

Resistance Warnings and Restrictions on Labels of Insecticide and Acaricide Products

Introduction

Following a report prepared by the Pesticides Safety Directorate (now Chemicals Regulation Directorate, CRD) in 1996, the Advisory Committee on Pesticides (ACP) approved standardised insecticide and acaricide resistance warnings. There are also additional resistance warnings and restrictions on uses approved either prior to, or after, 1996. This guideline was originally written to include all such label phrases and restrictions that must appear on the relevant product labels. In 2006 a new draft was prepared to take account of more recent regulatory decisions concerning insecticide resistance issues. (Applicants should also be aware of the resistance warning specified in Annex V labelling directive of 91/414/EEC¹. Further guidance on the appropriate use of this phrase is provided in [Efficacy guideline 606](#). Resistance risk analysis and use of resistance management strategies). No other phrases are allowed without further approval from CRD.

These phrases and restrictions also apply to relevant 'off-label' uses, where they appear as part of the approval notice and advisory information. This is in recognition of the need to ensure a consistent approach to resistance management across all potential uses. It is important to note that the restrictions also refer to potential future extensions of use.

Where there are recommendations for the control of more than one of the pests listed below, then the phrases shown must be combined (see Explanatory notes). CRD recognise that these composite statements can be long and therefore will allow flexibility in their drafting provided prior agreement has been obtained. Alternatively, if an approval holder considers that some of the label amendments shown are not appropriate, then an application must be made with the necessary data or a reasoned case.

Label phrases and restrictions

The following situations require restrictions on use and/or specific label phrases:

- i) All products with recommendations for aphid control, excluding specific recommendations solely for aphid control on cereals and excluding products containing dimethoate or neonicotinoids, must have the following label phrase: 2
- ii) All dimethoate products with approved uses on potato, sugar beet and other beet crops 3
- iii) All dimethoate products with approved uses on sugar beet and other beet crops..... 3
- iv) All pirimicarb products with recommendations for the control of aphids under protection 3

¹ "To avoid the build up of resistance do not apply this or any other product containing (identify active substance or class of substances, as appropriate) more than (number of applications or time period to be specified)".

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The mode of action classification for UK approved insecticide active substances are provided as reference in Appendix 1. However users **must** refer to individual product approvals to identify those active substances with a relevant use referred to in this guideline. Historical phrases that applied to uses no longer approved are given in Appendix 2.

- i) All products with recommendations for aphid control, excluding specific recommendations solely for aphid control on cereals and excluding products containing dimethoate or neonicotinoids, must have the following label phrase:***

“Strains of some aphid species are resistant to many aphicides. Where aphids resistant to products containing [*active ingredient*] occur, [*product name*] is unlikely to give satisfactory control. Repeat treatments are likely to result in lower levels of control.”

ii) All dimethoate products with approved uses on potato, sugar beet and other beet crops

“In potato, sugar beet and other beet crops, strains of peach-potato aphid resistant to organophosphorus insecticides are common. [product name] or any other dimethoate containing product must not be used for control of peach-potato aphid as it will be ineffective, leading to a seasonal build-up of resistant populations.”

In addition, product labels must specifically exclude claims of control for peach potato aphid (*Myzus persicae*).

iii) All dimethoate products with approved uses on sugar beet and other beet crops

Labels must state that only one application per crop of the equivalent of 84 g a.i./ha should be made for the control of *Pegomya* and that only one additional application per crop at the equivalent rate of 420 g a.i./ha should be made for the control of black bean aphid.

iv) All pirimicarb products with recommendations for the control of aphids under protection

“Strains of some aphid species are resistant to many aphicides. Where aphids resistant to products containing pirimicarb occur, [product name] is unlikely to give satisfactory control. Repeat treatments are likely to result in lower levels of control.

Note. Strains of the melon and cotton aphid are resistant to pirimicarb. Use of [product name] is unlikely to give control of this aphid.”

v) Aphicides on hops

a) Foliar applied aphicide sprays (excluding neonicotinoids, see b)

“Strains of some aphid species are resistant to many aphicides. Where aphids resistant to products containing [active ingredient] occur, [product name] is unlikely to give satisfactory control. Repeat treatments are likely to result in lower levels of control.

Note. for damson-hop aphid wherever possible use different active ingredients in a programme of treatments.”

b) Neonicotinoid foliar applied sprays

For hops, where there is a need for long-term control, any foliar use will be restricted to two applications per crop, unless a neonicotinoid soil or basal spray treatment has been applied, in which case use is restricted to one foliar application per crop. The following label phrase (and restriction) must appear:

“Use no more than two applications of any neonicotinoid insecticide (e.g. imidacloprid) on any crop. Where a neonicotinoid insecticide has previously been used on the crop (e.g. as a basal spray or soil treatment), use no more than a single foliar application of any neonicotinoid.

