Assured Produce

Crop Specific Protocol

FRUIT (CANE FRUIT)

Including Raspberries, Blackberries and Hybrid Berries which include Tayberries, Dewberries and Loganberries

(CROP ID: 39)

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Control Document No: 00027/08

Acknowledgements

Assured Produce gratefully acknowledges the contribution of all consultees in the preparation of this protocol, particularly members of National Summer Fruits and Janet Allen of ADAS.

Preface

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

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

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

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

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

Disclaimer and trade mark acknowledgement

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

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

Notes:

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 Products containing substances which have been revoked are shown on the PSD website (http://www.pesticides.gov.uk).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

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.

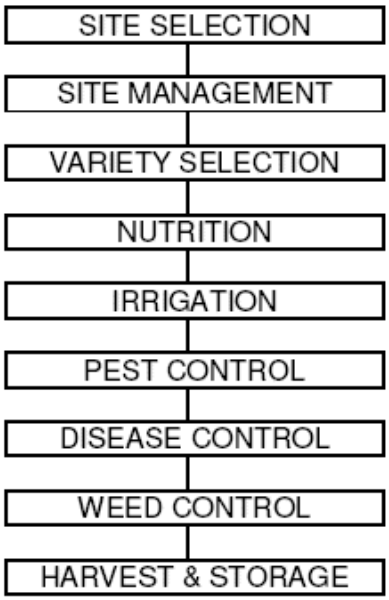
For pesticides on-label, only active substances are shown.

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 this 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.

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3 Site selection

3.1 Site history

3.1.1 Site selection

Sites which are not prone to frost, but have good shelter from the prevailing winds, are recommended for raspberry production. The latter is particularly important for tall-caned summer-fruiting varieties, e.g.. Tulameen, Glen Ample, Leo, Cowichan, Cascade Delight, Glen Doll and Glen Magna the primocanes of which can be prone to rocking or even breaking in the wind. Autumn-fruiting crops especially Joan Squire and other varieties with canes which are tall or with a spreading habit should be provided with cane support, so that the primocanes, foliage, flowers and fruits are not vulnerable to rocking and rubbing in the wind.

Open field grown summer-fruiting raspberries flower from mid May into June. Severe spring frosts, which normally occur in April and early May, in the past only occasionally directly, damaged open flowers. However, bud break and lateral shoot extension of many summer fruiting raspberry varieties notably Glen Moy, Glen Lyon, Malling Juno and Tulameen, but also in some years Glen Ample can occur in late March or early April. Rendering them vulnerable to damage by cold winds and frost, resulting in serious crop loss. Likewise the flowers and fruits of autumn-fruiting raspberries can be damaged by early autumn frosts in September or early October, causing crop loss and a marked shortening of the harvest period.

Injury to fruiting cane in the autumn, winter and early spring can also occur when there is a prolonged, or a sudden very cold, period following mild weather. Fruiting canes can be particularly vulnerable to cold injury in plantations located in low-lying frosty situations or where the site is very exposed to cold penetrating winds. The immature primocane of open field summer fruiting raspberries can be particularly susceptible to damage by the first severe autumn or early winter frost. If they have been protected throughout the summer and into the early autumn months by polythene clad tunnels, to attain the required number, height and thickness of primocane, in order to be suitable for early crop production the following late spring and early summer.

Wind and frost damage in the spring and autumn can lead to increased risk of fungal disease attack of flowers and fruits especially by *Botrytis*. This will inevitably necessitate the increased usage of suitable fungicides.

The planting of new raspberries adjacent to old established aphid or pollen-borne virus infected plantations i.e. Raspberry Leaf Spot Virus (RLSV), Black Raspberry Necrosis Virus (BRNV) or Raspberry Bushy Dwarf Virus (RBDV) should be avoided. If possible also isolate summer-fruiting raspberries from autumn-fruiting cultivars and black or hybrid berries in order to reduce the risk of virus incidence and/or spread of the latter virus.

Fields adjacent to areas known to contain wild *Rubus* spps should also not be used for raspberry production. If possible land should not be re-used for Raspberries where the presence of Raspberry root rot *(Phytophthora fragariae var. rubi*) has been confirmed.

The above comments also apply to black and hybrid berries; in the case of the latter, Tay and Loganberry are particularly prone to flower and lateral damage by frost in the late winter and early spring prior to and during the blossom period.

With the exception of the varieties e.g. Silvan, Kotata, Black Bute, Loch Tay and Helen, most blackberries flower somewhat later than summer fruiting raspberries and are therefore not usually so vulnerable to frost.

All plantations of black and hybrid berries will only thrive if they have adequate shelter against the prevailing winds, especially those from the north and northeast during the winter and south and southwest in the summer and autumn months. Considerable fruiting cane loss will be experienced if plants are regularly exposed to cold wind each year during the dormant and the early spring period.

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Fortunately, Tay and most, but not all, blackberries appear to be immune to infection by raspberry root rot, however, Loganberries are susceptible, so should not be planted on land where the presence of this disease has been confirmed.

Most raspberries and particularly black and hybrid berries are prone to Crown gall infection so sites should be avoided where this bacterium is known to be present in the soil. Only cane fruit plants free of infection by this disease should be planted.

In summary, it is **strongly recommended** that when selecting fields for cane fruit production, that the soil structure, drainage, texture, pH, depth, exposure of the site to prevailing winds, susceptibility to spring frost, presence of soil borne pests and diseases and proximity to other infected *Rubus* crops are considered.

3.2 Rotations

Ideally the planting of raspberries and other *Rubus* crops should follow arable crops where there has been time to eradicate perennial weeds and the risk of the presence of free-living nematodes with the exception of *Pratylenchus* is likely to be low.

Former grass leys or permanent pasture sites can be suitable provided that they are free of perennial weed or adequate time pre-planting is allowed for their effective control and they are not infested with the larvae of insect pests i.e. wireworm, leather jackets or cockchafers.

Avoid sites where volunteer crop weeds are likely to be present (e.g. potatoes or oilseed rape) or a very late autumn harvest of the previous crop took place (e.g. silage maize, potatoes or sugar beet) where as a consequence soil conditions are likely to be poor. The risk of damage to cane fruit crops, from residues of the herbicides used upon previously grown crops crop, that may be still be present in the soil at the time of planting, should be established. So that if necessary planting can be delayed or a alternative planting site sought, so as not to impede or prevent raspberry plant establishment. As a precautionary measure details of the previous residual herbicide usage of sites should be sought to ensure that no injurious residues are likely to be present. Sites previously used for some arable root crops e.g. sugar beet or vegetables, which may as a consequence have become infested or infected with free-living nematodes and/or bacterial crown gall and should be avoided.

Some blackberry cultivars notably Loch Ness and raspberries, generally primocane fruiting varieties e.g. Joan Squire have, been found to be susceptible to infection by the soil borne disease *Verticillium dahliae*.

Sites where the level of soil infection by this disease is known to be high, following potato, runner beans, linseed, strawberry or other susceptible crop production may not be suitable therefore for the planting of some *Rubus* crops.

In all cases the soil must be checked for the presence of free-living nematodes prior to planting in order to determine fully the site suitability for the crop. When the planting of cultivars known to be susceptible to *Verticillium wilt* is envisaged, pre-planting the level of propagules of this disease in the soil should be determined.

If the re-use of an old raspberry or blackberry site is unavoidable, then at least 3 years should elapse between the grubbing up and planting of the new plantation. In order to minimise the risk of residual herbicide residues damaging the new plants; to correct any soil nutrient, pH, structural and drainage deficiencies, to fully eradicate plants of the previous crop and also any deep rooted perennial weeds. The establishment for at least one year of a grass ley prior to planting would also help to improve the soils organic matter status prior to replanting land with *Rubus* crops.

Where significant numbers of one or both of the species of free living nematodes are detected that could act as vectors of some of the viruses of cane fruit crops i.e. *Longidorus* or *Xiphinema*, partial sterilisation of the soil

using, 1,3-dichloropropene, methyl bromide or dazomet may be required pre-planting. In the case of *Longidorus* and *Xiphinema* this should be followed respectively by periods of at least 6 months or 2 years during which the land is bare fallowed to allow any surviving nematodes to relinquish their virus load.

Where large numbers of *Xiphinema diversicaudatum* have been identified, the use of a nematocide followed by 2 year bare fallowing of the site is likely to prove inadequate to rid all of the remaining nematodes of their viral load. Sites so affected are unsuitable for planting with Rubus crops.

If only *Pratylenchus* species are detected the use of *Tagetes patula* or *T.erecta* as a break crop in the year prior to planting *Rubus* can be considered as a means of substantially lowering the numbers of this nematode, which could otherwise potentially cause serious direct feeding damage to the roots of these crops. If wireworms are found to be present in the soil prior to planting, in numbers which are likely to cause damage to the roots of *Rubus* crops, the use of a brassica break crop e.g. Caliente Mustard, should be considered to rid the soil of this insect. This crop contains a high level of glucosinolates and the enzyme myrosinase, which once incorporated into the soil generate methyl isothiocyanates.

If *Rubus* crops are to be in areas previously occupied by strawberries or blackcurrants infested by vine, strawberry root or clay coloured weevils, the planting of the *Rubus* crops should be delayed for at least one and preferably 2 years, during which period cereals are grown or the land is bare fallowed.

The planting of *Rubus* crops adjacent to known, seriously weevil infested plantations, soft fruit including *Rubus* crops should be avoided.

4 Site management

4.1 Soil mapping

See Generic Standards and/or Generic Guidance Notes.

4.2 Soil management

Soil type

Raspberries, black and hybrid berries will not tolerate poor or impeded drainage. Even temporary water logging can be disastrous. It is essential therefore to select well-structured soils for successful crop production. A deep well-drained sandy loam of good water holding capacity and well supplied with organic matter is the most suitable. Many deep loams and sandy soils can also give good results, provided that they have in the case of the former good drainage and the latter adequate natural water reserves or water can be provided by the installation of irrigation. In the case of sandy soils they should, also not be prone to erosion, by either the wind or water.

Clay loam and silty clay loam soils have also been used for raspberry production but require very careful management in order to avoid their compaction, poor aeration or problems with drainage. The planting of each crop row on a narrow bed or ridge can also help in this situation, by improving the depth of well drained soil that the plants are growing in. Heavy clay soils are generally unsuitable for cane fFruit production and must be avoided.

Naturally slow draining soils are ideal for the spread and development of raspberry root rot but even plantations located on light sandy soils can become seriously affected by this disease. Especially when the rows run down a slope, allowing the disease to spread readily in soil water from the top to the bottom of the field.

Avoid planting *Rubus* crops in fields where the soil contains free-living nematodes, which not only cause direct feeding damage to the root system of plants i.e. *Pratylenchus sp* but also, in some cases, act as virus vectors i.e. *Longidorus* and *Xiphinema*.

Black and hybrid berries are also intolerant of poor soil conditions and sites where there is a risk of prolonged water logging during the spring and autumn months. Which could kill roots, greatly reduce cane vigour and cropping potential as well as being 'conducive' to crown gall infection. The use of land of this type should always be avoided for *Rubus* crops.

All *Rubus* crops prefer a neutral to slightly acid pH. A pH 6.5 is ideal. Soils, which have a naturally high pH or have been inadvertently over limed or contain a high % of free calcium carbonate, are unsuitable for these fruit crops, as they are likely to induce deficiencies of manganese and iron (which will be difficult if not impossible to correct effectively).

Conversely, although these crops will tolerate acid soils if the pH is 6.0 or below, it should be raised prior to and maintained at 6.5 post planting.

4.3 Soil sterilisation

It is strongly recommended that this technique be avoided unless it is absolutely necessary and justifiable (See Generic Standards 4.3). It is however accepted that this is not always possible and soil sterilisation pre-planting may be required where

1. Free-living nematodes have been identified which could act as virus vectors, or if present in high numbers cause serious root damage
2. The re-use of land previously planted for raspberries cannot be avoided and the presence of *Phytophthora* root rot has been confirmed
3. When susceptible *Rubus* cultivars are to be planted in sites where the number of propagules *Verticillium* wilt in the soil are known to be high, and no suitable alternative planting site is available.

In all cases the soil must only be sterilised where a known pest or disease risk has been identified and not solely for the purposes of weed seed elimination. Dazomet, metham sodium, chloropicrin, 1, 3 dichloropropene or steam could be used prior to raspberry planting, the actual choice depending upon the nature of the problems present. It should however be noted that although in some circumstances still permitted the use of methyl bromide pre-planting of cane fruit crops is now severely restricted.

It should be appreciated that in the majority of cases such treatments will only partially eradicate the problem, merely reducing levels to an extent that initial crop establishment will be successful.

Inevitably in the case of *Phytophthora* root rot partial soil sterilisation pre planting will need to be accompanied by routine fungicide applications, annually for the life of the crop.

Further details are provided in Appendices 2 and 3.

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

Planting material

For successful *Rubus* crop production it is vital to plant stock that is virus-free and has a high general health and quality status and preferably has been certified under the Plant Health Propagation Scheme (PHPS) or a comparable and recognised scheme. The planting of cane derived from or from stock grown in close proximity to fruiting plantations or those of an unknown health status or which do not have an EU plant passport is not recommended. Plants being raised by growers for their own use should also be of the highest health status and preferably certified under the PHPS.

It is strongly recommended that when purchasing *Rubus* plants, those of the highest possible health status and preferably certified material, are obtained. Also that the plants are checked prior to, during or at least on arrival at the planting site to make sure that their quality meets the specification for which they are intended. (See Generic Standards 5.4.2 and 5.4.3)

Where growers require assurances from propagators that plants have been raised within the auspices of the Assured Produce Scheme, they should request an Assured Produce verification number from their propagator.

The roots and canes of planting stocks should be free of Crown gall and where 'long canes' of summer fruiting raspberry varieties are purchased, for early or late crop production under polythene or glass structures, the plants must be:

- Intact
- A minimum of 1.5 m in height
- Each cane have at least 20 potential fruiting nodes (buds) above 50 cm from ground level
- And should have a substantial structural and fibrous root system.
- The canes should be free of fungal infections i.e. *Botrytis* , spur blight, cane spot and cane blight. Damage to the cane rind and underlying tissue, produced by the feeding of raspberry cane midge larvae, or produced by mechanical damage during the lifting, grading or transport of plants also should not be present.
- Finally the majority of the fruiting nodes and especially those on the canes above 50cm should be intact and not damaged or destroyed by inappropriate handling during the lifting, transportation or storage of the canes.

In all cases the plants must not be desiccated or the root systems of the canes so small or weak that successful and rapid plant establishment is unlikely to be possible.

Where plants derived from micro-propagation, root or shoot cuttings grown in soil less compost in modules or small pots are being used for the establishment of raspberry and blackberry plantations for protected and open field cropping. These being planted into the border soil or pots under glass or other protection in May - July or the open field in May or June, the canes grown on from these plants crop during the following spring or summer, as appropriate. At the time of planting these plants must be of sufficient size (i.e. at least 0.25m in height), have a well established root system but not pot bound, be free of pests and diseases and if planted directly into the open field be sufficiently hardened off to survive.

Extended season production

In the open field, using a range of summer and primocane (autumn) fruiting varieties, it is possible to produce raspberries from late June or early July until the first substantial late autumn frost, a period of 14 - 18 weeks.

In the field some manipulation of cropping may be carried out to delay the harvest of summer fruiting varieties until the late summer or early autumn, by the annual planting of ex-cold stored, specially prepared 'long cane' in May (e.g. Tulameen, Octavia and Glen Ample). These plants cropping 60-90 days later according to the

variety used, weather conditions pertaining, method of plantation management used, etc, and are either grubbed post fruiting or left in position to return the year after planting to normal season production.

In addition, an extension of the harvest period for open field growing autumn fruiting (primocane) raspberries can be achieved by annual planting or staggering primocane production from established plants.

In order to advance harvest after the cutting out at ground level and the removal from the crop rows of fruited cane in late January. Polythene clad tunnels are placed in the early spring over the plantation and the soil surface of the crop rows and alleys covered with floating fleece, to encourage early primocane emergence and its rapid growth. As the risk of frost decreases and the daytime temperatures increase, the fleece is removed, the plants being protected by the tunnels alone from then onwards, until the late autumn or the end of harvest.

Or the plantation may be covered i.e. protected by polythene-clad tunnels from, just prior to flowering onwards, again to advance harvest.

To delay harvest the first 'flush' of primocane to be produced by the plants in the early spring may be removed and cropping restricted to later 'flushes' of cane.

Or the crop may be merely protected from the weather by covering with tunnels from the onset of harvest in late July/August. Fruit can then continue to be harvested until late October or even mid-late November in most years

Further manipulation of the UK harvest period has become possible by providing summer-fruiting raspberries with all year round protection under glasshouse or polythene clad structures. The plants are grown in pots, bags or troughs containing soil-less i.e. peat-based compost or other suitable substrate or planted directly into border soil.

Heating to advance the crop and for frost protection is necessary for very early crop production in March, April and May. Late May and early June harvested fruit is obtained from crops protected by glasshouses or fixed polythene clad tunnels, which are unheated or can be heated merely to provide frost protection. Or, by the covering of field-grown raspberries with mobile glasshouses or temporary polythene tunnel structures from late February/early March until the end of harvest. In the case of the field grown crops, post-harvest the covers are removed and the plants returned to open field management.

The floricanes of all summer fruiting raspberry cultivars require a period of chilling in order for them to break dormancy. Without sufficient chilling the canes will completely fail or only partially break bud. The chilling requirement of cultivars can vary greatly, with cultivars such as Glen Moy, Georgia and Glen Lyon requiring far less than Tulameen or in turn Glen Ample. It may impossible in some parts of the UK for some or all of these cultivars when grown under AYR protection to receive sufficient winter chilling during the late autumn/winter months for their floricane to break bud.

Where this is the case, it may be necessary to remove plants from the glasshouse in November and to place them in a cold store at a temperature of 4°C to -2°C for an appropriate length of time to provide them with their winter chilling.

So when returned to the glasshouse in late January or early February, as the temperatures begin to rise, bud break is even down the length of their floricane.

Late season production of raspberries is achieved using either established pot-grown plants or annually planting plants of primocane (autumn) fruiting raspberry cultivars. Or the planting in June/July of ex-cold stored long canes of a summer fruiting raspberry variety i.e. Octavia, Tulameen or Glen Ample. These are either directly planted into the soil or in pots or troughs containing a peat-based compost, housed under mobile or permanent glasshouses and provided with heat or at least some frost protection, so that they can produce fruit from late August/early September until just prior to Christmas.

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Double i.e. autumn followed by late spring/early summer cropping of some primocane fruiting raspberry varieties, is also now practiced by some growers, mainly by those who are growing crops which are provided with AYR protection of a glasshouse or fixed polythene clad structure. Fruit produced on laterals positioned at and just below the tips of current season primocane being picked from mid-late August until November or early December. The canes are then subjected to a period of lower temperatures to induce dormancy and provide the now floricane with their chilling requirements from December until late February/early March, before being cut back to, one or two buds below those, which produced fruiting laterals in the autumn. With increasing day length and temperature, the canes break bud, produce laterals, flower and bear fruit between May and the end of June. They are then cut through at ground level, removed from the crop row and plantation, to leave the current season's primocane left to grow, flower and fruit during the late summer and autumn months.

