Magnesium* (asMgO)	150	100	0	nil	nil	nil

* Magnesium should be applied in a readily available form such as kieserite

Top dressing

Top dressing rates will vary between the requirement for a baby leaf crop and that of a mature Spinach crop.

As a general rule, no more than 100 kg/ha N should be applied as a top dressing for the first crop. Subsequent crops may require only half this amount of N. Nitrogen applications for over-wintered Spinach should be applied only in the spring.

Mineral nitrogen analysis is a useful *guide* as to soil available nitrogen.

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Appendix 3 Insecticides currently approved for use on Spinach

Active Ingredient	Product Features	LERAP Category	Harvest Interval	MRL (mg/kg)
bacillus thuringiensis	a bacterial insecticide for the control of caterpillars	none stated	zero	none set
cypermethrin (1)	a contact and stomach acting pyrethoid insecticide	A	none stated	0.5
deltamethrin (1)	a contact and stomach acting pyrethoid insecticide	A	none stated	0.5
diflubenzuron	a selective persistent and contact insecticide	B	7 days	0.2 (draft)
nicotine	a general purpose non-persistent, contact alkaloid insecticide,	none stated	2 days	none set
pirimicarb (1)	a contact,fumigant and translaminar carbamate insecticide	none stated	3 days	0.2 (draft)
spinosad	A selective insecticide derived from naturally occuring soil fungi	B	3 days	10.0
tefluthrin (1)	a soil acting pyrethroid seed treatment	none stated	none stated	0.05

Notes:

(1) SOLA - see Appendix 6 for expiry date

Not all formulations of these active ingredients may be approved for the use on Spinach. Check before use.

Appendix 4 Fungicides currently approved for use on Spinach

Active Ingredient	Product Features	LERAP Category	Harvest Interval	MRL (mg/kg)
Copper oxychloride (1)	A protectant fungicide	None stated	14 days	20.0
fosetyl-aluminium (1)	a systemic phosphonic acid fungicide	none stated	7 days	none set
Fosetyl-aluminium/ Propamocarb hydrochloride	A systemic phosphonic acid fungicide	none stated	14 days	75.0 30.0
Cymoxanil/ fludioxonil/ metalaxyl	A systemic fungicide seed treatment	Seed treatment	None stated	0.05 0.05 0.05
metalaxyl M(1)	a systemic phenylamide fungicide	none stated	14 days	0.05
Thiram	A dithiocarbamate fungicide	none stated	14 days	0.05 dithiocarbamates

Notes:

(1) SOLA - see Appendix 6 for expiry date Not all formulations of these active ingredients may be approved for the use on Spinach. Check before use.

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Appendix 5 Herbicides currently approved for use on Spinach

Active Ingredient	Product Features	LERAP Category	Harvest Interval	MRL (mg/kg)
chloridazon (1)	a pre emergent residual herbicide	none stated	none stated	0.5 (draft)
chloridazon + quinmeric	a pre-emergence residual herbicide	none stated	none stated	0.5 0.5 (draft)
clopyralid (1)	a foliar translocated herbicide	none stated	14 days	1.0
lenacil (1)	a soil acting residual herbicide	none stated	none stated	0.1 (draft)
phenmedipham (1)	a contact carbamate herbicide	none stated	14 days	0.5
propaquizafop (1)	a selective graminicide, especially useful in removing volunteer cereals	B	21 days	0.2
Chlorpropham	A residual pre-emergence herbicide	none stated	Pre-emergence	0.05

Notes:

(1) SOLA - see Appendix 6 for expiry date. Not all formulations of these active ingredients may be approved for the use on Spinach. Check before use.

Appendix 6 Current specific off-label approvals for use on Spinach

Active Ingredient	Commercial Product	SOLA Number	Expiry Date
Bacillus thuringiensis	Dipel DF	2063/04	31/08/12
chloridazon	Pyramin DF®	2979/06	31/12/13
Chloridazon/quinmerac	Fiesta T	3164/06	31/12/13
clopyralid	Dow Shield® Cliophar® Lontrel 200	0472/05 2952/07 3322/07 2443/06	31/12/13 31/12/13 30/04/09 31/12/13
Copper oxychloride **	Headland Inoganic Liquid Copper	0157/08	31/12/13
cypermethrin	Toppel 100 EC®	0638/08	31/12/13
deltamethrin	Decis Decis Protech Bandu Pearl Micro Cleancrop Decathlon	1703/07 1655/07 1604/07 1689/07 1642/07	31/12/13 31/12/13 31/12/13 31/12/13 31/12/13
Diflubenzuron	Dimilin Flo	1321/05	31/12/13
Diflubenzuron	Dimilin 25 WP	3924/04	31/12/13
Fenhexamid	Teldor®	0026/05	31/05/11
fosetyl-aluminium	Aliette 80 WG® Standon Fullstop Cleancrop Chicane	3520/06 0267/08 3562/07	31/12/13 31/12/13 31/05/09
lenacil	Venzar Flowable® Cleancrop Lenflow®	0703/97 1708/01	31/12/13 31/12/13
Metalaxyl M	SL 567A	1507/05	30/09/12
phenmedipham	Betanal Flo® Alpha phenmedipham 320sc	0633/05 2508/08	28/02/15 31/08/10
pirimicarb	Aphox® Phantom	1298/01 1746/05	31/12/13 31/12/13
Chlorpropham	Jupiter 40EC	1838/08	31/08/12
Thiram	Unicrop Thianosan DG	2158/07	31/12/13
propaquizafop	Cleancrop GYR® Bulldog® Falcon® Raptor® Shogun®	0864/08 0860/08 0871/08 0132/02 1629/02	31/12/13 31/12/13 31/12/13 31/12/13 31/12/13
spinosad	Tracer	1290/08	31/01/17
tefluthrin	Force ST® (seed dressing)	0545/05	31/12/13
cymxanil/fludioxonil/metalaxyl M	Wakil XL (seed dressing)	0791/07	29/03/12

Notes:

* **Please note the expiry date of these SOLAs**

Specific off-label approval (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 extant approval of the specific product.

Control Document No: 00046/09

Appendix 7 Control Points: Spinach

CS.27 **SPINACH**

CS.27.1	You must be aware of the current EC legislation in respect of nitrate levels in spinach - Protocol reference: Section 6.1
CS.27.2	You must be able to provide information on your leaf nitrate monitoring programme including information on the laboratory used - Protocol reference: Section 6.1
CS.27.3	You must be able to demonstrate that you follow the Industry Code of Good Practice to minimise nitrate content of spinach grown in the UK - Protocol reference: Section 6.1