Total reliance on one pesticide will hasten the development of resistance. Pesticides of different chemical types or alternative control measures should be included in the planned programme. Alternating insecticides with different modes of action is a recognised anti-resistance strategy and [product name] should always be used in conjunction with other insecticides of a different mode of action.”

- c) All non-foliar applied aphicides (including neonicotinoids) e.g. basal sprays

“Exclusive use of this product to control damson-hop aphid may select for a population which is less susceptible and subsequently lead to control failure through development of resistance. To minimise the likelihood of the development of resistance, do not treat your entire crop in any one year with this product.”

vi) *Neonicotinoid seed treatments used on Myzus persicae host crops*

A general statement must be added to neonicotinoid seed treatment products used to treat crops considered to be a host crop of *Myzus persicae*, regardless of whether *M. persicae* is the intended target. Under a resistance management section, the following must be added:

‘Use of this product should form part of a resistance management strategy. Where a neonicotinoid seed treatment has been used, the first subsequent foliar spray should be made with a product containing a different active substance and from a different mode of action class. Consult the IRAG website for further information on a particular management strategy for the targets in question.’

In addition, it would be preferable for advisory wording to appear on the seed label with the following meaning:

‘Consider resistance management when using subsequent foliar applications. Consult the IRAG website for further information’

vii) Neonicotinoid containing products used on ornamentals (soil incorporation and foliar treatments)

Use should be restricted to two foliar applications per crop per year unless a neonicotinoid soil treatment has been used, in which case use is restricted to one foliar application per crop. The following label phrase (and use restriction) must appear:

“Use no more than two applications of any neonicotinoid insecticide (e.g. clothianidin, imidacloprid or thiacloprid) on any crop per year. Where a neonicotinoid insecticide has previously been used as a soil treatment, use no more than a single foliar application of any neonicotinoid.

Total reliance on one pesticide will hasten the development of resistance. Pesticides of different chemical types or alternative control measures should be included in the planned programme. Alternating insecticides with different modes of action is a recognised anti-resistance strategy and [*product name*] should always be used in conjunction with other insecticides of a different mode of action. This includes consideration of sequences involving soil treatments followed by foliar sprays. Where a neonicotinoid soil treatment has been used, the first subsequent foliar spray should be a non-neonicotinoid containing product with a different mode of action.”

viii) Neonicotinoid containing products used as foliar treatments either for the control of *Myzus persicae*, or for use on *M. persicae* host crops (see viii)b))

There is widespread use of this group (e.g. acetamiprid, clothianidin imidacloprid, thiacloprid) with both ‘on’ and ‘off’ label approvals across a range of crops/pests. The highest resistance risk is considered to be either direct or incidental exposure to the peach potato aphid (*Myzus persicae*). The length of growing season of an individual crop, and thus the potential need for multiple applications, has also been taken into account. The approval of neonicotinoid treatments on *M. persicae* host crops which are targeting other pest species will be considered case-by-case. Restrictions may or may not be appropriate, but it is advisable in any case for these uses to include on the label the general resistance warning specified under viii)c)). In consideration of all of these factors, the following restrictions on use and label phrases apply. For some products, several of the uses described below may be relevant and an example of how to combine the resistance warnings is given under ‘Explanatory Notes’.

a) Foliar treatments for the control of *Myzus persicae*

- i) For control of *M. persicae* on tomato, aubergine, pepper, cucumber, courgette, lettuce, 'Chinese leaf' crops, and herbs, foliar use is restricted to two per crop unless a neonicotinoid seed treatment or soil treatment has been applied, in which case use is restricted to one foliar application per crop. The following label phrase (and use restriction) must appear :

"Use no more than two applications of any neonicotinoid insecticide (e.g. clothianidin, imidacloprid or thiacloprid) on any crop. Where a neonicotinoid insecticide has previously been used on the crop (e.g. as a seed treatment or soil treatment), use no more than a single foliar application of any neonicotinoid.

Total reliance on one pesticide will hasten the development of resistance. Pesticides of different chemical types or alternative control measures should be included in the planned programme. Alternating insecticides with different modes of action is a recognised anti-resistance strategy and [product name] should always be used in conjunction with other insecticides of a different mode of action. This includes consideration of sequences involving seed or soil treatments followed by foliar sprays. Where a neonicotinoid seed or soil treatment has been used, the first subsequent foliar spray should be a non-neonicotinoid containing product with a different mode of action."

- ii) For control of *M. persicae* on short-term crops such as baby leaf production (which are harvested before the 8 true leaf stage), use is restricted to a single application (by any method). The following label phrase (and use restriction) must appear :

"Use no more than a single application of any neonicotinoid insecticide on any crop. Do not use [product name] as a foliar spray if a seed treatment or soil treatment containing a neonicotinoid insecticide (e.g. clothianidin or imidacloprid) was used in the crop.