As raspberry production in the UK, using the above management systems can now span from late April to late December. It is important to note the following when either AYR glasshouse, fixed polythene clad of temporary polythene clad structures are used to advance or delay harvest or merely to protect the crop from adverse weather:

i. Observe all additional operator and crop safety requirements when applying Agrochemicals under protection.
ii. Avoid the air temperature rising above 20°C in these structures. Preferably allow a maximum temperature of no more than 18°C.

Venting or uncovering of the crop should be carried out as soon as this temperature is exceeded. In all cases uncovering or venting is advised to improve pollination and to minimise crop stress when the inside temperature is 18°C or above. High temperatures can encourage the development and spread of raspberry powdery mildew and a rapid increase in the populations of, two spotted spider mite and large raspberry aphid.

A relative humidity of less than 75% should also be maintained within these structures, in order to reduce the spread and development of diseases i.e. cane and fruit *Botrytis* , spur blight and raspberry rust that can thrive where the humidity exceeds this level.

The harvest period of blackberries and to a lesser extent Tay and Loganberries is also extended by the use of various covers over field grown crops i.e. walk-in "French" or "Spanish" tunnels.

The production of early blackberries is also carried out by either planting into the soil, or into pots or troughs placed in the open field and covered by polythene clad 'Spanish' tunnels from late winter/early spring until the end of their harvest. Or, the plants may be grown under all year round protection. In both of these cases these crops are generally merely provided with some form of frost protected.

Fully protected plants, under glass and more permanent polythene clad structures, are normally planted in buckets, troughs or bags containing a soil less compost. The former being hung from the roof so that the fruiting and primocanes trail down towards the floor of the house, readily displaying the fruit to pickers and reducing the risk of cane and fruit infection by disease.

The harvesting of blackberries is now possible from mid May/early June until late November by the judicious use of a range of varieties in the field and by using protection to advance and extend production.

Extension of the Logan and Tayberry harvest is currently achieved by using heated glasshouses or by the covering of field crops to advance the onset of harvest into early June. The open field crops being harvested in July.

The requirements of the protected black and hybrid berry crops including those regarding temperature and relative humidity are more or less identical to those of raspberries. High temperature and relative humidity creating ideal conditions for the spread and development of blackberry downy mildew and fruit *Botrytis*

There is now widespread usage of temporary polythene clad tunnels and structures i.e. 'Spanish tunnels' and 'rain covers' to protect field grown raspberry and blackberry crops during the period from flowering until the end of harvest.

These are not primarily used to advance harvest, but as with summer and primocane fruiting raspberries merely used to protect the crop from adverse weather and to enable harvest to continue no matter what the climatic conditions. This practice can also offer the possibility of reducing some routine pesticide applications, notably for control of some fungal diseases, e.g. fruit *Botrytis*, provided that the climatic conditions within the structures are suitably managed. Their use can however also produce climatic conditions and crop growth ideal for a number of diseases of raspberry e.g. powdery mildew and raspberry rust and in the case of blackberry, downy mildew and favour a range of pests affecting raspberries and other cane fruit crops. These include two-spotted spider mite, the large raspberry aphid and a range of other aphid species that can affect Rubus crops, common green capsid, glasshouse whitefly, tarnished plant bug, western flower thrip, blackberry leaf midge and small raspberry sawfly.

6 Nutrition

6.1 Nutrient requirement

Soil-based crops

Soil analysis must be carried out pre-planting to determine pH, P, K and Mg levels; suitable fertilisers can then be incorporated into the soil before planting the crop. Typical fertiliser recommendations for Raspberries, black and hybrid berries can be found in Appendix 1.

A maximum annual application of 70 to 120 kg/ha of nitrogen (according to soil type) should be observed if applied as a base top dressing for field grown crops. Where fertigation is utilised (i.e. nutrients applied little and often within irrigation water) then this maximum might be increased but only if required for optimum plant growth and yield. Nitrogen applications must be made only after the onset of crop growth each spring and should cease each growing season by the end of August. In order to design a suitable fertigation programme to use, in a specific cane fruit plantation, the water used for the irrigation should be analysed in order to determine, the levels of any nutrients it contains, its pH and alkalinity expressed as total bicarbonate. The rates of nutrients applied by this method may then be suitably adjusted and if necessary the fertiliser solution, acidified to improve nutrient availability to the plants.

Where acidification of the water supply becomes necessary with nitric acid, then the amounts of nitrogen supplied to the plants by the use of this acid must be taken into account when designing and managing the fertigation programme for the crop during its growing season.

If "top dressings" of nitrogen are being applied to summer fruiting raspberries 2 or 3 times during their growing season, then the final application should be made no later then the middle of July. For fertigated *Rubus* crops nitrogen applications post harvest should be kept to a minimum, to avoid increasing primocane susceptibility to some diseases or adversely affecting their winter hardiness.

Fertigation should never be allowed to take soil moisture levels beyond field capacity even for only a short period as this will lead to the leaching of nutrients as well as causing serious root damage.

The soil pH for Raspberries should be maintained at or near to 6.5. Raspberries will suffer from lime-induced micronutrient deficiencies notably of manganese and iron above a pH of 7 for most soils. Foliar and in some cases soil applications of these nutrients can be used to correct these deficiencies, but with varying success.

If the soil pH is significantly below 6, lime as ground chalk or magnesium limestone can be incorporated pre-planting to raise the pH to 6.5. Where the soil is very acidic, part of the lime required should be ploughed down to depth and the remainder applied and worked into the topsoil just prior to planting. The pH at 0-0.15

cm and 0.15-0.30 cm depth should be checked annually along the crop rows and lime applied as appropriate to maintain crop health and vigour. In general it is unwise to use magnesium limestone routinely as the liming source for *Rubus* crops as repeated applications can lead to unacceptable levels of magnesium being achieved especially relative to the soil potassium level.

For fertigated crops annual soil and foliar analysis is essential to determine accurately the crops nutrient requirements. For non-fertigated crops, annual foliar analysis with soil analysis once every 2 or 3 years should suffice.

Where Rubus plants are planted into the soil and protected AYR, by a glasshouse or fixed polythene clad structure, the conductivity i.e. salinity of the soil resulting directly from the application of fertilisers or from the accumulation of residues of liquid feed given in excess to the crops requirements, should be determined. Pre-planting to ensure that the level is not so high that it will severely impede or prevent plant establishment. But also annually, during the crops dormant season, so that if necessary, the amounts of nutrients applied to the soil pre and post planting can be reduced or eliminated accordingly. Or in extreme cases water may need to be applied to leach excess salts from the soil in the rooting zone of the crop.

It is strongly recommended that when making nutrient applications, soil and foliar analysis, soil type and the timing of applications, should be considered to ensure optimum crop response with minimal risk of environmental pollution. (See Generic Standards 6.1.2, 6.1.3, and 6.1.5)

Crops in soil-less media

Nutrition in soil-less growing media should normally be through the irrigation system, but the carefully monitored use of controlled release fertilisers is also acceptable. However it is recommended in all cases where soil less media is employed for Rubus crops, that the pH, level and source of supply of both major and trace elements present in compost, should be known at the time of its supply. Professional advice should be sought as to the optimum pH and levels of nutrients required as 'base' fertilisers for a specific compost and for the fertiliser programme to be used post planting. This to include the programme of applications to utilise and the monitoring methods that need to be employed for specific protected cropping regimes.

It is recommended that in order to design a suitable fertigation programme to use for in-substrate grown crops, that the water used for irrigation should be analysed. To determine, the levels of any nutrients including trace elements it contains, its pH and alkalinity expressed as total bicarbonate. This will enable the rates of the individual fertiliser components of each feed to be suitably adjusted to take account of any nutrients present in the water source and for the feed to be where necessary acidified to improve nutrient availability to the plants, to avoid nozzle blockage and to prevent an unacceptable rise or lowering of compost pH. As with soil grown crops where acidification of the water supply becomes necessary with nitric acid, then the amounts of nitrogen supplied to the plants by the use of this acid must be taken into account when designing and managing the fertigation programme for the crop.

7 Irrigation

Adequate soil moisture is essential to give satisfactory initial plant establishment, even growth, adequate fruit numbers, size of berries and yield of fruit in subsequent years.

For most soil types and in the majority of seasons irrigation is essential to ensure adequate and quality fruit production for mid and late summer harvested raspberry plantations. It is also vital for all crops in order to obtain adequate primocane (spawn) growth for good crop production in the following year.

Irrigation requirements should be planned using soil moisture monitoring devices such as a neutron probe or tensiometer or a scheduling system used to forecast future irrigation requirements.

Irrigation is vital where biennial cropping of raspberries, black or hybrid berries is being practised and is essential for all protected crops.

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Soil moisture during planting

The roots of raspberry plants are very susceptible to drought and great care must be taken to ensure adequate soil moisture pre-planting especially in the spring and early summer months. Raspberry and other *Rubus* planting stocks must also be handled carefully and protected from dehydration between lifting from propagation (viz. the spawn bed) and planting in the fruiting field. This is particularly important for ex-cold stored long cane for planting in the field or under cover in the late spring/early summer months.

Establishment

Irrigation will be required for winter-planted, protected crops that are containerised in soil-less compost or grown in border soil from early March i.e. soon after bud break onwards.

In most seasons except where the soil texture is predominantly sand, or the crop planted into a polymulch covered raised bed irrigation should not be necessary until mid-late spring for field grown, winter or early spring, planted crops. However, from early to late May onwards there will undoubtedly be periods when the application of water via overhead or trickle lines would enhance primocane production and height.

In trials, considerable benefit has been obtained from the use of irrigation during the establishment and subsequent seasons. The availability of irrigation from planting onwards is vital for late spring/early summer field planted crops.

The application of irrigation to field grown crops of summer fruiting raspberries after the middle of September is usually unnecessary and potentially undesirable due to the risk of encouraging late season cane production and reducing the frost-hardiness of primocanes. Black and hybrid berry stocks supplied as bare root or pot grown plants will also require irrigation during the spring and summer establishment period.

Cropping

The application of water, via trickle lines of adequate longevity, laid along each crop row should be used in preference to overhead applications.

Overhead applications are wasteful; invariably damage flowers and fruit if carried out just prior to or during harvest, and encourage infection by and the spread of fungal pathogens such as fruit and cane *Botrytis,* cane spot, spur blight, cane blight, *Cladosporium, Penicillium, Rhizopus and Mucor* .

8 Crop protection

8.1 The basic approach to crop protection

8.1.1 Non-chemical methods

See Generic Standards and/or Generic Guidance Notes.

8.1.2 Integrated crop management

8.1.2.1 Introduction

The predominant aim is to minimise pesticide inputs and to prevent rather than to cure. An integrated approach must be adopted to achieve this involving the following management steps.

Good management and planning

a. *Careful site selection to avoid potential or previous pest problems thereby enhancing plant health.*
b. *Sensible crop rotations to avoid the build up of problems.*
c. *The use where possible of resistant cultivars which also meet the required fruit quality parameters and eating requirements of market outlets.*

Cultural preventative techniques

a. *Good crop and field hygiene.*
b. *Promoting plant health by maximising nutrient availability through the routine use of soil and foliar analysis and accurate fertiliser application to avoid excesses and deficiencies.*
c. *By utilising irrigation as a control measure wherever appropriate and feasible.*
d. *By ensuring effective primo and fruiting cane management throughout the growing season of the crops as appropriate to the Rubus crop in cultivation.*

Corrective action

If the above fails to prevent or control pests the following approach should be adopted:

a. It is strongly recommended that the need to take corrective action should be based upon the regular monitoring of crops with reference to thresholds (where established). The effect of prevailing weather conditions should also be considered.
b. Where corrective action is required, biological and natural methods of pest and disease control, if available must be considered first.
c. If chemical control is needed, the following points must be considered, whilst ensuring effective control is achieved:

- Use the product most selective to biological control agents and naturally occurring beneficial organisms.
- Use the minimum effective dose rate.
- Use appropriate application methods with correctly maintained equipment, utilising spot treatment whenever possible.
- Use the least environmentally toxic and persistent product.
- Apply crop protection chemicals in a way that minimises the risks of environmental pollution.
- Aim to minimise the risk of the presence of pesticide residues in the crop at harvest - See Generic Guidance Notes.

8.1.2.2 Cultural control

Site selection

Avoid planting Raspberries, black and hybrid berries in soils known to be infested by free-living nematodes, or other soil pests such as wingless weevils e.g. Vine and clay coloured weevil, wireworm, or leatherjackets.

If possible also avoid sites adjacent to large areas of wasteland or set aside land where thrips, blossom weevils, tarnished plant bugs and other species of capsid are likely to be a problem. Hedgerows and areas of woodland containing a large population of wild *Rubus* can also pose a threat to raspberry plantations planted near to them. Due to the likely presence of aphid vectors of *Rubus* viruses e.g. Raspberry leaf spot virus (RLSV), Black raspberry necrosis virus (BRNV) and the potential transfer of pollen-borne Raspberry bushy dwarf virus (RBDV) from wild to cultivated crop plants by pollinating insects.

Avoid planting on very heavy or poorly drained soils especially those prone to water logging. The prolonged presence of free water will not only cause root asphyxiation but also enable the rapid spread of *Phytophthora* root rot to take place. Steeply sloping sites where the soil surface could be prone to water erosion should also be avoided, as again they can offer ideal conditions for the movement of *Phytophthora* from one end of a row to the other.

Do not plant Raspberries, black or hybrid berries on soils known to have high levels of soil-borne disease innoculum present, e.g. *Phytophthora* and *Verticillium* wilt.

Avoid planting primocane (autumn) fruiting raspberry varieties (especially Autumn Bliss or Joan Squire) and Loganberries immediately adjacent to main season summer fruiting raspberry varieties that could act as sources of infection of RBDV to which these varieties have no immunity.

If possible, avoid planting new raspberry, black and hybrid berry plantations adjacent to old *Rubus* crops. Which are heavily infected by diseases and could easily act as a source of infection for diseases such as *Phytophthora* root rot or the cane diseases, cane spot, or *Botrytis* or in the case of blackberries, purple blotch or downy mildew. This is particularly important when planting varieties, for marketing reasons which have little immunity/resistance to disease e.g. Glen Ample, Glen Moy, Glen Lyon, Tulameen, Joan Squire, Caroline, Polka.

Avoid locating all *Rubus* crops on sites prone to frost or those very exposed to prevailing winds as frost and/or wind damage of canes, foliage, flowers and fruits can provide entry points for fungal spores, e.g. *Botrytis*, infection of frosted flowers.

Rotations

Soil-borne pests such as nematodes, vine weevil, etc, are less likely to become a problem with the use of a good crop rotation.

Phytophthora spp. produce very resistant resting spores which have considerable longevity in the soil, so the utilisation of a specific rotation of Raspberries with other fruit or arable crops is unlikely to be beneficial therefore in reducing the potential impact of this disease.

The use of suitable arable crop rotations and or the fallowing of land may however be used to reduce the presence of some nematode species, and the viruses they can carry, prior to planting or replanting raspberries on a specific site.

Varietal choice

Some summer and primocane raspberry varieties possess the A10 gene. This has until recently conferred effective resistance to the feeding of the most common races of the main aphid borne virus vector of raspberry i.e. the large raspberry aphid, *Amphorophora idaei* Leo, Autumn Bliss, Octavia, Malling Juno, Glen Rosa, Malling Minerva, Malling Hestia and Glen Doll and Glen Fyne possess this gene.

Unfortunately, there is evidence that this resistance may no longer be fully effective and/or new strains of this aphid species are present in plantations in at least some parts of the UK, which are able to feed successfully on A10 cultivars. How widespread or how effective these additional strains of large raspberry aphid are is as yet undetermined.

Before planting, growers must determine the susceptibility of varieties to this pest and, if possible, utilise varieties with A10 or similar resistance. If this is not possible then they should devise an effective monitoring and control regime for this pest.

The rind of the primocane of some raspberry varieties readily splits as the canes grow e.g. Glen Moy, Glen Lyon, Tulameen, Autumn Bliss, Joan Squire and Himbo-Top, offering egg-laying and larval-feeding sites for raspberry cane midge. The resultant damaged cortical tissue of the canes being susceptible to infection by cane blight. This can be exacerbated where primocane emergence and growth is advanced and prolonged by providing crops with protection, AYR using a glasshouse or fixed polythene clad tunnel or even temporary protection under Spanish tunnels. Or if the primocanes are damaged by spring frosts, by inappropriate pesticide or herbicide usage or mechanically damaged by machinery utilised for spraying, mowing or other

cultivation works within the plantation. Physical damage to the rind of primocane can leave all raspberry cultivars vulnerable to attack by this pest and disease.

When deciding upon which variety to plant for this type of cropping, its susceptibility to this pest should be considered and either cultivars utilised whose canes do not split readily or a cane management, pest monitoring and control strategy designed which will prevent this pest from causing crop damage.

Currently no resistance exists to prevent infestation of raspberry, black or hybrid berries by any of the other major pests that can affect them.

Raspberries, black and hybrid berries vary in their susceptibility to the major cane and foliar diseases that can afflict them.

These resistances/tolerances in the main are well documented and this data should be used, along with an assessment of the prevailing climatic conditions, to decide when and if spraying will be necessary for their control.

This does not apply to sites where raspberry root rot has been confirmed or for fruit *Botrytis* control as in both cases it will be necessary in the majority of cases to carry out prophylactic spraying for their control.

Irrigation

Plants that are stressed due to lack of water are more susceptible to attack by certain pests such as two-spotted spider mite.

Plants that are suffering from an excess of water are rendered more susceptible to disease. Free water in the soil increases the spread of certain soil-borne diseases, e.g. *Phytophthora*.

Overhead irrigation of the crop can aid the spread and development of spur blight, cane spot, cane blight, purple blotch and 'cane *Botrytis* ', raspberry and blackberry rust, downy mildew and flower and fruit infection by cane spot, *Botrytis,Cladosporium* and other post harvest rots.

Prolonged drought conditions will increase the susceptibility of shoot tips, foliage, flowers and fruits to Powdery mildew infection.

Primocane management

It is strongly recommended that in the case of Summer fruiting raspberries all unwanted primocanes are removed as soon as possible after their emergence and always before they have exceeded a height of 200mm each spring and summer, in order to:

i. Minimise competition between the fruiting and primocanes for nutrients, water and light.
ii. Allow the desired number of primocanes (retained to bear fruit the following season) to develop to their full vegetative and cropping potential.
iii. Aid spray penetration of the crop canopy to achieve effective pest control with minimal pesticide usage.
iv. Reduce the number of potential egg laying sites for Raspberry cane midge.
v. Improve fruit presentation for picking.
vi. Produce a more open, balanced foliage and cane canopy aiding early cane maturity and allowing the canes and foliage to dry rapidly after rain and/or overhead irrigation thereby reducing disease spread and/or development.

Unwanted primocanes can be removed by hand; by hoeing, pulling, cutting (using secateurs) and strimming. Or mechanically by mowing, or by shallow cultivation of the soil, around and between the plants in the rows and across and along the alleys. Preferably by the application; as a carefully directed sprayover the unwanted primocane of a suitable desiccant spray. In all cases the unwanted primocane should be either completely

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removed or killed as quickly as possible.

Care must also be taken to avoid injury to primocane, which is to be retained. Such damage could potentially offer egg-laying sites for raspberry cane midge or for disease infection by cane blight after cutting or hoeing. Except where numbers are excessive, the unwanted primocane can usually be left in the alleys to wilt and decompose. It should not be left in the crop rows.

In some situations the removal of all of the 'first flush' of primocanes produced in the spring can be considered. This will remove many potential egg-laying sites for raspberry cane midge at the time of this pest's emergence from the soil in the early spring. The removal of one or more flushes of primocane produced in the spring may also be required where summer fruiting raspberries are grown under AYR protection. Where the plants are very vigorous and if retained, the early flushes of cane, would compete with and interfere with picking. As well as by the end of their growing season, be either excessively tall, stout or be present in such high numbers as to be unsuitable for cropping the following year.

In the last year of a plantation's life more radical action can be contemplated i.e. the removal of all primocanes as they emerge pre-harvest during the spring and early summer months, in order to maximise the cropping potential of the fruiting canes.

First flush removal may also be appropriate following severe spring frost damage to primocanes, where if retained, they would develop into substandard fruiting cane and/or be very prone to raspberry cane midge attack or cane blight infection. The cane removal must however be carried out promptly, ideally within a few days of the damage occurring, to ensure the maximum response as far as additional fruit production is concerned and so as not to unacceptably delay the emergence of further 'flushes' of additional i.e. replacement primocane. In all cases this practice must only be considered where plantations:

i. Are healthy.
ii. Have adequate or excessive vigour.
iii. Are not suffering from the adverse effects of residual herbicide usage.
iv. First primocane emergence is early; leaving adequate time for replacement cane to be produced and grow so that by the end of the growing season they are of a suitable height and quality.
iv. Irrigation and preferably fertigation is available for the plantation.

Biennial cropping can be considered for some varieties and sites. This enables the complete separation of fruiting and vegetative cane usefully breaking some pest and disease cycles and hence reducing overall pesticide usage.

Biennial cropping of summer fruiting raspberries, black and hybrid berries offers the potential to break the life cycles of several diseases. This includes cane blight, 'cane *Botrytis* ', cane spot, purple blotch, rust and spur blight, the potential source of re-infection, i.e. the fruiting canes, having been removed completely from the environs of the primocanes.

Biennial cropping of raspberries, black and hybrid berries should only be considered where the plantation:

1. Is healthy.
2. Has adequate or excessive vigour.
3. Where irrigation is available.

Preferably, plantations should be planted for biennial cropping, rather than an established annual cropping plantation converted to this regime.

It is **strongly recommended** that all spent fruiting cane is removed as soon as possible after harvest in annual cropping summer fruiting raspberry, black and hybrid berry plantations to reduce the spread of disease from the old fruited canes to the primocanes. In biennial fruiting plantations fruited cane should remain in situ post harvest and should not be removed until after leaf fall and preferably in December or January.

In the case of both annual and biennial managed plantations; primo-and fruiting canes must be cut out at the time of their removal as close as possible to ground level. To minimise the retention of cane stubs in the row, which will not only produce damage by the abrasion of adjacent primocanes on their cut surfaces but also act as a reservoir of cane blight and *Fusarium,* particularly in the case of raspberries. The damage produced by the sharp ends of old fruiting cane stubs upon the rind of primocanes allows entry of these diseases as well as leading to the accentuation of natural cane splitting, producing ideal egg laying sites for raspberry cane midge.

As a method of cane disposal, the spent cane 'prunings' can be pulverised in the alleyways of plantations. Provided that canes are adequately macerated without causing any damage to the canes retained in the crop rows, this practice particularly where the alleys are grassed, should not markedly increase disease incidence within the plantation. The accumulation of such a mulch over the soil's surface may be beneficial on some sites as a means of increasing soil organic matter status and to stabilise the surface of a soil which would otherwise be potentially prone to water erosion. The moisture holding capacity of the soil may also be improved.

Annual nitrogen applications to the plantation may need to be increased appropriately to aid the decomposition of this organic mulch, a process that might otherwise lead to nutrient deficiency of the crop. In addition, heavy soils warm up and dry out more slowly in the spring when covered with a mulch, delaying primocane emergence and fruiting cane bud break. Mulching of the alleyways therefore can delay cropping but also increase the frost risk to emerging primocanes and noticeably reduce the activity of soil-applied residual herbicides.

It is strongly recommended that in the case of Primocane (Autumn) fruiting raspberries all unwanted primocanes are removed as soon as possible after their emergence and always before they have exceeded a height of 200mm each spring and summer, in order to:

i. Minimise cane to cane competition in the crop row for nutrients, water and light.
ii. Allow the desired number of primocanes to develop to their full vegetative and cropping potential (yield and berry size).
iii. Aid spray penetration of the crop canopy to achieve effective pest control with minimal pesticide usage.
iv. Reduce the number of potential egg laying sites for Raspberry cane midge.
v. Improve fruit presentation for picking.
vi. Produce a more open, balanced foliage and cane canopy aiding early cane maturity and allowing the canes and foliage to dry rapidly after rain and/or overhead irrigation thereby reducing disease spread and/or development.

As in the case of Summer fruiting raspberries unwanted primocane, can either be removed by hand, by hoeing, pulling, cutting (using secateurs), strimming, or mowing. Or by shallow cultivation of the soil, around and between the plants in the rows and across and along the alleys, or preferably by the use of a carefully directed application of a suitable cane desiccant. In all cases the unwanted primocane of primocane fruiting cultivars should be either completely removed or killed as quickly as possible.

Care must also be taken to avoid injury to the primocane of primocane fruiting raspberries, which is to be retained. As such damage could potentially offer egg-laying sites for Raspberry cane midge or for disease infection by Cane blight after cutting or hoeing. Except where numbers are excessive, the unwanted primocane can usually be left in the alleys to wilt and decompose. It should not be left in the crop rows.

The removal of all of the 'first flush' of primocanes produced in the spring by Primocane fruiting raspberries is generally inadvisable, unless a delay in harvest is required or the primocane has been very severely damaged by a spring frost.

Integrated control

Integrated control in raspberries, black and hybrid berries includes, cultural, biological and chemical control methods. Its most important feature is regular crop monitoring, which must be carried out either by suitably

trained farm staff or a qualified adviser. This will need to be carried out at least fortnightly and on occasions weekly during the growing season, in order to check for the presence of pests and diseases. Prediction models for pest emergence and to determine the risk of potential crop damage, pheromone and sticky traps used to identify the presence of and to monitor the activity and population of pests should be utilised whenever possible.

Economic thresholds should be observed where applicable. The following tentative thresholds should act as only act as a guide.

1. Large raspberry aphid - one per young or mature leaf on primo or fruiting cane checked. (Control measures should always be employed where raspberry varieties susceptible to aphid-borne viruses are present) e.g. Tulameen, Glen Moy, Glen Prosen, Glen Ample. Monitor (preferably weekly) throughout the crops' growing season from bud break until leaf fall.
2. Two-spotted spider mite - an average of 10 motile mites or eggs/leaf identified on 50 leaves, selected at random for examination across a plantation.

   Check fruiting canes soon after bud burst for the presence of over wintered 'Red' female Two-spotted spider mites (concentrate on but not exclusively checking areas within a plantation where mites were a noticeable problem the previous year).

   Continue to check plants for the presence or absence of mites and their natural predators every week throughout the growing season. If found, monitor population numbers.

   Before introducing predators or spraying to control this pest, take account of the prevailing climatic conditions i.e. whether they are conducive or not for the mites' development.
3. Raspberry cane midge - The timing of sprays for the control of this pest should be based upon the use of either a predictive service. In the case of open field grown raspberry and loganberry crops utilising daily maximum and minimum soil temperatures for the site at a depth of 10 cm above a base level of 4° C to provide the date of emergence for this pest.

   Or for open field and protected crops by, during the spring, weekly, artificially damaging the rind of primocanes, selected at random in the crop rows all of which have reached approximately 15cm in height. Each batch of damaged cane being cut 7 days later and the wounds examined under a microscope, so that the first midge eggs that are laid can be identified. This process being repeated weekly until the onset of the egg laying of this pest has been established or the crop is considered no longer vulnerable to attack.

   Or traps containing the sex pheromone of this pest can be used to detect the date of emergence of adult male midges from the soil in the spring and to monitor the population of this pest within plantations thereafter through the spring and summer months.

   The above methods of determining the date of midge emergence or onset of egg laying, should be used in conjunction with the following to determine when, and if, the plantation should be sprayed:
4.
   1. The stage of primocane development,
   2. The level of cane midge damage within the plantation the previous year i.e. whether or not and how many 'Patch lesions' were found beneath the rind of the primocanes (now tied into fruit) when examined during pruning in the late autumn/winter
   3. The susceptibility to cane midge attack of the variety being cultivated (i.e. does its rind split), and has the cane already been damaged by frost or mechanically so that it is now prone to midge attack.
5. In the case of Raspberry beetle, regular crop inspections pre-flowering of raspberry, black and hybrid berry crops can be used to establish its presence, feeding upon young expanding foliage and flower buds. However, lack of visual detection does not mean that fruit damage will not occur. In the majority

of cases routine pesticide use pre and /or post flowering will currently be necessary in order to ensure a crops freedom from unacceptable fruit damage.

The use of non UV light reflective white sticky traps positioned in raspberry plantations pre-flowering to detect the presence of and to establish a threshold at which spraying for the control of this pest is essential is currently under development.

To date trials experience in Scotland and Switzerland suggests that control measures for this pest will be required when catches are in excess of 5 beetles/trap or where the fruit is destined for fresh and 20/trap for processing crop sales.

Research is continuing to determine and enhance the reliability of these traps by the addition of flower volatiles attractive to raspberry beetle. So at present growers should become accustomed to their use, but not rely solely on them, when determining when or if to apply pesticides for the control of this pest.

At the present time integrated control opportunities are very limited for the diseases of *Rubus* crops. However, there are several important guidelines that should be adhered to:

i. There are no biological control methods for fungal diseases recommended in this protocol. However, the cultural controls outlined in Section 4.2 should be carefully observed.
ii. Currently, several diseases generally require prophylactic fungicide treatments in order to ensure control. However, there are other fungal diseases that only require fungicide or other treatment after the disease has been observed in the plantation or known to be present in the soil. Note the listings in Section 4.2 and do not apply prophylactic chemical treatments exclusively for control of pathogens listed under "non-prophylactic".

Biological control

Predatory and parasitic organisms are available to control a wide range of pest problems in horticultural crops. In many cases, they are the most effective and economic choice. At present in *Rubus* crops there are several commercially available proven biological control organisms. *Phytoseiulus persimilis*, for the control of Two-spotted spider mite, *Amblyseius cucumeris* for Raspberry leaf and bud mite and for tortrix caterpillars *Bacillus thuringiensis* var *kurstaki* (see Appendix 4). These should be used as the first choice for both outdoor and protected cropping. *Amblyseius californicus* can also be used for Two-spotted spider mite control but currently only on crops that are grown under AYR protection.

For protected crops of Raspberries and Blackberries the parasitic nematodes *Heterorhabdites megidis* has also been successfully utilised for vine weevil control where crops are containerised and growing in a peat or peat/bark-substrate. *Steinernema kraussei* can also be employed to kill the larvae of this and other root weevils e.g. clay coloured weevil, affecting protected, both in soil and substrate grown crops. In addition the significant cold tolerance of this nematode species indicates that it might also be used to provide some control of these pests in open field in soil grown crops.

For soil grown protected crops the introduction of chickens into the crop pre-fruiting (at the time of adult weevil emergence from the soil) and post harvest has provided useful control of both adult and larval stages of this pest.

Before doing this however it may be necessary to obtain permission from the market agent who will be used for the distribution and sale of the fruit.

In addition *Feltiella acarisuga* (*Therodiplosis persicae)* is used for Two-spotted spider mite and *Amblyseius cucumeris* for Raspberry leaf and bud mite and Blackberry (Red berry) mite control and against thrips, an increasing problem in protected and field grown *Rubus* crops and especially blackberry and autumn (primocane) fruiting raspberries.

For aphid control *Aphidius ervi, Aphidoletes aphidimyza, Aphelinus* abdominalis and *Chrysoperla carnea (*green lacewing) have been used with varying success to provide control of some aphid species affecting raspberry crops grown all year round (AYR) under glass or permanent polythene clad structures.

Glasshouse whitefly (*Trialeurodes vaporariorum*) has become a common pest affecting many AYR protected raspberry crops, for its control the parasitic wasp *Encarsia formosa* has been used with mixed results.

In both outdoor and protected *Rubus* plantations, the encouragement of naturally occurring predators e.g. *Typhlodromus pyri, Amblyseius finlandicus,* and *Anthocoris* is essential in order to minimise chemical usage and maintain crops free of injurious pests for which there are currently few, if any, chemical control methods.

Progress on the use of biological control organisms is proceeding rapidly and it is the responsibility of all growers to remain in touch with these developments.

8.1.2.3 Chemical control

Chemicals should only be used as part of an integrated pest and disease management programme. Regular monitoring of raspberry crops must be undertaken at least every two weeks throughout the growing season and a written record must be kept of observations made and subsequent recommendations.

Before applying fungicides ensure that you use the product, which is safest to the environment, natural predators and introduced biological control organisms as well as being efficacious for the particular disease concerned. It is strongly recommended that fruit and cane disease control programmes, are designed to minimise the risk of the development of disease resistance to pesticides. (See Generic Standards 8.2.3)

Where chemical control is being employed sprays must not be allowed to come into direct contact or to drift into field margins, into ditches, lakes and watercourses.

Be aware of any 'Buffer zone' restrictions, which may appertain to some pesticides. The restrictions relate to the proximity of a watercourse, the type of spray applicator being employed, the chemical product and rate being applied.

- As a general guide the "no spray Buffer zone" for tractor mounted/drawn hydraulic sprayers is 5 m, and for hand held sprayers 1 m from the top of the bank of the watercourse.
- For dry ditches, a 1 m Buffer zone measured from the top of the bank in all cases should be used.
- This applies to all pesticide products listed in Category A.
- For any product listed in Category B, a 'local-environmental risk assessment for pesticides' (LERAP) can be carried out to ascertain whether the Buffer zone can be reduced.
- A written record of any calculations carried out must be kept for future reference.
- For Broadcast air assisted applications the no spray "(Buffer) zone" width for Category A pesticide products is generally greater i.e. 18 m and in some cases even wider due to the increased potential for pesticide drift possible by this method of application. LERAPs for Broadcast Air-assisted sprayers can now be undertaken (see below and Generic Guidance Notes 8.5.5).
- Before applying pesticides check to see if they are subject to "Buffer zone restrictions".
- Always refer to the DEFRA/PSD publications "Local Environmental Risk Assessments for Pesticides

  A practical guide" (published 1999).
  Horizontal boom sprayers (published 2001)
  Broadcast air-assisted sprayers (published 2002)

If a product is to be used under the terms of a SOLA, the relevant "Notice of Approval" document must be obtained and read before applying the product. At all other times abide by all label restrictions.

Pest	Active ingredients
Aphid	chlorpyrifos, pirimicarb, (SOLA's for use on blackberry & Rubus Hybrids), nicotine, pymetrozine (1) , thiacloprid rotenone(1), bifenthrin (1) (when used for Vine weevil control), lambada-cyhalothrin(1) (when used for capsid or clay coloured weevil control), pyrethrins
Capsid	deltamethrin, thiacloprid (1), nicotine and chlorpyrifos (when used for raspberry beetle control), lambada-cyhalothrin(1), bifenthrin (1) (when used for Vine weevil control)
Caterpillar	chlorpyrifos and deltamethrin (when used for raspberry beetle control), bifenthrin (1) (when used for Vine weevil control), *Bacillus thuringiensis* var kurstaki (SOLA for use on blackberry & Rubus Hybrids), pyrethrins
Leafhopper	chlorpyrifos (when used for Raspberry Beetle control), thiacloprid (1) (when used for aphid control), bifenthrin (1) (when used for Vine weevil control), lambada-cyhalothrin (1) (when used for capsid or clay coloured weevil control)
Spider mite	chlorpyrifos, clofentezine (1) , tebufenpyrad (1), bifenthrin (1) (when used for Vine weevil control), abamectin(1)
Raspberry beetle	chlorpyrifos, (SOLA's for use on blackberry rotenone) deltamethrin, (SOLA's for use on blackberry), thiacloprid (1) (when used for capsid control), bifenthrin (1) (when used for Vine weevil control)
Raspberry cane midge	chlorpyrifos
Scale insect	deltamethrin, (when used for raspberry beetle control), thiacloprid (1) (when used for aphid control)
Raspberry bud moth	None recommended
Raspberry sawfly	deltamethrin, chlorpyrifos, rotenone (when used for control of other pests), thiacloprid (1) (when used for aphid control), bifenthrin (1) (when used for Vine weevil control)
Nematodes	1, 3-dichloropropene
Damaging vertebrate animals and birds	aluminium ammonium sulphate, ziram
Slugs and snails	metaldehyde, ferric phosphate, copper silicate
Vine and other root weevils	chlorpyrifos, deltamethrin (when used for Raspberry beetle control)), thiacloprid (1) (when used for aphid control), lambada-cyhalothrin(1) ,bifenthrin (1)
Glasshouse whitefly	dodecyl phenol ethoxylate, natural plant extracts ,bifenthrin (1) (when used for Vine weevil control) thiacloprid (1) (when used for aphid control)

Notes:

(1) Specific off-label approvals (SOLA's) only

Consider the guidelines laid down in Section 8.1.2, note that prophylactic treatments are only acceptable for control of *Botrytis* rot, of fruit, 'Cane *Botrytis* ', Cane spot, Spur blight (where cultivar susceptibility has been recognised) and *Phytophthora* root rot where confirmed on the farm.

The prophylactic use of fungicides for field grown raspberries for the effective control of cane spot, spur blight, *Botrytis* and powdery mildew is acceptable where a cultivar or cultivars are known to be susceptible to and the weather conditions are conducive to infection and development of these diseases or to protect primocane from infection by cane blight where there has been considerable fruiting cane loss to this disease during the current growing season. It is also appropriate on black and hybrid berries for control of *Botrytis* , purple blotch, spur blight, downy mildew and cane spot according to each cultivar's recognised level of susceptibility to these diseases.

For protected cropping the appropriate management of the environment within the polythene clad or glasshouse may significantly reduce or even mitigate the need to routinely apply fungicides for at least some or even the majority of these diseases.

Fungicides should only be used to control *Phytophthora* and rust if the disease has already been identified in

the crop or a risk has been identified due to problems in preceding crops and/or adjacent crops.

Disease	Active ingredients
Botrytis (fruit rots)	iprodione, thiram (SOLA for use on blackberry & Rubus Hybrids), pyrimethanil (1) ,fenhexamid, azoxystrobin (1) (when used for Powdery mildew control)
Botrytis (cane disease infection)	iprodione, chlorothalonil, thiram, (SOLA for use on blackberry & Rubus Hybrids), fenhexamid, pyrimethanil (1) , carbendazim (1) (when used for Cane blight control), azoxystrobin (1) (when used for Powdery mildew control)
Cane blight	carbendazim (1) , tebuconazole (1)
Cane spot	bordeaux mixture, copper ammonium carbonate, copper oxychloride (SOLA for use on blackberry), thiram (SOLA for use on blackberry & Rubus Hybrids), carbendazim (1) (when used for Cane blight control)
Phytophthora root rot	fluazinam (1) , metalaxyl-M (1), dimethomorph (1)
Powdery mildew	bupirimate (SOLA for use on blackberry), fenarimol, fenpropimorph (1) , azoxystrobin (1) carbendazim (1) (when used for Cane blight control), tebuconazole (1) (when used for Cane blight control), myclobutanil (1)
Raspberry rust	fenpropimorph (1) , azoxystrobin (1) (when used for Powdery mildew control), tebuconazole (1) (when used for Cane blight control), myclobutanil (1) (when used for Powdery mildew control)
Spur blight	Thiram (SOLA for use on blackberry & Rubus Hybrids) (when used for Cane spot or *Botrytis* control), Bordeaux mixture,carbendazim (1) (when used for Cane blight control)

Notes:

(1) Specific off-label approval (SOLA) only

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 455 775

8.3 Advice on 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 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 Weed control

8.10.1.1 Cultural control

It is **strongly recommended** that weed control programmes are designed and implemented taking the major weed species present and their germination periods into account.

Shallow cultivation between crop rows is an acceptable method of weed control for some *Rubus* plantations, providing that the work can be carried out without causing crop plant damage, does not render the soil prone to erosion, or increase the risk of crop contamination with soil.

Polythene mulches can be used along the crop rows to suppress weeds, to reduce the production of

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primocanes encouraging the majority of primocanes to develop around the site of the original planting stock 'stool'. Eventually however, polythene mulches, laid at the time of planting of the raspberries, black and hybrid berries will degrade and the remnants require disposal. At this stage all polythene material must disposed of in a legal and environmentally responsible manner. It is **strongly recommended** that polythene is recovered, recycled if possible or sent to a registered landfill site. Polythene must not be burnt or buried on the farm.

Hand weeding can be an economic proposition for removing perennial weeds, but in most cases other soil surface management techniques will need to be employed. In some situations the establishment of a grass sward composed of a suitable mixture of perennial grass species but not "tumble down" may be utilised in the alleys as a means of suppressing unwanted weed and primocane growth and improving soil surface and structural conditions. Mulches of straw can also be employed in the alleys in some situations.

The application of straw, bark chip, sawdust or similar materials, as a, mulch down the crop rows of raspberries and other *Rubus* crops however is not recommended.

These materials can produce soil conditions ideal for *Phytophthora* root rot development, will delay emergence, weaken and increase the susceptibility to frost of the primocanes.

Work abroad has indicated that the annual application of composted green waste of an appropriate quality to the soils surface down the crop rows of raspberries may help along with other techniques i.e. planting the crop on raised beds or ridges to mitigate the effect of *Phytophthora* root rot. The composition of composted green waste, particularly of its pH and nutrient status, must however be determined before its use to ensure it is suitable for use for this purpose.

8.10.2 Chemical control

The control of weeds using residual and contact herbicides is in the majority of cases the only practical method available. In all cases every effort should be made to remove perennial weeds prior to planting. Translocated herbicides are the most suitable for this purpose often accompanied by a range of soil cultivation techniques. A list of herbicides currently approved is given (in Appendix 7).

8.11 Growth regulators

There are currently no label recommendations or SOLAs for the use of growth regulators in Raspberries in the UK. Research in the UK and elsewhere has indicated that the growth regulator products currently available are unlikely to be of value for this crop.

8.12 Post-harvest management

No pesticides are approved for application post harvest to raspberry fruits and fruit should not be irradiated.

All 'fruited' cane should be removed from the crop rows along with unwanted primocanes as soon as is practical on the completion of harvest of summer fruiting raspberry varieties. Primocanes to be retained to crop the following year should then be promptly tied onto the crop support trellis into their fruiting position for the following year. Removal of unwanted primocanes and the tying in of cane to be retained to crop the following year in the vegetative 'phase' rows of such plantations should be continuous throughout the growing season until leaf fall and or cane growth ceases.

Where plantations are managed 'biennially' it will be necessary to retain fruited cane until post leaf fall and after the onset of plant dormancy in order to adequately maintain the root system of the fruited 'phase' of the plantation.

The fruited canes of primocane (autumn fruiting) varieties should be retained after harvest until at least they have reached dormancy and usually until the middle or end of January. If spring cropping of the canes is not

envisaged then at this stage all cane can then be cut out at ground level, removed from the rows and disposed of in a suitable manner away from the plantation or pulverised down the alleys. The exact course of action will be determined according to the season, ground conditions, machinery available and variety involved.

Where primocane fruiting varieties e.g. Joan Squire, Himbo-Top are used to produce a second crop i.e. late spring/early summer crop, from fruiting laterals, positioned on the primo (now fruiting cane) below those which flowered and fruited the previous autumn/early winter. Only very short, damaged or diseased cane or those fruited down most of their length the previous autumn are removed from the rows in January. The majority being cut back to just below the last bud that produced a fruiting lateral in the autumn, and then clipped or laced into their fruiting position to a fixed wire, positioned to one side or down the middle of the crop row. To be cut through at ground level and be removed from the rows post harvest in June or July. During the spring current season primocane emerges from the soil and grows either around or to one side of the twice-cropped canes.

In summer fruiting raspberry plantations all attempts must be made to prevent the wind rocking of primocanes and hence potential damage to their foliage, cane rind and roots. They should be secured within or alongside the crop row by the most suitable method dictated by the trellis system being used. Post-harvest control of perennial and annual weeds by the use of residual and contact herbicides together with, where applicable, hand removal, should also be a priority.

The fruiting and primocanes of annual cropping black and hybrid berries should be kept separate as far as is practically possible, throughout the summer and autumn months o reduce the spread of disease from one to the other. All black and hybrid berries should be provided with adequate protection against prevailing winds and especially those varieties with semi-erect cane in order to prevent their damage by wind rocking or rubbing upon each other or the wires of the support trellis. Where possible and appropriate, primocanes of these varieties should be tipped in the early summer to encourage side shoot development and thereby to increase the number of cropping nodes/plant the following year. But thereafter provided with some means of support or tied to the support trellis to prevent them from being damaged by machinery or pickers passing through the plantation or by the wind.

As with summer fruiting raspberries post harvest the old fruited cane of black and hybrid berries should be removed as soon as possible and disposed of as appropriate and where possible the primocane tied onto the support trellis into next years fruiting position. On sites where winter damage to canes is likely to occur, the primocanes may be tied loosely to the lowest wire of the trellis through the winter, and then placed into their fruiting position in the late winter/early spring, pre-bud break.

9 Harvesting and storage

Smoking must not be allowed in *Rubus* plantations during harvest. All staff employed for the harvesting of the raspberry crop, must at all times be carefully supervised to ensure that fruit is only picked when it has reached the required stage of ripening, will meet the quality standards of its intended market and that high standards of personal hygiene are observed. Toilets and associated hand washing facilities must be provided at a reasonable distance and in sufficient numbers to adequately cater for staff engaged in picking crops.

Picked fruit should be constantly taken, initially from the alleys to a shaded collection point located on the headland of the site, from which it can be speedily transported to the packhouse and/or cold store within 45 minutes of picking.

Care must be taken during harvest to prevent contamination of fruit by plant debris, soil, insects or other extraneous matter. Preferably containers holding the fruit should not be stood down directly onto the soil or under the crop canopy in the rows. It is **strongly recommended** that to avoid fruit contamination by dust, foliage, insects, etc during its transit from the field to the packhouse or cold store, that it is transported within an enclosed vehicle or trailer and preferably within a cooled vehicle.

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10 Pollution control and waste management

See Generic Standards and/or Generic Guidance Notes.

11 Energy efficiency

See Generic Standards and/or Generic Guidance Notes.

12 Health and Safety

See Generic Standards and/or Generic Guidance Notes.

13 Conservation

See Generic Standards and/or Generic Guidance Notes.

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Appendix 1 Typical fertiliser applications for Raspberries, black and hybrid berries (kg/ha)

Before planting

Nutrient (kg/ha)	Soil Index				
	0	**1**	**2**	**3**	**3+**
Nitrogen (N)	nil	nil	nil	nil	nil
Phosphate (P_2O_5)	200	100	50[M]	50	nil
Potash (K_2O) *	200 [(1)]	100	50[M]	nil	nil
Magnesium (MgO)	165	125	85	nil	nil

Notes:

[(1)] at this rate the nutrient should be applied in the autumn and well incorporated into the soil to avoid scorching the roots of the newly planted crop

'M' maintenance dressing intended to maintain soil reserves and prevent depletion of soil fertility rather than to give a yield response

* Sulphate of potash should be used when applications in excess of 120kg/ha are required.

Base dressings of macronutrients should be made prior to planting. Well-rotted bulky organic manures can be applied and incorporated to improve soil structure of all soil types and improve the water holding capacity of light soils. These manures contain nutrients therefore fertiliser applications should be reduced according to the following table for each tonne of organic manure applied.

Nitrogen - Typical total nitrogen content of manures (fresh weight basis) (kg/tonne)

Manure	Dry Matter %	Total Nitrogen
Cattle	25	6.0 [(1)]
Pig	25	7.0 [(1)]
Sheep	25	6.0 [(1)]
Poultry layer	30	16.0
Broiler/Turkey litter	60	30.0

Note:

[(1)] Values of N may be lower for FYM stored for long periods in the open

NB: The actual % of total nitrogen available to the next crop following applications of manures will vary according to date of application, soil type, when incorporated and rainfall. For further information consult DEFRA "Fertiliser Recommendations for Agricultural and Horticultural Crops (RB209)" 7 th Edition 2000. ISBN: 0-11-243058-9. Note that this publication is currently under revision and that the new edition expected to be published in 2008 is likely to be amended. With regards to the range, nutrient content, timing of application and total amount of manures or composted green waste that can be applied pre-planting of cane fruit crops. No changes are expected however as to the recommendations, for fertiliser use pre-planting or for established cane fruit crops.

Appendix 1 Typical fertiliser applications for Raspberries, black and hybrid berries (kg/ha) (cont'd)

Available Phosphate, Potash and Magnesium in farmyard manures (fresh weight basis) (kg/tonne)

Manure	Dry Matter %	Phosphate ($P_2 0_5$)	Potash ($k_2 0$)	Total Magnesium (as MgO)
Cattle	25	2.1	7.2 (1)	0.7
Pig	25	4.2	4.5 (1)	0.7
Sheep	25	1.2	2.7 (1)	ND
Poultry layer	30	7.8	8.1	2.2
Broiler/Turkey litter	60	15	16	4.2

Notes:

Key

ND No data

(1) Values of potash may be lower for FYM stored for long periods in the open

The nutrient value of slurries and liquid manures vary greatly according to the animal source and its Dry Matter status. For information on this subject refer to section 2 "Organic manures", DEFRA "Fertiliser Recommendations for Agricultural and Horticultural Crops (RB209) 7 th Edition 2000.

After planting

Nutrient (kg/ha)	Soil Index				
	0	1	2	3	3+
Phosphate ($P_2 O_5$)	110	70	40	40	nil
Potash ($K_2 O$) (for Raspberries)	250 (1)	180 (1)	120	60	nil
Potash ($K_2 O$) (for Blackberries and hybrid berries)	220 (1)	150	80	nil	nil
Magnesium (MgO)	100	65	50	nil	nil

Notes:

(1) Sulphate of potash should be used when applications in excess of 120 kg/ha are required

Application of phosphorus and magnesium along with any lime requirements of plantations are generally applied in the winter months to allow seasonal rainfall to wash them down the soil profile. Nitrogen and potash are applied just prior to the onset of crop growth in the spring to minimise nutrient loss from the soil by leaching.

Appendix 1 Typical fertiliser applications for Raspberries, black and hybrid berries (kg/ha) (cont'd)

Post planting nitrogen

Nitrogen usage is based upon the soil texture of the site, age of and general vigour of the plantation, the previous season's cropping performance and method of application.

Currently the following is the normal practice:

Soil texture	Nitrogen (kg/ha)
Sandy or shallow soils	120
Deep silty soils	70
Clays	80
Other mineral soils	100

NB: with continued change in varieties, adjust nitrogen rates used depending on plant vigour.

Nitrogen applications may also be split, e.g. half being provided for the crop at bud break, the remainder in late May around early fruit set to assist the maintenance of primocane growth which will bear the following seasons crop.

Fertigation

Part and is some cases all of each seasons' fertiliser requirements are now applied in some plantations via trickle irrigation lines i.e. 'Fertigation'. Fertigation, commencing according to the method of crop production 1-3 weeks prior to the crop flowering and ceasing in the late summer or early autumn, in time for the crops to acclimatise to the shortening day length and the onset of cooler weather. Small amounts of nutrient, i.e. potassium, nitrogen, phosphate and magnesium and in some cases micronutrients being applied on a weekly or daily basis. The amount of each nutrient applied via fertigation, should be based upon, the amounts of nutrients present in the soil or substrate at the onset of the fertigation. The variety, age, yield potential and vegetative vigour of the plantation. The amount of nutrients (N, P, K and Mg) applied via fertigation with or without the use of an initial top dressing of fertiliser each spring, should not exceed those recommended for cane fruit in DEFRA "Fertiliser Recommendations for Agricultural and Horticultural Crops (RB209) 7th Edition 2000. The application of nutrients via fertigation to summer fruiting raspberries, blackberries and hybridberries especially of nitrogen should ideally cease by the end of July and at the latest the end of August. As application beyond these dates could adversely affect the winter hardiness of the primocane of these crops.

Fertigation is essential where polymulch is laid over the soil surface down the crop rows to aid primocane management and for weed control. Its use also offers the opportunity for a marked reduction in overall nutrient application and the more effective crop utilisation of the nutrients that are applied.

Raspberries, black and hybrid berries grown under the protection of glass or polythene structures receive their nutrients either via soil surface applications or, more usually, by fertigation using the trickle irrigation system or a combination of these two methods. Where grown in substrate (soil less compost) in plastic pots, bags or troughs the initial use of straight, slow release or PG fertiliser incorporated into the compost pre-planting is followed by top dressings and fertigation according to the plants' needs.

Manures

The application of fresh farm or stable manure or animal slurries as a source of nutrients applied to or incorporated in the soil surface is not recommended for established *Rubus* crops. However, for light sandy soils the application of a composted straw based farm or stable manure or composted green waste can be considered. As a mulch for or incorporated into the soil surface where its use will enhance the soils organic matter status and reduce the risk of water erosion of its surface. Such applications should be made only during the late winter/early spring months.

Appendix 2 Soil sterilants currently approved for use pre-planting of Cane Fruit

	Formalin	Dazomet	Metam sodium
Rate of use	0.5 1/m ^{2} diluted with 2.51 water	220-570 kg/ha	400-1000 1/ha
Physical form	Liquid	Granules	Liquid
Preferred soil temperature for treatment	Effective at 0° C	Above 10° C	Above 10° C
Application method	Soil drench. Terragator for field scale use	Best applied using specialist applicator	Injected into soil using specialist applicator
Requirement for polythene cover after treatment	No cover required	Polythene cover preferred, but surface can be sealed by smearing	Polythene cover preferred, but surface can be sealed by smearing
Preferred interval required prior to planting	At least 4 weeks, but a cress test is recommended	Usually 6 weeks, but a cress test is recommended	At least 7 weeks, but a cress test is recommended
Spectrum of activity	Good fungicide and general biocide. Limited effect against weeds and nematodes	Good fungicide. Controls many soil pests, nematodes and weeds	Good control of nematodes, weeds and fungal diseases at higher doses
Human toxicity	Toxic if swallowed. Harmful in contact with skin or by inhalation	Harmful in contact with skin and if swallowed. Irritating to eyes skin and respiratory system	Irritating to eyes, skin and respiratory system

Notes:

* The approval for the use pre-planting soft fruit crops of methyl bromide has been revoked. Limited usage is, however in some circumstances, permitted until the final expiry date for the approval of this product 31/12/07.

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Appendix 2 Soil sterilants currently approved for use pre-planting of Cane Fruit (Cont'd)

	Chloropicrin	**Steam**	**1.3 dichloropropene [(1)]**
Rate of use	150-400 1/ha	15 kg/m ^{2}	225-450 1/ha
Physical form	Liquid	Gas/liquid`	Liquid
Preferred temperature for effective treatment	Above 10 ^{o} C	Not applicable	Above 5°C
Application method	Injected into soil. Can only be applied by contractor	Injected into soil using special equipment	Injected into soil. Can only be applied by contractor
Requirement for polythene cover after treatment	Must be sealed with polythene sheets	Sheeted at time of treatment	Polythene cover preferred, but surface can be sealed by smearing
Preferred interval required prior to planting	At least 14 to 20 days (depending on product), but a cress test is recommended	No interval required	At least 6 weeks, but a cress test is recommended
Spectrum of activity	Good fungicide. High doses needed for good weed and nematode control. No *Phytophthora* root rot control	General biocide	Main action is as a nematocide but some evidence that it controls *Verticillium* wilt
Human toxicity	Highly toxic. A chemical subject to the Poisons Act	Non toxic, but dangerous during application due to high temperatures	Toxic if swallowed. Harmful in contact with skin and by inhalation, Irritating to eyes, skin and respiratory system

(1) 3-Dichloropropene (2 January 2008)
Due to the EU review products containing 1,3-Dichloropropene will be suspended for advertisement; sale and supply with effect from 20 March 2008. Approval for use and storage will be suspended from 20 March 2009. In the UK there is only one product - Telone II (05749)

Appendix 3 Biological control organisms for Rubus crop production

Pest	BCO	Comments
Two-spotted spider mite	*Phytoseiulus persimilis*	Typical application rate is 25,000-40,000/ha of crop row, the rate will however depend upon the date and the level of infestation at the time of introduction. Apply to AYR protected crops as soon as pest becomes active. To open field crops from mid May onwards as soon as pest seen. This predator performs best when the relative humidity is 70% and the temperature is above 20C ^{0} .
Two spotted spider mite	*Feltiella acarisuga*	Can provide additional control to *Phytoseiulus persimilis.* Predator can be introduced into AYR protected cane fruit crops from April onwards as soon as pest seen. Establishes and performs best if relative humidity above 70%. Use 250 cocoons per hot spot for Two spotted spider mite for 4 weeks, or 2500 cocoons per ha for 4 introductions.
Two spotted spider mite	*Amblyseius californicus*	Can **only** be used for control of this pest in AYR glasshouse protected crops. Introduce at 2 per m ^{2} every 3 weeks from April onwards (preventative) or at 6 per m ^{2} , where spider mite numbers are high. *A. Californicus* is active at lower and will tolerate higher temperatures and more tolerant of pesticides than *Phytoseiulus persimilis* . Will over winter in crop. May also provide some control of Raspberry leaf and bud mite and Blackberry mite.
Lepidoptera caterpillars	*Bacillus thuringiensis* var *kurstaki*	Used at 0.5 - 1.0 kg/ha in a minimum of 1000l/ha of water, best results are obtained when applied at high volume onto juvenile stages of these insects. No effect upon non-Lepidoptera caterpillars e.g. of Raspberry sawfly.
Aphids	*Aphidius ervi*	Only suitable for use in AYR protected crops. Distribute evenly through crop by holding bottle horizontal and releasing adults amongst crops foliage. Used at rates from 0.25 per m ^{2} per week (as a preventative) to 4 per m ^{2} per week (curative). Use from May -September, up to 30C ^{0}
Aphids	*Aphidoletes aphidimyza*	Only suitable for use in AYR Protected crops. Used to provide additional control to *Aphidius ervi* introduced at 1 per m ^{2} from May-September.
Aphids	*Chrysoperla carnea*	Green lacewings, the larvae are voracious predators of aphids. Only suitable for use in AYR protected crops and even then many may escape via house vents. Complimentary predator to *Aphidius ervi* and *Aphidoletes aphidimyza*. Introduced at 10 per m ^{2} per week to infested areas of the crop.
Sciarid flies	*Steinernema feltiae Hypoaspis miles or H. aculeifer*	Applied where this insect (larvae & adults) has become a problem of protected in substrate grown crops. The insect pathogenic nematode Steinernema feltiae is used at 0.5 to 1 million/m^{2}, requires a minimum growing media temperature of 10 to 14 C^{0}. Can be very fast acting but lacks persistence. In contrast the predatory mites Hypoaspis miles or H. aculeifer are introduced onto compost at 100/ m^{2} (preventative) or 500/ m^{2} (curative). Establish well and persist, so can provide good background control of this pest.
Vine weevil	*Heterorhabdites megidis Steinernema carpocapsae Steinernema krausii*	Soil and compost temperatures should not fall below 12C ^{0} for 14 days following treatment. Soil and compost must be moist at time of and remain so after application. *Steinernema krausii* will work at lower temperatures down to 5 C ^{0}

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Appendix 3 Biological control organisms for Rubus crop production (continued)

Pest	BCO	Comments
Glasshouse whitefly	*Encarsia formosa*	Only suitable for use in AYR protected crops. Introduced at 1-4 per m^2 per week (preventative) or 10-20 per m^2 per week (curative). Vary variable control of this pest achieved by *Encarsia formosa* in cane fruit crops.

Timing:

a. In outdoor summer fruiting Raspberries *Phytoseiulus* are generally most successfully introduced 7 days after the last insecticide application has been made prior to harvest. N.B. The exact timing will depend upon the insecticides previously used in the crop, the weather and the level of pest infestation.

   Many autumn fruiting raspberries notably Joan Squire, Caroline and T Plus are particularly attractive to this pest and usually more than one introduction of Phytoseiulus *persimilis* is necessary to obtain acceptable control. The first introduction being made in May or early June when the weather is suitable, and after any aphid sprays which may be needed in the early spring. Two or three more introductions each 7-14 days apart may then be made, applying in total 30-40,000 mites/ha of crop row, in batches of 10,000 to 15,000. A further introduction of the *Phytoseiulus* is often made according to the cultivar being grown in late July or early to mid August, i.e. soon after the application of an insecticide for raspberry beetle control has been made at first pink fruit.

b. For crops grown under protection, the first batch of *Phytoseiulus* is introduced as soon as adult Two-spotted spider mites become active in early spring. Under protective cover two additional predators the native midge *Feltiella acarisuga* (*Therodiplosispersicae)* and the introduced *Amblyseius californicus* have also provided excellent control of this pest, attacking both adult and nymphal stages voraciously. The use of *A. californicus* in the UK is at present only permitted on fully all year round protected crops. Some raspberry plantations also harbour natural predatory insects e.g. *Typhlodromus pyri*. Often these are associated with adjacent apple and pear orchards where considerable populations of these mites reside, which are also often resistant to organophosphorus insecticides. With careful plantation and adjacent land management these natural predators can offer useful control of spider mites. These can be particularly useful when not only two-spotted but also fruit tree red spider mite (*Panonychus ulmi*) is feeding in the raspberry crop, which is not controlled by *Phytoseiulus* .

   Bacillus thuringiensis can be used in both field grown and protected raspberries for the control of a range of Lepidoptera caterpillars, which can affect the crop.

   Anthocoris and *Oris* (flower bugs) also have been found present in raspberry plantations in recent years sometimes to the annoyance of pickers. However, they do predate upon thrips and may be actually preventing fruit damage by these insects, as well as reducing the number of aphids and capsid's in raspberry crops. The use of *Amblyseius cucumeris* and more recently *A. californicus* has provided control of Raspberry leaf and bud mite and Blackberry mite notably where these pests are affecting protected but also to some extent in the case of *A. cucumeris* in field grown raspberry and blackberry crops.

   For protected raspberry, black and hybrid berry crops. *Aphidius ervi A. colemani* and *Aphelinus abdominalis, Aphidoletes aphidimyza and Chrysoperia carnea* have been used in order to try to achieve control of a range of aphid species affecting these crops and *Encarsia formosa* for glasshouse whitefly, with varying degrees of success. *Heterorhabditis megidis* is used for vine weevil larval control where the crops are pot, bag or trough grown in soil-less compost. However it requires a minimum growing media temperature of 14 C^0, so is more suited to use in protected rather than open field grown crops. More recently the insect pathogenic nematode *Steinernema kraussei* was introduced. This is active down to growing media temperature of 5 C^0, so can be used for the control of root weevil larvae, in protected soil and substrate grown and also open field soil grown crops. In the case of the latter with mixed success

   Finally, products, which have a physical mode of action, derived from natural organic plant extracts are utilised for the control of pests such as two spotted spider mites, aphids and glasshousse whitefly. Their use can be considered where predators are regularly being introduced into *Rubus* crops as a means of substantially reducing pest

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populations either overall or locally, to a level, which can then be controlled effectively by introduced predators.

Appendix 4 Insecticides currently approved for Rubus crops

Active Ingredient	Product Features	Approval Type	Harvest Interval [1]	LERAP Category	Hazard Rating	MRL (mg/kg)
Abamectin [2]	A selective acaricide & insecticide Provides control of adult and immature stages of two spotted spider mite. Maximum rate of use, 0.05 litres/100 litres of water. A maximum total dose of 1.0 litres of product/ha/yr.	SOLA 2290/07 (until 31/12/13) permits use on protected raspberry & blackberry	3 days	none stated	Harmful	E C Definitive 1.0 raspberries & blackberries 0.010* dewberries, loganberries, all other cane fruit except wild fruit No Codex MRL set
Bacillus thuringiensis var kurstaki [2]	A bacterial insecticide for the control of caterpillars. Unlimited use	On label approval for use on outdoor & protected raspberry. SOLA 1554/06 (until 31/12/13) for use on outdoor & protected blackberry & Rubus hybrids	none stated	none stated	none stated	none set
bifenthrin [2]	Contact & residual pyrethroid acaricide/insecticide. Effective control of adult stages of Vine and other weevils. Also, control of Two spotted spider mite adults & juveniles. Very harmful to predatory insects & mites. 2 applications/crop. Rate 50 ml/100L of water	SOLA's [2] 3056/05, 0109/06 & 1628/06 (until 31/12/13) (Outdoor & protected raspberry & blackberry)	2 days	A	Harmful Irritant	E C Definitive 3.00 raspberries & blackberries 0.050* dewberries, loganberries, all other cane fruit except wild fruit
chlorpyrifos [2]	Organo phosphate insecticide and acaricide. Contact and ingested activity, can kill many beneficial insects but safe to some populations of Typhlodromus mite. Individual rate of use according to target pest, from 1.0 to 1.5L or 0.6 to 1.0 kg/ha . Maximum total dose of 3 L/ha or 1.8 kg of product/ha per year or up to 3 applications permitted per year.	SOLA 0018/08 (until 31/05/08), SOLA's 1912/07, 1754/07, 1763/07 & 1777/07 (until 31/08/08). SOLA's 2977/05, 2964/05, 0023/08, 2139/05, 2976/05 & 1585/06 (until 31/12/13), permit use on outdoor blackberry	7 days	A	Harmful Irritant	E C Definitive 0.5 raspberries & blackberries 0.050 * dewberries, loganberries, all other cane fruit except wild fruit No Codex MRL set
clofentezine	Ovicidal tetrazine acaricide. Can provide control of the egg and young larval stages of two-spotted and fruit tree red spider mites. Safe to predators useful for integrated control. For use on field grown and protected crops, up to 3 applications/ year. maximum individual dose of 0.4L/ha for outdoor and 0.4L/1000L of water for protected crops.	SOLA [2] 2269/01 (Outdoor crops raspberry & blackberry) (until 31/12/13) 2268/01(Protected raspberry & blackberry) (until 31/12/13)	14 days 7 days	None stated	None stated	E C Definitive 3.0 raspberry & blackberries 0.30 dewberries, loganberries, all other cane fruit except wild fruit No Codex MRL set

Notes:

[1] Or latest time of application

[2] SOLA - see Appendix 8 for the specific product and expiry dates.

* Level at or about limit of determination (LOD).

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

Appendix 4 Insecticides currently approved for Rubus crops (Cont'd)

Active Ingredient	Product Features	Approval Type	Harvest Interval (1)	LERAP Category	Hazard Rating	MRL (mg/kg)
deltamethrin (2)	Synthetic pyrethroid. Contact and residual activity. Broad spectrum controls a wide range of insect pests. Will kill predatory and other beneficial insects. Rates of use can vary according to product. In most cases no limit to number of applications/yr (check product label for details of use)	Full approval until 1/11/08 for use on outdoor & protected raspberry also SOLAs 1654/07, 1705/07, 1572/07, 1605/07 & 1629/07 (until 1/11/08) permitting use on outdoor blackberry	None stated	A	Harmful Irritant	E C Definitive 0.5 raspberries & blackberries 0.050 * dewberries, loganberries, all other cane fruit except wild fruit No Codex MRL set
Ferric phosphate	A molluscicide bait for slugs and snails	Full until 31/10/11 Some products with approval for use in outdoor and protected cane fruit crops	None stated	None stated	None stated	None set
Lambda-cyhalothrin (2)	A contact and ingested pyrethroid insecticide, for control of capsids, clay coloured and other weevils. Up to 4 applications/yr or a maximum of 150ml of product applied/ha/yr	SOLAs 3755/06, 1286/07 & 0728/06 (until 13/11/09) & 3266/07 (until 28/06/11) for use on outdoor raspberry, blackberry & Rubus Hybrids	28 days	A	Harmful	E C Definitive 0.20 raspberries 0.02* blackberries, dewberries, loganberries, all other cane fruit except wild fruit
metaldehyde	A molluscicide bait for slugs and snails which when eaten by target pest causes dehydration and death	Full approval according to product, from 30/09/08 until 31/12/13 Approved for use on outdoor & protected crops.	None stated	None stated	Harmful	None set
natural plant extracts	Natural plant extracts. Approved for use on outdoor & protected crops.	Product acts by physical means & is not controlled by COPR or PPPR. Outdoor & protected crops.	None stated	None stated	None Stated	None set
pirimicarb (2)	Carbamate insecticide. Aphid specific. Very safe to natural predators and introduced biologicals. Contact translaminar and fumigant activity. No limitation to number of applications.	Full until 31/12/13 Approved for use on outdoor & protected raspberry. SOLA,s 3466/06, 3461/06, 3453/06, 3445/06, 3004/06, 2998/06 & 3110/06 (until 31/12/13) for use on outdoor black & hybridberries	3 days	None stated	Harmful	No UK or EC MRL set Codex MRL 0.50 (for raspberries)

Notes:

(1) Or latest time of application

(2) SOLA - see Appendix 8 for the specific product and expiry dates.

* Level at or about limit of determination (LOD).

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

Appendix 4 Insecticides currently approved for Rubus crops (Cont'd)

Active Ingredient	Product Features	Approval Type	Harvest Interval (1)	LERAP Category	Hazard Rating	MRL (mg/kg)
pymetrozine (2)	A novel azomethine insecticide specifically for aphid control. Systemic in action, preventing aphid feeding. Currently will provide control of aphids resistant to organo phosphorous and carbamate insecticides. 3 applications/ year.	SOLA 1633/06 (until 31/10/11) for use on outdoor raspberry, & blackberry. SOLA 1702/06 (until 31/10/11) for use on outdoor raspberry, blackberry & rubus hybrids. SOLA 0492/07 9until 31/07/08) for use on protected raspberry, blackberry & rubus hybrids. SOLA 0493/07 (until 31/07/08) for use on protected raspberry & blackberry. SOLA 0498/07 (until 30/10/11) for use on raspberry, blackberry & rubus hybrids. SOLA 0504/07 (until 30/10/11) for use on protected raspberry & blackberry.	SOLAs 0492/08, 0504/07 & 1702/06 12 weeks. SOLA's 0493/07, 0498/07 & 1633/06 3 days	None stated	Harmful	E C Definitive from 15/06/08 3.0 for raspberries & blackberries 0.02* for dewberries, loganberries, all other cane fruit except wild fruit No Codex MRL set
pyrethrins	Contact action, natural pyrethrins, action on a range of pests including aphids & caterpillar. Outdoor & protected crops. All cane fruit crops. No limitation on number of applications/year.	Full until 31/12/13	1 day	None stated	Harmful	none set
rotenone	A natural contact insecticide of low persistence. Contact action broad-spectrum, short persistence useful where natural prediators are being used for two spotted spider mite control. Maximum rate of application 0.125 litres/ 100 litres of water.	Full until 31/12/13, approved for use on outdoot & protected raspberry, black, hybridberries.	1 day	none stated	none stated	none set
tebufenpyrod (2)	A pyrazole mitochondrial electron transport inhibitor (METI) acarcide for two spotted spider mite control. Maximum individual dose 0.5 kg/ha Maximum dose/ha/yr 0.5 kg.	SOLA 0134/08 until 31/12/13 for use on outdoor and protected raspberry and blackberry	7 days	B	Harmful	none set
thiacloprid (2)	A chloronicotinyl insecticide, with action on, the motile stages of a range of sucking insects, including aphids, capsid & glasshouse whiteflies. Maximum individual dose 250ml/ha, maximum total dose/ha/year 750ml.	SOLA 0336/06 (until 31/12/14) for use only on outdoor crops of raspberry, blackberry and Rubus hybrids. SOLA 0534/07 (until 21/12/14) for use on protected raspberry and blackberry.	3 days	None stated	Harmful	E C Provisional from 15/06/08 1.0 for raspberries, blackberries, for dewberries, loganberries, all other cane fruit except wild fruit

Notes to Appendix 5:

(1) Or latest time of application

(2) SOLA - see Appendix 8 for the specific product and expiry dates. Not all products containing these active ingredients may be currently approved for use on all forms of Cane Fruit. As label recommendations are revised regularly, read a current label before use

* Level at or about limit of determination (LOD).

Appendix 5 Fungicides currently approved for Rubus crops

Active Ingredient	Product Features	Approval Type	Harvest Interval (1)	LERAP Category	Hazard Rating	MRL (mg/kg)
azoxystrobin (2)	A systemic translaminar and protectant strobilurin fungicide. Outdoor crops: 2 applications/year for powdery mildew control. Protected crops: 2 applications/year. At least 12 days between each application. Maximum rate of use 1.0l/ha Contains an active from the Qol cross-resistance group. Apply preventatively rather than curatively. Use ICM strategy incorporating other methods of control, including other fungicides with a different mode of action	SOLA 0365/03 (until 31/12/11) for use on outdoor crops of raspberry & blackberry & 1194/05 (until 31/12/11) for use on protected crops of raspberry & blackberry	7 days (for outdoor crops) 10 days (for protected crops)	B	Harmful	E C Definitive 3.0 for raspberries & blackberries 0.05* for all other cane fruit except wild fruits
bordeaux mixture	Copper sulphate/lime complex fungicide. Protectant action. No limit to number of applications	Full for use on outdoor & protected raspberry & hybridberry (Loganberry) Last date of use unstipulated	None stated	None stated	Harmful Irritant	None set
bupirimate	A systemic pyrimidine fungicide. Protectant and eradicant against powdery mildew. Harmful to *Phytoseiulus* predators. No limited to number of applications. Maximum individual rate of application 1.41/ha & minimum 1.1l/ha.	Full approval until 31/12/13. for use on outdoor crop of raspberry. SOLA 0996/07 until 31/12/13 for use on outdoor blackberry & hybridberries.	8 days	None stated	Irritant	None set
carbendazim (2)	A systemic benzimidazole fungicide with curative and protective action. For post harvest use only for Cane Blight control. 3 applications per year.	SOLAs 2450/07, 3113/07 & 3097/07 (Until 30/06/08) For use on outdoor and protected crops of raspberry, blackberry, Rubus hybrids	Post harvest use only	None stated	Harmful	E C Definitive 0.1* for all cane fruit except wild fruits 1.0 Codex MRL

Notes:

(1) or latest time of application

(2) SOLA - see Appendix 8 for the specific product and expiry dates

* Level at or about limit of determination. Not all products containing these active ingredients may be currently approved for use on all forms of Cane Fruit. As label recommendations are revised regularly, read a current label before use.

Appendix 5 Fungicides currently approved for Rubus crops (Cont'd)

Active ingredient	Product features	Approval type	Harvest interval (1)	LERAP category	Hazard rating	MRL (mg/kg)
copper oxychloride (2)	A protectant copper fungicide and bactericide. Protectant. Some products no limitation t number of applications/yr others limited to 3 applications/year on raspberry, blackberry & hybridberry.	Some products full until 31/12/13. For use on outdoor and protected crops of raspberry, blackberry & hybridberry SOLA 3139/06 for use only on outdoor blackberry & 3132/06 for use on outdoor & protected blackberry, hybridberry & Loganberry (until 31/12/13)	None stated	None stated	None stated	None set
copper ammonium carbonate	A protectant copper fungicide. Use on outdoor crops of raspberry, & loganberry. Raspberry 2 & loganberry 3 applications/year.	Full until 31/12/13	None stated	None stated	Harmful	None set
dimethomorph (2)	A cinnamic acid fungicide with translaminar activity. 1 application/year for control of phytopthora root rot	SOLA 2777/07 until 31/08/08 for use on protected and protected and outdoor raspberry and blackberry	3 months	none stated	Harmful	None set
fenarimol	A systemic curative and protective pyrimidine. Protectant and eradicant activity. Use restricted to three applications/year. Safe to Phytoseiulus predators.	Full until 30/06/09. For use on outdoor and protected crops of raspberry.	14 days	None stated	None stated	E C Definitive 0.1 for raspberries 0.02* for all other cane fruit except wild fruits No Codex MRL set

Notes:

(1) or latest time of application

(2) SOLA - see Appendix 8 for the specific product and expiry dates

* level at or about limit of determination Not all products containing these active ingredients may be currently approved for use on all forms of Cane Fruit. As label recommendations are revised regularly, read a current label before use

Appendix 5 Fungicides currently approved for Rubus crops (Cont'd)

Active ingredient	Product features	Approval type	Harvest interval (1)	LERAP category	Hazard rating	MRL (mg/kg)
fenhexamid	A protectant fungicide, with a different mode of action to other commonly used Botryticides. A maximum of 4 sprays/annum. No more than 2 applied consecutively, safe to the majority of predators and also pollinating insects.	Full until 31/5/11 For use on outdoor and protected crops of raspberry, blackberry & hybrid berries	1day (for raspberry & blackberry) 7 days (for hybrid berries)	None stated	None stated	E C Provisional 10.0 for all cane fruit, except wild fruits No Codex MRL set
fenpropimorph (2)	A morpholine fungicide, protectant and eradicant, 3 applications/year.	SOLA's 0802/04, 1703/07 & 0804/04 (until 31/12/13) For use only on outdoor crops of raspberry, tayberry & loganberry.	14 days	None stated	Harmful Irritant	E C Definitive 1.0 for all cane fruit except wild fruits No Codex MRL set.

Notes:

(1) or latest time of application

(2) SOLA see Appendix 8 for the specific product and expiry dates

* level at or about limit of determination Not all products containing these active ingredients may be currently approved for use on all forms of Cane Fruit. As label recommendations are revised regularly, read a current label before use.

Appendix 5 Fungicides currently approved for Rubus crops (Contd)

Active ingredient	Product features	Approval type	Harvest interval (1)	LERAP category	Hazard rating	MRL (mg/kg)
fluazinam (2)	A pyridinamine protectant fungicide. 2 applications/year in March and September/October. Can be applied to both in soil and crops grown containerised crops grown in substrate.	SOLAs (2) 2080/03 (until 30/09/08) & 3760/07, 2168/03 & 3759/07 (until 31/12/13) for use on outdoor & protected raspberry, blackberry & Rubus hybrids	3 months	B	Harmful Irritant	None set
iprodione	A protectant dicarboximide. Protectant and eradicant activity. Resistant strains of *Botrytis* are known to exist to this product. Restricted to five applications per year. (Rovral WG (13811) 4 applications/year 10 days between individual applications)	Full until 31/08/08 For use on outdoor and protected raspberry only. SOLA 3535/06 (until 31/08/08) for use on outdoor blackberry & Rubus hybrids (Rovral WG (13811) full approval until 31/12/13 for use on outdoor raspberry)	7 days	None stated for old products. (For Rovral WG A)	Irritant	E C Provisional 10.00 for all cane fruit except wild fruits Codex MRL 30 (For all cane fruits)
metalaxyl-M (2)	A phenylamide systemic fungicide. Two applications/year in March and September/October	SOLA 2195/07(until 30/09/12) For use only on outdoor crops of raspberry, blackberry & Rubus hybrids	3 months	None stated	Harmful	E C Provisional 0.050* for all cane fruit except wild fruits No Codex MRL set

Notes:

(1) or latest time of application

(2) SOLA - see Appendix 8 for the specific product and expiry dates

* level at or about limit of determination

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

Appendix 5 Fungicides currently approved for Rubus crops (Contd)

Active Ingredient	Product Features	Approval Type	Harvest Interval (1)	LERAP Category	Hazard Rating	MRL (mg/kg)
myclobutanil	A systemic, protectant and curative conazole fungicide. For control of Powdery mildew, also with activity against raspberry rust. 6 applications/year, Minimum interval between applications of 7 days. Application using conventional hydraulic sprayers, including hand held sprayers. Maximum in-use concentration must not exceed 45ml product/100litres of water. Spray to run off.	SOLA (2)1189/05 (until 31/12/08) For use only on protected raspberry & blackberry crop	3 days	None stated	Harmful	E C Definitive 0.02* for all cane fruit except wild fruits No Codex MRL set
potassium hydrogen carbonate	Commodity substance with eradicant fungicidal action. Maximum concentration of use 0.02kg/1L of water. No restriction to number of applications/yr	Full until 31/12/08 For use on outdoor & protected raspberry, blackberry & hybrid berries.	None stated	None stated	None stated	None set
pyrimethanil (2)	Anilino pyrimidine fungicide protectant. Protected crops: 4 applications/crop. Application using conventional hydraulic sprayers. The maximum concentration must not exceed 2ml product/L of water. *Botrytis* control only. Safe to predators. Outdoor crop: Maximum total dose 4l/ha per year. Maximum rate of use 2l/ha	SOLA (2) 3636/07 (until 31/12/13) permits use on protected crop of raspberry & blackberry 1737/05 (until 31/12/13) on outdoor crops of raspberry & blackberry	1 day (protected crop) 7 days (outdoor crop)	None stated	None stated	E C Provisional from 6/04/08 for blackberries 0.050* for dewberries, loganberries and other cane fruit except wild fruit
tebuconazole(2)	A systemic conazole fungicide, protectant, with activity against Cane blight, Powdery mildew and Raspberry rust. 3 applications/year	SOLAs 0897/05,1376/07, 1358/07, 1323/07 & 0543/07 (until 6/05/09) For use on outdoor and protected crops of raspberry, blackberry & *Rubus* hybrids	14 days	B	Harmful	No E C or Codex MRL set
thiram(2)	Protectant dithiocarbamate. Protectant action. No limit on number of applications	Full until 31/12/13 For use on outdoor and protected raspberry crop SOLA 2159/07 (until 31/12/08) and 2155/07 (until 31/07/09) for use on outdoor blackberry & *Rubus* hybrids	7 days	none stated	Harmful Irritant	None set

(1) or latest time of application

(2) SOLA - see Appendix 8 for the specific product and expiry dates

* Level at or about limit of determination. Not all products containing these active ingredients may be currently approved for use on all forms of Cane Fruit. As label recommendations are revised regularly, read a current label before use.

Appendix 6 Herbicides currently approved for Rubus crops

i) Pre-planting herbicides

Active Ingredient	Product Features	Approval Type	Harvest Interval (1)	LERAP Category	Hazard Rating	MRL (mg/kg)
glyphosate	A translocated non-residual phosphonic acid herbicide. Perennials and annuals controlled post emergence. Allow a minimum of ten days before ploughing if perennial weeds present and seven days before planting. Some but not all products can be used pre-planting of protected cane fruit crops.	Full until 20/06/12 (date varies according to product)	Pre-planting only	B	Harmful	E C Provisional 0.1* for all cane fruit except wild fruits No Codex MRL set
carfentrazone-ethyl	A triazolinone contact herbicide, for removal of annual weeds pre planting. For use pre-planting open field or protected can fruit crops 1 application permitted.	Full until 24/08/09	Pre-planting only.	None stated	Harmful	E C Provisional 0.01* for all cane fruit except wild fruits No Codex MRL set

ii) At planting herbicides

Active Ingredient	Product Features	Approval Type	Harvest Interval (1)	LERAP Category	Hazard Rating	MRL (mg/kg)
Trifluralin (2)(5)	A soil incorporated dinitroaniline for control of annual grasses and a limited range of annual broad-leafed weeds applied at anytime up to fourteen days before planting. Allow at least one day between incorporation into the soil and planting. Follow by a suitable post-planting residual herbicide. Not to be used on sand or fen soil with more than 10% organic matter.	Full until 20/03/09 for use in outdoor raspberry SOLAs 3582/06, 3539/06, 3507/06, 1984/07 & 1893/07 (until 31/08/08) for use on outdoor blackberry and *Rubus* hybrids	At planting only	None stated	Harmful Irritant	None set

Notes:

* or latest time of application

(2) SOLA - see Appendix 8 for the specific product and expiry dates

(5) A review of trifluralin usage has recently been carried out & its continued usage pre-planting of cane fruit crops was not supported. Revocation of this herbicides approval for use in cane fruit crops will take place in 2008

* level at or about limit of determination.

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

Appendix 6 Herbicides currently approved for Rubus crops

iii) Post planting herbicides

Active Ingredient	Product Features	Approval Type	Harvest Interval (1)	LERAP Category	Hazard Rating	MRL (mg/kg)
asulam (2)	A translocated carbamate herbicide used for dock and bracken control, for details of use see SOLA 2 applications permitted per year	SOLAs 1892/00 (until 31/05/08) 2186/07 & 2180/07 (until 30/09/08) and 0799/07 (until 31/12/13) for use in outdoor raspberry, blackberry & loganberries	Use only between March April, Sept. November	None stated	None stated	None set

Notes:

* or latest time of application

(2) SOLA - see Appendix 8 for the specific product and expiry dates

(5) A review of trifluralin usage has recently been carried out & its continued usage pre-planting of cane fruit crops was not supported. Revocation of this herbicides approval for use in cane fruit crops expected during 2007

* level at or about limit of determination.

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

Appendix 6 Herbicides currently approved for Rubus crops (Cont'd)

iii) Post planting herbicides (Cont'd)

Active Ingredient	Product Features	Approval Type	Harvest Interval (1)	LERAP Category	Hazard Rating	MRL (mg/kg)
chlorthal-dimethyl (2)	A residual benzoic acid herbicide. A residual herbicide, which primarily provides pre-emergence weed control but with some selective annual broad leafed weed control at the seedling and small plant stage. One application per year. Established and newly planted outdoor and protected crops of raspberry.	Full until 31/12/13 for use in outdoor raspberries SOLA 1553/06 (until 31/12/13) for use in outdoor blackberry & hybridberry	Use only on newly planted crops	None stated	None stated	None set
carfentrazone-ethyl (2)	Contact herbicide & desiccant for removal of unwanted primocane in crop rows & alleys of outdoor & protected raspberry, blackberry & rubus hybrids. Maximum individual dose of 0.8 litres/1000 litres of water/treated ha. A maximum of 1.6 litres of product/ha/year. A minimum of 7 days between applications	SOLA 0551/08 (until 24/08/09)	21 days	None stated	Harmful	EC Provisional 0.01* for all cane fruit except wild fruits. No Codex MRL set
dichlobenil	A residual benzonitrile herbicide. Annual and perennial weeds controlled pre and post emergence. Range according to rate of use. Residual activity 3-6 months according to rate. One application/year. Only for use on crops established at least two years. Applied when crop dormant, between late December to March pre bud break, not to be used within two years of plantation being grubbed.	Full until 31/12/13 For use on outdoor raspberry, blackberry and hybridberry crops	Dormant season use late Dec - March (pre crop bud break)	None stated	Irritant	None set
diquat	A non–residual bipyridyl contact herbicide and crop desiccant. Activity only against broad-leaved weeds. Some products state maximum individual rate and total dose/ha/yr as 2 L/ha. Other products rate 1.5 to 2 L/ha with no restriction on number of applications/yr.	Full date of expiry 31/12/11 or 31/12/13	none stated	none stated	Harmful Toxic	E C Provisional 0.050* for all cane fruit except wild fruits
fluazifop-p-butyl (2)	A phenoxypropionic acid grass herbicide. Not to be applied during flowering and fruiting period, one application per year. Applied to actively growing grass weeds. Will not control annual meadow grass.	Full until 31/12/13 For use in outdoor and some but not all productsalso in protected raspberry SOLA 3274/06 (until 31/12/13) for use in outdoor blackberry & hybridberry	Growing season use but not between flowering and end of harvest	None stated	Irritant	None set

Notes: (1) or latest time of application. (2) SOLA - see Appendix 8 for specific product and expiry date * level at or about limit of determination
Not all products containing these active ingredients may be currently approved for use on all forms of Cane Fruit.
As label recommendations are revised regularly, read a current label before use.

Appendix 6 Herbicides currently approved for Rubus crops (Cont'd)

iii) Post planting herbicides (Contd)

Active Ingredient	Product Features	Approval Type	Harvest Interval (1)	LERAP Category	Hazard Rating	MRL (mg/kg)
glufosinate - ammonium	A non selective, non residual phosphinic acid contact herbicide used as a carefully shielded spray down alleys avoiding contact with dormant or green buds or shoots of fruiting canes and young primocane (Spawn) to be retained; up to 3 applications/year in spring/summer when weed actively growing. Between 1 st March and 30 th September.	Full until 31/12/13(varies according to product) For use in outdoor & protected raspberry, blackberry & hybrid berries	Use between 1 March 30 September	None stated	Harmful Irritant	No UK or EC MRL set Codex MRL 0.1 (For all cane fruit)
isoxaben	A soil acting amide herbicide. Pre emergence annual broad-leafed weed control. No activity against grasses or cereals 1 application per year between October and April. Can be used in the planting year.	SOLAs 1110/06 & 3755/06 (until 31/12/13) permits use in *Rubus* hybrids	Use between October April only	None stated	None stated	None set
lenacil (2)	A residual soil acting uracil herbicide. Can be used immediately post planting and on established crops. Applied during dormant period or in spring prior to weed germination and before crop flowers. One application per year. Allow 3 months between application of lenacil and any other residual herbicides. Rate2.2-2.8 kg/ha according to soil type.	Full until 31/12/13 for use in outdoor raspberry SOLA 0884/06 (until 31/12/13) for use in outdoor blackberry & hybrid berries	Dormant season and before crop flowers	None stated	Harmful Irritant	None set
MCPB	A translocated phyoxybutyric herbicide for control of a wide range of broad leaved and perennial weeds. Post harvest use usually late August/September. When growth of primocanes slowing down. Directed spray across alleys and at bases of canes in rows. Also can be used for spot spraying patches of weed in alleys pre-post Harvest. 1 application/crop. Max dose 5.6L.	Full until 31/12/13 for use in outdoor raspberry, blackberry & hybridberry	Late August September	None stated	Harmful Irritant	E C Provisional 0.050* for raspberries & blackberries

Notes:

(1) or latest time of application

(2) SOLA - see Appendix 8 for specific product and expiry date

* level at or about limit of determination

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

Appendix 6 Herbicides currently approved for Rubus crops (Cont'd)

iii) Post planting herbicides (Contd)

Active ingredient	Product features	Approval type	Harvest Interval (1)	LERAP category	Hazard rating	MRL (mg/kg)
napropamide (2)	A soil applied amide herbicide. Annual grass and broad-leafed weeds controlled pre-emergence. 1 Application per year to crops established for at least 10 months. Do not use on soil with more than 10% organic matter. Applied pre-weed emergence November-February.	Full until 31/12/13 for use in outdoor & protected raspberries SOLA's 3013/06 & 3006/06 (until 31/12/13) for use in outdoor blackberry & hybrid berries	Use between November February only	None stated	None stated	None set
oxadiazon (2)	A residual and contact oxadiazolone herbicide. Annual broad-leafed and some annual grass weed control pre emergence. Also pre and post emergence control of perennial bindweed at highest dose rate. Directed preferably shielded application to established crops only in April-June period (before crop flowers), down alleys and between cane rows. Avoid contact with young primocanes (spawn).	Full until 31/12/13 for use in outdoor raspberry & spot treatment in protected raspberry SOLA 3297/06 (until 31/12/13) for use in outdoor blackberry & hybrid berries	Jan June (before crop flowers)	None stated	Irritant	None set
paraquat/ diquat	A non-selective non-residual contact bipyridyl herbicide and crop desiccant, Paraquat is subject to the Poisons Act 1972. Used pre planting and post planting dormant season to clear soil surface of annual broad leafed and grass weeds and as a shielded directed spray in growing season kept off of green canes. Also used as a shielded spray for unwanted primocane (Spawn) removal in alleys in spring and summer.	Full until 11/07/08for use in outdoor and protected raspberry, blackberry & hybrid, berries	None stated	None stated	Harmful Toxic	E C Definitive 0.020* for all cane fruit except wild fruits (Also see diquat) 0.01* Codex MRL set for paraquat

Notes:

(1) or latest time of application

(2) SOLA - see Appendix 8 for specific product and expiry date

* level at or about limit of determination

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

Appendix 6 Herbicides currently approved for Rubus crops (Cont'd)

iii) Post planting herbicides (Cont'd)

Active Ingredient	Product Features	Approval Type	Harvest Interval (1)	LERAP Category	Hazard Rating	MRL (mg/kg)
pendimethalin	A residual dinitroaniline herbicide. One application per year. Apply to weed free soil from autumn to early spring. Immediately after planting new crops and after cutting out of canes in established crops. Apply before bud burst. Do not use on soils where organic matter exceeds 10%. Should not be used on protected crops. 1 application/year permitted. All *Rubus* crops except primocane fruiting raspberries. Rate 3.3 to 5 L/ha for products with approvals until 31/08/08. Up to 3.3 L/ha for products with approval expiry dates 18/11/09 & 31/12/13	Full until 31/08/08, 18/11/11 or 31/12/13 N.B. (date varies according to product) For use in outdoor & protected raspberry, blackberry and hybrid berries	Dormant season use only October March (before bud burst)	B	None stated	E C Definitive from 15/06/08 0.050* all cane fruit except wild fruits No Codex MRL set
propyzamide	A residual amide herbicide. Annual broad leafed and grass weeds controlled pre emergence with some post emergence activity including at high rates of use for couch and other perennial grass suppression/control. (England only) 1 Application per year during period 1st October-31st January. Do not use on soil with more than 10% organic matter, only use on crops established for at least 12 months.Rate of use varies according to a.i. of product. Maximum rate of use 3.4 kg or 4.25 L/ha, 1 application permitted/yr	Full until 31/12/13 for some products others expire 31/08/08 or 31/03/09 For use on outdoor & protected raspberry, blackberry & hybrid berries	Dormant season use only between 1 October and 31 January	none stated	None stated	E C Provisional 0.02* for all cane fruit except wild fruits No Codex MRL set

Notes:

(1) or latest time of application

(2) SOLA - see Appendix 8 for specific product and expiry date

* level at or about limit of determination

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

Appendix 7 Products with specific off-label approval (SOLAs) for use on Cane Fruit

Crop	Number	Product Name	Active Ingredient	Expiry
Raspberries	0365/03	Amistar (10443) ®	azoxystrobin	31/12/11
	1194/05	Amistar (10443)®	azoxystrobin	31/12/11
	2290/07	Dynamec (13331®	abamectin	31/12/13
	2186/07	Asulox (09969) ®	asulam	30/09/08
	0799/07	Asulox (13175) ®	asulam	31/12/13
	2180/07	Asulox (09969) ®	asulam	30/09/08
	3056/05	Talstar 80 Flo (12352) ®	bifenthrin	31/12/13
	0109/06	Starion Flo (12455) ®	bifenthrin	31/12/13
	1628/06	Brigade 80 SC (12853) ®	bifenthrin	31/12/13
	2450/07	Bavistin DF(03848) ®	carbendazim	30/06/08
	3113/07	Delsene 50 Flo (11452) ®	carbendazim	30/06/08
	3097/07	Clayton Chizm FL (11050) ®	carbendazim	30/06/08
	3104/07	Cleancrop Curve (11774) ®	carbendazim	31/06/08
	2372/07	Chloropicrin Fumigant (04216) ®	chloropicrin	31/12/13
	2373/07	K & S Chlorofume (08722) ®	chloropicrin	31/12/13
	2268/01	Apollo 50 SC (10590) ®	clofentezine	31/12/13
	2269/01	Apollo 50 SC (10590) ®	clofentezine	31/12/13
	2777/07	Paraat	dimethomorph	31/05/08
	0802/04	CleanCrop Fenpro (09885) ®	fenpropimorph	31/12/13
	1703/05	CleanCrop ® Fenpropimorph (09445) ®	fenpropimorph	31/12/13
	0804/04	Corbel (00578) ®	fenpropimorph	31/12/13
	2080/03	Shirlan programme (10574) ®	fluazinam	30/09/08
	2168/03	Shirlan (10573) ®	fluazinam	31/12/13
	3760/07	Alpha Fluazinam 50 SC (13622) ®	fluazinam	31/12/13
	3759/07	Volley (13591) ®	fluazinam	31/12/13
	3755/06	Clayton Lanark (12942) ®	Lambda-cyhalothrin	13/11/09
	0728/06	Hallmark with Zeon Technology (12629) ®	Lambda-cyhalothrin	13/11/09
	3266/07	Markate 5 (13529) ®	Lambda-cyhalothrin	28/06/11
	1286/07	Cleancrop Silo (13351) ®	Lambda-cyhalothrin	13/11/09
	2195/07	SL567A (12380) ®	metalaxyl-M	30/09/12
	1189/05	Systhane 20 EW (09396) ®	myclobutanil	31/12/13
	0504/07	Chess WG (13310) ®	pymetrozine	31/10/11
	0498/07	Chess WG (13310) ®	pymetrozine	31/10/11
	0493/07	Chess WG ® (10651)	pymetrozine	31/07/08
	0492/07	Chess WG ® (10651)	pymetrozine	31/07/08
	1702/06	Plenum WG (10652) ®	pymetrozine	31/10/11
	1633/06	Plenum WG (10652) ®	pymetrozine	31/10/11
	3636/07	Scala (11695) ®	pyrimethanil	31/12/13
	1737/05	Scala (11695) ®	pyrimethanil	31/12/13

Appendix 7 Products with specific off-label approval (SOLAs) for use on Cane Fruit (Cont'd)

Crop	Number	Product Name	Active Ingredient	Expiry
Raspberries	1376/07	Alpha Tebuconazole 20 EW (12893) ®	tebuconazole	06/05/09
(Cont'd)	1358/07	Mitre (12901) ®	tebuconazole	06/05/09
	1323/07	Oris 20 EW (12311) ®	tebuconazole	06/05/09
	0897/05	Folicur (11278) ®	tebuconazole	06/05/09
	0134/08	Masai (13082) ®	tebufenpyrod	31/12/13
	0543/07	Riza (12696) ®	tebuconazole	06/05/09
	0336/06	Calypso (11257) ®	thiacloprid	31/12/14
	0534/07	Calypso (11257) ®	thiacloprid	21/12/14
	1984/07	Treflan ® (05817)	trifluralin	31/08/08
***Rubus* hybrids**	2186/07	Asulox (09969) ®	asulam	30/09/08
	0799/07	Asulox (13175) ®	asulam	31/12/13
	2180/07	Asulox (09969) ®	asulam	30/09/08
	1554/06	Dipel DF (11184) ®	Bacillus thuringiensis var kurstaki	31/12/13
	0996/07	Nimrod (10563) ®	bupirimate	31/12/13
	2450/07	Bavistin DF (03848) ®	carbendazim	31/06/08
	3113/07	Delsene 50 Flo (11452) ®	carbendazim	31/06/08
	3097/07	Clayton Chizm FL (11050) ®	carbendazim	31/06/08
	2104/07	Cleancrop Curve (11774) ®	carbendazim	30/06/08
	2372/07	Chloropicrin Fumigant (04216)®	chloropicrin	31/12/13
	2373/07	K & S Chlorofume(08722) ®	carbendazim	31/12/13
	1553/06	Dacthal W75 (11323) ®	chlorthal-dimethyl	31/12/13
	3132/06	Cuprokylt (00604) ®	copper oxychloride	31/12/13
	3139/06	Cuprokylt FL (08299) ®	copper oxychloride	31/12/13
	0922/06	Telone II (05749) ®	1,3-dichloropropene	20/03/09
	3760/07	Alpha Fluazinam 50 SC (13622) ®	fluazinam	31/12/13
	3759/07	Volley (13591) ®	fluazinam	31/12/13
	2080/03	Shirlan programme (10574) ®	fluazinam	30/09/08
	2168/03	Shirlan (10573) ®	fluazinam	31/12/08
	3760/07	Alpha Fluazinam 50 SC (13622) ®	fluazinam	31/12/13
	3759/07	Volley (13591) ®	fluazinam	31/12/13
	3274/06	Fusilade Max (11519) ®	Fluazifop-P-butyl	31/12/13
	3535/06	Rovral WP (11694) ®	Iprodione	31/08/08
	1110/06	Agriguard Isoxaben (11652)®	Isoxaben	31/12/13
	1112/06	Flexidor 125 (10946) ®	Isoxaben	31/12/13
	3755/06	Clayton Lanark (12942) ®	Lambda-cyhalothrin	13/11/09
	0728/06	Hallmark with Zeon Technology (12629) ®	Lambda-cyhalothrin	13/11/09
	3266/07	Markate 50 (13529) ®	Lambda-cyhalothrin	28/06/11
	1286/07	Cleancrop Silo (13351) ®	Lambda-cyhalothrin	13/11/09
	0884/06	Clayton Lenacil 80 W (09488) ®	lenacil	31/12/13
	2195/07	SL567A (12380) ®	metalaxyl-M	30/09/12
	0920/06	Tipoff (12292) ®	1-naphthylacetic acid	31/12/13

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Appendix 7 Products with specific off-label approval (SOLAs) for use on Cane Fruit (Cont'd)

Crop	Number	Product Name	Active Ingredient	Expiry
***Rubus* hybrids**	3013/06	Devrinol (09375) ®	napropamide	31/12/13
(Cont'd)	3006/06	Devrinol (09374) ®	napropamide	31/12/13
	3466/06	Barclay Pirimisect (11360) ®	Pirimicarb	31/12/13
	3461/06	Clayton Pirimicarb 50 SG (09221) ®	Pirimicarb	31/12/13
	3453/06	Cleancrop Miricide (11776) ®	pirimicarb	31/12/13
	3445/06	Phantom (11954) ®	pirimicarb	31/12/13
	3004/06	Agriguard Pirimicarb (09620) ®	pirimicarb	31/12/13
	2998/06	Standon Pirimicarb 50 (08878)®	pirimicarb	31/12/13
	3110/06	Aphox (10515)®	pirimicarb	31/12/13
	1702/06	Plenum WG (10652)®	pymetrozine	31/10/11
	0504/07	Chess WG (13310)®	pymetrozine	31/10/11
	0492/07	Chess WG (10651) ®	pymetrozine	31/07/08
	1376/07	Alpha Tebuconazole 20 EW (12893) ®	tebuconazole	06/05/09
	1358/07	Mitre (12901) ®	tebuconazole	06/05/09
	1323/07	Oris 20 EW (12311) ®	tebuconazole	06/05/09
	0897/05	Folicur (11278) ®	tebuconazole	06/05/09
	0543/07	Riza (12696) ®	tebuconazole	06/05/09
	0336/06	Calypso (11257) ®	thiacloprid	31/12/14
	2159/07	Unicrop Thianosan DG (05454) ®	thiram	31/12/08
	2155/07	Thianosan DG (13404) ®	thiram	31/07/09
	3582/06	Alpha Trifluralin 48 EC (07406) ®	trifluralin	31/08/08
	3539/06	Trimaran (11400) ®	trifluralin	31/08/08
	1984/07	Treflan ® (05817)	trifluralin	31/08/08
	3507/06	Treflan ® (05817)	trifluralin	31/08/08
Blackberries	0365/03	Amistar (10443) ®	azoxystrobin	31/12/11
	1194/05	Amistar (10443) ®	azoxystrobin	31/12/11
	2290/07	Dynamec (13331) ®	abamectin	31/12/13
	0799/07	Asulox (13175)®	asulam	31/12/13
	2186/07	Asulox (09969) ®	asulam	30/09/08
	2180/07	Asulox (09969) ®	asulam	30/09/08
	1554/06	Dipel DF (11184) ®	bacillus thuringiensis var kurstaki	31/12/13
	3056/05	Talstar 80Flo (12352) ®	bifenthrin	31/12/13
	0109/06	Starion Flo (12455) ®	bifenthrin	31/12/13
	1628/06	Brigade 80 SC (12853) ®	bifenthrin	31/12/13
	0966/07	Nimrod (10563) ®	bupirimate	31/12/13
	2540/07	Bavistin DF (03848) ®	carbendazim	30/06/08
	3113/07	Delsene 50 Flo (11452) ®	carbendazim	30/06/08
	3097/07	Clayton Chizm FL (11050) ®	carbendazim	30/06/08
	3104/07	Cleancrop Curve (11774) ®	carbendazim	31/06/08
	3272/07	Chloropicrin Fumigant (04216) ®	chloropicrin	31/12/13
	2373/07	K & S Chlorofume(08722) ®	chloropicrin	31/12/13

Appendix 7 Products with specific off-label approval (SOLAs) for use on Cane Fruit (Cont'd)

Crop	Number	Product Name	Active Ingredient	Expiry
Blackberries	1912/07	Alpha Chlorpyrifos 48 EC (04821) ®	chlorpyrifos	31/08/08
(**Cont'd**)	2977/05	Cyren (11028) ®	chlorpyrifos	31/12/13
	2976/05	Lorsban WG (10139) ®	chlorpyrifos	31/12/13
	1754/07	Barclay Clinch II (11346) ®	chlorpyrifos	31/08/08
	1763/07	Greencrop Pontoon (09667) ®	chlorpyrifos	31/08/08
	2964/05	Equity (12465) ®	chlorpyrifos	31/12/13
	1777/07	Standon Chlorpyrifos 48 (08286) ®	chlorpyrifos	31/08/08
	2139/05	Lorsban WG (11962) ®	chlorpyrifos	31/12/13
	1673/06	Govern (12870) ®	chlorpyrifos	31/05/08
	0023/08	Govern (13223) ®	chlorpyrifos	31/12/13
	2976/05	Lorsban WG (10139) ®	chlorpyrifos	31/12/13
	1585/06	Parapet (12773) ®	chlorpyrifos	31/12/13
	1553/06	Dacthal W75 (11323) ®	chlorthal-dimethyl	31/12/13
	2269/01	Apollo 50 SC (10590) ®	clofentezine	31/12/13
	2268/01	Apollo 50 SC (10590) ®	clofentezine	31/12/13
	3139/06	Cuprokylt FL (08299) ®	copper oxychloride	31/12/13
	3132/06	Cuprokylt (00604) ®	copper oxychloride	31/12/13
	1654/07	Decis Protech (11502) ®	deltamethrin	01/11/08
	1705/07	Decis (07172) ®	deltamethrin	01/11/08
	1572/07	Agriguard Deltamethrin (10770) ®	deltamethrin	01/11/08
	1605/07	Bandu (10994) ®	deltamethrin	01/11/08
	1629/07	Cleancrop Decathlon (12934) ®	deltamethrin	01/11/08
	0922/06	Telone II (05749) ®	1,3-dichloropropene	20/03/09
	2777/07	Paraat ®	dimethomorph	31/05/08
	2080/03	Shirlan programme (10574) ®	fluazinam	30/09/08
	2168/03	Shirlan (10573) ®	fluazinam	31/12/13
	3760/07	Alpha Fluazinam 50 SC (13622) ®	fluazinam	31/12/13
	3759/07	Volley (13591) ®	fluazinam	31/12/13
	3274/06	Fusilade Max (11519) ®	fluazifop-P-butyl	31/12/13
	3535/06	Rovral WP (11694) ®	Iprodione	31/08/08
	3755/06	Clayton Lanark (12942) ®	lambda-cyhalothrin	13/11/09
	0728/06	Hallmark with Zeon Technology (12629) ®	lambda-cyhalothrin	13/11/09
	3266/07	Markate 50 (13529) ®	lambda-cyhalothrin	28/06/11
	1286/07	Cleancrop Silo (13351) ®	lambda-cyhalothrin	13/11/09
	2195/07	SL567A (12380) ®	Metalaxyl-M	30/09/12
	3297/06	Ronstar Liquid (11215) ®	oxadiazon	31/12/13
	0884/06	Clayton Lenacil 80 W (09488) ®	lenacil	31/12/13
	1189/05	Systhane 20 EW (09396) ®	myclobutanil	31/12/13
	0920/06	Tipoff (12292) ®	l-naphthylacetic acid	31/12/13
	3013/06	Devrinol (09375) ®	napropamide	31/12/13
	3006/06	Devrinol (09374) ®	napropamide	31/12/13
	3466/06	Barclay Pirimisect (11369) ®	pirimicarb	31/12/13

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Appendix 7 Products with specific off-label approval (SOLAs) for use on Cane Fruit (Cont'd)

Crop	Number	Product Name	Active Ingredient	Expiry
Blackberries	3461/06	Clayton Pirimicarb 50 SG (09221) ®	pirimicarb	31/12/13
(Cont'd)	3453/06	Cleancrop Miricide (11776) ®	pirimicarb	31/12/13
	3445/06	Phantom (11954) ®	pirimicarb	31/12/13
	3004/06	Agriguard Pirimicarb (09620) ®	pirimicarb	31/12/13
	2998/06	Standon Pirimicarb 50 ® (08878)	pirimicarb	31/12/13
	3110/06	Aphox (10515) ®	pirimicarb	31/12/13
	1702/06	Plenum WG (10652) ®	pymetrozine	31/12/11
	1633/06	Plenum WG (10652) ®	pymetrozine	31/10/11
	0504/07	Chess WG (13310) ®	pymetrozine	31/10/11
	0498/07	Chess WG 13310) ®	pymetrozine	31/10/11
	0493/07	Chess WG (10651) ®	pymetrozine	31/07/08
	0492/07	Chess WG (10651) ®	pymetrozine	31/07/08
	3636/07	Scala (11695) ®	pyrimethanil	31/12/13
	1737/05	Scala (11695) ®	pyrimethanil	31/12/13
	0897/05	Folicur (11278) ®	tebuconazole	06/05/09
	0543/07	Riza (12696)®	tebuconazole	06/05/09
	1376/07	Alpha Tebuconazole 20 EW (12893) ®	tebuconazole	06/05/09
	1358/07	Mitre (12901) ®	tebuconazole	06/05/09
	1323/07	Osiris 20 EW (12311)®	tebuconazole	06/05/09
	0134/08	Masai (13082) ®	tebufenpyrod	31/12/13
	0336/06	Calypso (11257) ®	thiacloprid	31/12/14
	0534/07	Calypso (11257) ®	thiacloprid	21/12/14
	2159/07	Unicrop Thianosan DG (05454) ®	thiram	31/12/08
	2155/07	Thianosan DG (13404) ®	thiram	31/07/09
	3582/06	Alpha Trifluralin 48 EC (07406) ®	trifluralin	31/08/08
	3539/06	Trimaran (11400) ®	trifluralin	31/12/07
	3507/06	Treflan (05817) ®	trifluralin	31/08/08
	1984/07	Treflan (05817) ®	trifluralin	31/08/08
Loganberries	2186/07	Asulox (09969) ®	asulam	30/09/08
	1892/00	Asulox (09969) ®	asulam	31/05/08
	0799/07	Asulox (13175) ®	asulam	31/12/13
	2450/07	Bavistin DF (03848) ®	carbendazim	30/06/08
	3113/07	Delsene 50 Flo (11452) ®	carbendazim	30/06/08
	3097/07	Clayton Chizm FL (11050) ®	carbendazim	31/07/08
	3104/07	Cleancrop Curve (11774) ®	carbendazim	30/06/08
	3132/06	Cuprokylt (00604)®	copper oxychloride	31/12/13
	3139/06	Cuprokylt FL (08299) ®	copper oxychloride	31/12/13
	08012/04	CleanCrop Fenpro (09885) ®	fenpropimorph	31/12/08
	1703/05	CleanCrop Fenpropimorph (09445) ®	fenpropimorph	31/12/08
	0804/04	Corbel (00578) ®	fenpropimorph	31/12/08
	0504/07	Chess WG (13310) ®	pymetrozine	31/10/11
	0492/07	Chess WG (10651)	pymetrozine	31/07/08

Appendix 7 Products with specific off-label approval (SOLAs) for use on Cane Fruit (Cont'd)

Crop	Number	Product Name	Active Ingredient	Expiry
Loganberries	1702/06	Plenum WG (10652) ®	pymetrozine	31/10/11
(Cont'd)	1984/07	Treflan (05817) ®	trifluralin	31/08/08
Tayberries	1703/05	CleanCrop ® Fenpropimorph (09445) ®	fenpropimorph	31/12/08
	0804/04	Corbel (00578) ®	fenpropimorph	31/12/08
	0802/04	CleanCrop Fenpro (09885) ®	fenpropimorph	31/12/08

Notes for Appendix 7:

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.

SOLAs uses may only take place if all the conditions in the "Notice of Approval" the products 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.

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Appendix 8 Guidelines for minimising pesticide residues in raspberries

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
fenhexamid	*Botrytis*	Residues found regularly	Increased use of cultural control - see guidelines below
fenhexamid	*Botrytis*	Residues found less regularly	Increased use of cultural control - see guidelines below
pyrimethanil	*Botrytis*	Residues found occasionally	Increased use of cultural control - see guidelines below
azoxystrobin fenpropimorph myclobutanil bupirimate	Powdery mildew	Residues found occasionally	Increased use of cultural control - see guidelines below
metalaxyl	Raspberry root rot	Residues found occasionally	Increased use of cultural control - see guidelines below
pirimicarb	Aphids	Residues found regularly	Gain early control - see guidelines below
bifenthrin	Two spotted spider mite & clay coloured weevil	Residues found occasionally	Increasede use of biological control
chlorpyrifos	Raspberry cane midge, Raspberry beetle, Wingless weevils, caterpillars, Aphids and capsid	Residues found occasionally	Increase the harvest interval - see guidelines below

Guidelines:

Consumers and retail customers are raising increasing concerns over the incidence of pesticide residues occurring in fresh produce. Their desire to purchase produce that is free from residues has necessitated raspberry growers to consider ways and means of minimising the presence of residues in fruit at harvest.

Assured Produce, in consultation with the technical representatives from all the major soft fruit marketing and producer organisations has also considered this problem and in particular the active ingredients which are found in raspberries during the UK production season.

For the identified active ingredients they have formulated guidance notes on potential crop protection and management strategies that growers may wish to follow to minimise the risk of residues occurring.

Appendix 8 Guidelines for minimising pesticide residues in raspberries (cont'd)

Active Ingredients Found in UK Raspberries

Following good agricultural practice and integrated crop management should avoid any MRL exceedance in the first place. The table below lists those active ingredients found in raspberries. It is not a list of MRL exceedances but where residues are reported between the MRL and the limit of detection. Each has a star rating, depending upon the frequency in which they are found:

Crop	Chemical Type	Active Ingredient	Typical Product Name	H.I.Days	Star Rating
Raspberry	**Fungicide**	azoxystrobin	Amistar	7	*
		bupirimate	Nimrod	8	*
		fenhexamid	Teldor	1	***
		fenpropimorph	Corbel, CleanCrop Fenpro	14	*
		metalaxyl	SL567A	3 months	*
		myclobutanil	Systhane 20EW	3	**
		pyrimethanil	Scala		
	Insecticide	chlorpyrifos	Equity, Lorsban WG	7	*
		bifenthrin	Talstar 80 FL, Starion Flo	2	*
		pirimicarb	Aphox	3	***

*** Residues found regularly
** Residues found less regularly
* Residues found occasionally

Possible solutions to minimise these residues

A number of suggestions have been formulated to minimise the risk of residues of these active ingredients occurring in residue analyses. These have only been offered where the strategy is considered to be reasonable and practical.

Insecticides

Chlorpyrifos (Lorsban WG, Dursban, etc)

This insecticide is currently used primarily but not exclusively in raspberry plantations in order to achieve control of Raspberry beetle and Raspberry cane midge.

Usage is already restricted on label (according to product, rate of individual applications and target pest) to a maximum of 3L or 1.8kg of product applied/ha/crop per year, two or 3 applications per year and a 7 day harvest interval.

Raspberry beetle

Although two other insecticides namely deltamethrin (Decis) and rotenone (Derris) can be used for this pests control, neither are as effective as chlorpyrifos against this pest. In addition deltamethrin is very damaging to both natural and introduced predatory mites and insects established in the crop, both at the time of and potentially for several months following its use.

There is nil tolerance for the presence of adult Raspberry beetles, larvae or larval damaged fruits, so growers routinely apply insecticides for this pest's control. In the case summer fruiting raspberries, applications are made immediately prior to flowering and or post-blossom at the late green fruit or late pink fruit stage. The timing and number of applications being based upon the perceived risk to the crop, i.e. the grower's experience with regards to past beetle numbers and previous crop damage within an individual plantation or the plantations across the whole farm.

In the case of primocane (autumn) fruiting raspberries, growers have traditionally applied an insecticide at first pink fruit to achieve control of this pest. In recent years some growers have started to 'scout' crops pre-flowering for the presence of

adult beetles. An insecticide being applied, just prior to the onset of flowering, if beetles have been found foraging on the tips of canes at this stage. Followed by, a second at first pink fruit, where fruit damage by this pest has been unacceptably high, the previous season.

Although fortnightly or preferably weekly scouting of crops, from April until first open flower of summer and primocane fruiting raspberries can reveal their presence. It can offer no clear guidance as to the level of fruit damage, from beetle larval feeding that is likely to occur.

Non-UV light-reflective sticky white traps are available for use pre-flowering, to help determine the level of beetle activity within plantations.

Unfortunately although it has been shown that, where less than five beetles are found on a trap, from first emergence the beetles to first open flower, there is a low risk of fruit damage by this pest.

The current nil tolerance for the presence of this insect, in harvested fruit, means that very few, if any growers are likely to take the risk and not spray.

At present the optimum density for these traps is also unknown, so growers are unlikely to be able for some time to rely on them as the sole guide as to whether or not to spray.

The enhancement per-flowering of beetle catches by the addition of flower volatiles to these traps is currently under investigation, but will still not enable them to be used during the flowering period of the crop. There will still therefore be no means of assessing the risk of damage to fruit, caused by beetles that have emerged from the soil or left their Rosaceous intermediate host plants for raspberry after the use of a pre-flowering spray .

Until recently all of the research to date carried out into the life history, monitoring and control of this pest has been for field grown raspberries.

Information on how beetle populations react in all-year-round glasshouse or field (primarily Spanish-tunnelled) protected crops is still not fully understood. It is not envisaged therefore that, in the foreseeable future, growers will be able to safely desist from the use of at least some routine spray applications for control of this pest.

Although recent trials have demonstrated that some newer insecticides, notably thiacloprid have activity against Raspberry beetle, on a par to that of chlorpyrifos, the use of this insecticide is currently remains limited to outdoor crops.

Raspberry cane midge

This insect is an ever-present threat to the majority of summer fruiting raspberry plantations. The impact of the damage that the larvae of this insect causes to primocanes is not seen until the end of their growing season, i.e. the winter or more often the following spring/summer i.e. their fruiting year. Low levels of midge infestation; are easily missed by growers, who may be unaware of this pest's presence in plantations.

The weather conditions, primocane management and stage of development in the spring at the time of adult midge emergence from the ground in a specific season can allow a first, second and even third generation of midge larvae to damage primocanes.

By the following spring, the tissue damaged by larval feeding now infected by *Fusarium* and or *Leptosphaeria* may have left canes weak, dying or even dead. Resulting on occasions in 30% + plus loss of fruiting cane.

Chlorpyrifos is at present the only insecticide with label approval for control of this pest and recent trials have indicated that there are no immediate replacements for its use. A reliable predictive model to determine the date of adult midge emergence, based upon cumulative soil temperatures, collected from late winter onwards above a threshold of 4^{0} C and recorded at a depth of 10cm exists for open field grown crops.

If used along with the examination of mature primocane, during the winter for the presence and number of 'patch' lesions

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produced by midge larval, feeding and the current season's primocane for natural growth splits or frost damage, which could offer ideal midge egg laying sites. The use of this predictive model can enable growers to accurately evaluate the risk in the current year and determine if, when and how often to spray to prevent damage.

So that when the above monitoring methods have been correctly used, a single insecticide spray, in the spring, directed onto the primocanes at or soon after the predicted date of adult midge emergence from the soil, is all that is required to provide effective control of this pest.

However, although it can be successfully employed for field grown crops, protected by Spanish tunnels at harvest, this predictive model is unsuitable and unrealiable as a means of ascertaining the date of midge emergence. For either AYR protected glasshouse or field grown crops covered with tunnels in the late winter/early spring each year to substanially advance harvest.

For these crops the wounding and then microscopic examination of primocane every seven days, in order to detect when the first midge eggs have been laid, is a monitoring system that until now has had to be employed. Which has been both a time-consuming and expensive process to carry out.

The sex pheromone of the Raspberry cane midge has recently been identified and synthesised by East Malling Research and the Natural Resources Institute. This has been found to be highly attractive to adult male midges and has been used as both means of identifying the date on which adult male midge's emergence from the soil, in spring. As well as to monitor this pest's activity in raspberry plantations, there after through the spring and summer months. Trials under commercial conditions were carried out during 2006 in both open field grown and protected crops to assess the use of single white delta traps baited with polythene vial dispensers containing this pheromone. In order to test a catch of 30 midges/trap as the nominal threshold to determine the date in the spring of the first application of chlorpyrifos for this pests control also to determine its efficacy and practicality as a means to monitoring midge emergence and activity in protected crops. These have confirmed that the traps can be very effective. As a means of identifying when the first adult midges emerge from the soil in the spring, when the threshold for spraying is reached and to monitor the number of midge adults present in a plantation for the remainder of the crops growing season.

This work also identified that some modifications to the pheromone dispenser and trap dispenser were required before they could be made commercially available to the industry. This is now underway and it is hoped that at least some trapswill be available for growers to use in plantations during the current year. However it is still not completely understood how large an area an individual trap can be reliably expected to monitor midge activity. So if used growers are advised, to install these traps, in not just one location, but to place them in a range of crops e.g. within plantations of summer & primocane fruiting raspberries, which are protected (covered with Spanish tunnels) early, late protected or in the open field. So that they are able to acurately determine midge activity within the various growing situations.

Trials work will also be continuing during 2007 & 2008 to determine the efficacy and practicality of using the sex pheromone of the Raspberry cane midge as a means of disrupting the mating of or to lure and kill this pest. If either of these systems prove to be successful the hope is that the industry may no longer need to use chlorpyrifos or any other conventionally applied pesticide routinely to achieve control of this pest. .

In the meantime, the existing midge emergence predictive model based upon cumulative soil temperature of if available pheromone traps could be used for field grown crops that **are unprotected until the onset of flowering** to determine when to spray. Both of these, if used along with, the monitoring of historical damage and the current seasons primocanes stage of growth, will enable growers, in most years, to restrict to just one pre-flowering spray, the use of chlorpyrifos for the control of this pest.

At some sites, it may also be possible to combine the use of the predictive model or pheromone traps with the removal of egg laying sites for this insect, by 'first flush' of primocane removal, just prior to this pest's date of emergence.

The application of chlorpyrifos may then not be required at all for the control of this pest.

Although the continued use of chlorpyrifos for Raspberry cane midge control is likely to be unavoidable for the foreseeable future. **Our guidance is that growers should consider the adoption of the following strategies, in order to minimise**

the risk of residues of this insecticide from being found in fruit at harvest:

- Usage should not only be limited, as per label approval, to two applications per year but the amount of chlorpyrifos used on each occasion should be restricted to 1L/ha for the 480 g/L and 0.6kg/ha for the 75% a i w/w products.
- That for Raspberry beetle control; to minimise the risk of residues in fruit, application of this product should be made no later than **late green bud**, to provide as long a harvest interval as possible.
- Where possible, *but only if the grower had confidence that this action would provide adequate control to meet the market's tolerance for fruit contamination by this pest,*the application of chlorpyrifos might be restricted further, to pre flowering use.

This action would however, probably need to be followed post-flowering, preferably at the late green fruit stage by the use of either rotenone (Derris), deltamethrin (Decis), bifenthrin (Talstar 80Flo) or thiacloprid (Calypso). Deltamethrin and bifenthrin because of their adverse impact upon beneficial insects and mites need to be used with caution. This being particularly the case where predatory mites were likely to be required in plantations to provide Two-spotted spider mite control.

- For open field plantations and those unprotected until the onset of flowering or harvest, the use of the existing Raspberry cane midge emergence prediction model based upon cumulative soil temperatures or catches within traps containing the sex pheromone of this pest. Would enable growers in most years to safely restrict chlorpyrifos use for the control of this pest to just one spray. Appropriately applied at high volume to thoroughly wet the rind of the target primocanes.
- If the predictive model or the traps containing the sex pheromone of this pest are used along with the monitoring of canes in winter, for damage caused this pest and the assessment of current season's primocanes stage of growth i.e. susceptibility to midge attack. In some years, growers could with confidence omit sprays for the control of this pest.
- The use of the predictive model, or traps containing the sex pheromone of this pest with at the appropriately timed 'first flush' of primocane removal using sodium monochloroacetate (e.g Croptex Steel + Wayfarer). Where the condition of the plantation allowed this practice to be safely carried out. Could also eliminate the need to use this insecticide, in some years for the control of this pest.

Aphids

Pirimicarb

In recent years a range of aphid species and most notably the large raspberry aphid (*Amphorophora idaei*), have become an increasing problem in UK raspberry plantations. In part due to the fact that at least two of the major summer and more or less all of the primocane fruiting raspberry cultivars currently used by the industry have only partial resistance to the feeding of this aphid. Unfortunately this aphid species is also an important virus vector in the raspberry crop, so effective control is essential so as to reduce the risk of virus infection of the crop plant as well as to ensure that individual insects do not become crop contaminants at harvest.

All year round protection under glass or fixed polythene clad structures of raspberries and the protection of open field grown crops with temporary polythene clad tunnels for a high proportion of the growing season has created ideal conditions for the rapid multiplication of populations of this and other aphid pests.

For open field grown and protected crops, there is now the opportunity to use instead of pirimicarb either pymetrozine or thiacloprid, to provide control of these pests. SOLA’s are now available with either a 12 week and 3 day harvest interval for pymetrozine use in most open field and protected *Rubus* crops. SOLA's now permit the use of thiacloprid in outdoor and protected raspberry and blackberry crops, with a 3 day harvest interval.

Recent research, as part of a Defra LINK project, has indicated that the application of a suitable insecticide in the early autumn, i.e. post harvest of summer fruiting raspberries, may substantially reduce the population of the large raspberry aphid present in the treated plantation the following spring and summer. Thereby offering the possibility of eliminating or substantially reducing the need to apply insecticides for the control of this pest during the spring and summer months pre harvest. This method of aphid control is currently still being appraised.

Our guidance is that growers should consider the adoption of the following strategies, in order to minimise the

risk of residues of this insecticide from being found in fruit at harvest:

- Carry out routine monitoring of individual raspberry plantations throughout the growing season, preferably weekly for the presence of this pest. In order that pesticides can be applied, to provide effective control of these pests, when ever practicably possible well in advance of harvest.

- Continue to carry out routine monitoring of the crop post harvest until leaf fall. In order that when necessary control measures can be applied to ensure that the population of aphid pests over wintering in the crop can be kept to a minimum.

- That where possible indigenous natural predators of these pests should be encouraged establish and to forage in the crop canopy of open field grown and protected crops. Also where their efficacy is proven against these pests suitable, indigenous and non-indigenous predators introduced routinely or as appropriate into all year round protected raspberry crops. To assist in if not provide complete control of these pests.

Fungicides

Many fungicides are applied on a prophylactic basis in raspberries to control aerial diseases such as Fruit and cane *Botrytis*, Powdery mildew, Raspberry rust and Spur blight. They are therefore applied routinely up until harvest.

It is generally accepted that any fungicide that is applied within 21 days of harvest is at risk of appearing in a residue analysis.

The only reliable way of preventing pesticide residues from occurring in harvested raspberries is to avoid the application and use of the listed fungicides altogether. However this is not feasible at present given the high disease pressure that ifs often placed upon raspberry crops during the production season.

Therefore, the most practical way to minimise the risk of residues occurring is to reduce, whenever this is feasible the need to rely so heavily upon prophylactic fungicide treatments. This is best achieved by following specific crop management techniques to reduce the risk of infection and spread of diseases.

Botrytis

The incidence of fruit *Botrytis* affecting raspberries at harvest has substantially decreased, due to the increasing number of field grown raspberry crops that are now protected at or prior to harvest by temporary tunnel structures.

This has provided a drier environment around the plants and reduced rain and water splash and wind damage to developing flowers and fruits. Recent summers with drier than the long-term average weather has undoubtedly also helped.

However some crops are still unprotected, predominantly those for processing, local fruit and i.e. PYO and farm shop sales and these remain at greater risk as far as fruit *Botrytis* infection is concerned.

For tunnel protected crops, the rows adjacent to the legs of each tunnel bay, are most at risk of *Botrytis* infection. These can be subject to both rain and soil splash and high relative humidity during periods of heavy or continuous rainfall. Lack of access to makes them difficult to effectively spray.

The following crop management techniques are suggested as a means of reducing the risk of infection and spread of this disease:

- When purchasing plants ensure that they are free of cane *Botrytis*. In the case of 'Long cane', canes which are bearing numerous *Botrytis* lesions on their surface, should always be rejected as they performance is likely to be substantially impaired.

- Where possible, make use of portable tunnels to protect crops from wet weather, during the flowering and or harvest period, in order to reduce the risk of infection and spread.

- For Spanish Tunnel protected crops, ensure that plant rows are set back far as possible and preferably by at least 1.37m from tunnel legs to reduce the effect of soil/rain splash and to improve the airflow and hence speed of drying of the crop's foliar canopy, following rain. Use mulches of straw or a permeable membrane e.g. Mypex, laid along the length of the leg rows to further reduce the rain splash.
- Consider the use of gutters or other forms of water removal from the roofs of polythene-clad tunnels, to avoid rain splash altogether. Steps should also be taken to suitably manage the run off from tunnel roofs away from headlands.
- Crops being grown under tunnels or other forms of protection should be adequately vented to avoid high relative humidity, which will favour *Botrytis* infection. Growers should always have a means of measuring the relative humidity of tunnel or glasshouse covered crops and systems in place which will allows swift ventilation of these structures should the relative humidity become too high.
- Where summer fruiting plantations are to be retained for cropping in subsequent years, all fruited and unwanted primocanes should be removed as soon as practically possible post harvest. Primocanes to be retained to crop the following year should be suitably supported to prevent their being damaged in the wind and appropriate fungicides applied routinely, until the end of the growing season, to reduce cane *Botrytis* and Spur blight infection from occurring.

- The polythene covers over tunnelled summer fruiting raspberry crops should be removed as soon as is practically possible post harvest. As the environmental conditions beneath them in the late summer and early autumn months are likely to be conducive to Powdery mildew, cane *Botrytis*, Spur blight and Raspberry rust infection, spread and development.

- Prior to and during harvest, effective primocane removal/control and support should be practiced in summer fruiting raspberry crops.

To maintain the crop canopy as open as possible, in order to avoid the creation of conditions ideal for the above diseases. Care should however always be taken to minimise physical or chemical damage to the rind of primocanes when carrying out the above processes, which could in themselves allow the entry of diseases including Cane blight.

- The application of excessive amounts of nitrogen to crops should be avoided at all times, especially post harvest when this could adversely affect primocane maturation and increase their susceptibility to both Spur blight and cane *Botrytis* .
- Where practical all crop debris of both summer and primocane fruiting raspberries i.e. canes should be from removed from plantations post pruning and burnt or disposed of by other means off site. In the case of AYR protected crops, care should also be taken to remove as much foliar debris, (which could harbour pests and diseases) as possible, between leaf fall in the autumn/early winter and onset of cane growth the following late winter/early spring.
- If in the case of field grown crops, if cane debris is to be pulverised in the alleys of plantations this work should be carried out, so that when completed no cane debris preferably in excess of 15cms length is left on the soil surface.
- Lastly old fruited cane stubs in excess of 2.5cm in length or unwanted cut primo or flori-canes canes should not be left in the rows at the completion of winter pruning.

Powdery mildew

The incidence of this disease in the raspberry crop has significantly increased in recent years, due to the use by the industry of cultivars which are more susceptible to infection and the now widespread use of either temporary polythene clad structures e.g. Spanish Tunnels. In order to merely protect the crop from adverse weather conditions, during harvest, or from flowering or the very early spring onwards to advance the harvest. In addition many growers are using all year round fixed polythene clad tunnels or glasshouses to further extend the harvest period of raspberries.

The higher temperatures, often accompanied by high levels of Relative humidity, experienced by crops covered by these structures, which are often well in excess of those experienced by open field crops, also create conditions conducive to the sporulation, distribution and development of this disease.

Cultural suggestions to reduce the incidence of Powdery mildew are summarised below:

- Those crops being grown under protection should always be adequately vented to ensure that the crop is not subjected to excessively high temperatures or the build up of humidity; which favours powdery mildew infection. Growers should always have some means of measuring both the temperature and humidity; within protected crops and a system; which

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allows them to vent swiftly should the humidity rise too high. The importance of proactive tunnel and glasshouse environmental management cannot be stressed too highly.
- When feeding plantations, avoid excess use of nitrogen, which could lead to the production of soft growth; which is more susceptible to infection.
- Prior to and during harvest, effective primocane removal/control and support should be practiced in summer fruiting raspberry crops. To maintain the crop canopy as open as possible, in order to avoid the creation of conditions ideal for the above disease.

Improved Crop Monitoring

One way of ensuring agrochemicals are applied, at the optimum time and only when necessary (to avoid the use of unnecessary applications), is to rely upon high quality, routine crop monitoring. Ideally, crops should be assessed at least once or twice every week for the commonly found insect pests and diseases, as opposed to the fortnightly inspections that are currently the industry standard. This is particularly important early in the season. At this stage, should specific insect pests or diseases appear, then early curative and preventive action can be taken to avoid the use of applications later in the season, closer to harvest, thus reducing the risk of residues occurring.

Where such monitoring is conducted, it is wise to employ record sheets to log any problems which are found each week, record the choice of agrochemical, the date it was applied and why it was applied. At the end of the season, this allows growers to relate any residues, which have occurred to the chemical application and the monitoring procedure, thus allowing the effectiveness of the monitoring to be assessed.

Appendix 9 Control Points: Fruit (Cane Fruit)

CS.39 **FRUIT (CANE FRUIT)**

CS.39.1 You should be able to show evidence that when selecting fields for cane fruit production you have considered soil structure, drainage, texture, pH, depth, exposure of the site to prevailing winds, susceptibility to spring frost, presence of soil-borne pests and diseases and proximity to other infected Rubus crops

- Protocol reference: Section 3.1.1

CS.39.2 Your plantations should be managed to minimise the spread of pests and diseases from fruiting to primocanes -

Protocol reference: Section 8.1.2.2

CS.39.3 Weed control programmes should be designed and implemented taking into account the major weed species present and their germination periods -

Protocol reference: Section 8.10.1

CS.39.4 *Deleted 2005*

CS.39.5 You should ensure that any polythene waste from plantations is recovered and disposed of or recycled in the most appropriate manner -

Protocol reference: Section 8.10.1

CS.39.6 Picked fruit should be transported within a clean enclosed vehicle to help prevent contamination from dust, foliage, insects, etc -

Protocol reference: Section 9

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