Total reliance on one pesticide will hasten the development of resistance. Pesticides of different chemical types or alternative control measures should be included in the planned programme. Alternating insecticides with different modes of action is a recognised anti-resistance strategy and [product name] should always be used in conjunction with other insecticides of a different mode of action"

- iii) For the control of *M. persicae*, or for use against other aphid species, on long season Brassicas (e.g. Brussels sprouts, winter cabbage, winter cauliflower, purple sprouting broccoli, kale) no more than one seed or drench treatment, followed by no more than two foliar applications of any neonicotinoid per crop. These same restrictions will also apply to brassicas, where there is a need for long term control (with crops grown to marketable maturity). These will be considered on a case by case basis to determine whether two foliar application are appropriate, rather than restricting to one foliar application as is the case for other short season crops. The following label phrase (and use restriction) must appear :

“Use no more than two foliar applications of any neonicotinoid insecticide (e.g. acetamiprid, clothianidin, imidacloprid, thiacloprid) on any crop. Two foliar applications are permitted regardless of whether a neonicotinoid insecticide has previously been used on the crop as a seed or module treatment.

Total reliance on one pesticide will hasten the development of resistance. Pesticides of different chemical types or alternative control measures should be included in the planned programme. Alternating insecticides with different modes of action is a recognised anti-resistance strategy and [product name] should always be used in conjunction with other insecticides of a different mode of action. This includes consideration of sequences involving seed or soil treatments followed by foliar sprays. Where a neonicotinoid seed or soil treatment has been used, the first subsequent foliar spray should be a non-neonicotinoid containing product with a different mode of action.

One or both of the neonicotinoid foliar applications should be targeted at *Brevicoryne brassicae* and should be applied late in the season where numbers of *Myzus persicae* are low. Alternate non neo-nicotinoid containing products between foliar applications of neonicotinoids.

- iv) Foliar applications of neonicotinoids (e.g. thiacloprid) for the control of aphids on potato are restricted to one application on ware crops and two applications on seed crops. The following label phrase (and use restriction) must appear :

“Use no more than a single application of any neonicotinoid insecticide on ware potatoes, and no more than two applications of any neonicotinoid insecticide on seed potatoes.

Total reliance on one pesticide will hasten the development of resistance; pesticides of different chemical types or alternative control measures should be included in the planned programme. Alternating insecticides with different modes of action is a recognised anti-resistance strategy and [product name] should always be used in alternation with other non-neonicotinoid insecticides of a different mode of action.”

b) Foliar treatments for the control of pests on major host crops of *Myzus persicae*

- i) Foliar applications of neonicotinoids (e.g. thiacloprid) for the control of pollen beetle on oilseed rape are restricted to one application following a neonicotinoid seed treatment. The following label phrase must appear :

“Use no more than one foliar application of any neonicotinoid insecticide on oilseed rape.

“Total reliance on one pesticide will hasten the development of resistance. Pesticides of different chemical types or alternative control measures should be included in the planned programme. Alternating insecticides with different modes of action is a recognised anti-resistance strategy and [product name] should always be used in conjunction with other insecticides of a different mode of action. This includes consideration of sequences involving seed or soil treatments followed by foliar sprays.

c) Foliar treatments on crops which are not a host, or only a very minor host, of *M. persicae*

No restriction on the number of applications is required on resistance grounds. The following label phrase must appear:

“Total reliance on one pesticide will hasten the development of resistance. Pesticides of different chemical types or alternative control measures should be included in the planned programme. Alternating insecticides with different modes of action is a recognised anti-resistance strategy and [product name] should always be used in conjunction with other insecticides of a different mode of action.”

ix) *Pymetrozine containing products*

There is widespread use of pymetrozine with ‘on’ and ‘off’ label approvals across a range of crops/pests. The highest resistance risk is considered to be exposure to peach potato aphid (*Myzus persicae*) on the major host crops (brassicacae and potatoes). It is also recognised that optimal effectiveness is best achieved with two sequential sprays. In consideration of this, the following restrictions on use and label phrases apply.

- a) Use on potatoes is restricted to two applications on ware potatoes and three applications on seed potatoes.
- b) Use on short-term crops (e.g. baby leaf production) is restricted to two applications.
- c) Use on other crops/uses is restricted to three applications, except on ornamentals where four applications are permitted. In all situations a maximum of only two sequential applications are permitted before alternating with different modes of action, or using alternative control methods.
- d) The following label phrase must appear:

“To prevent the development of resistance [*product name*] containing pymetrozine should not be used continuously in sequence or as the sole method of control. A maximum of two treatments should be made in sequence. Alternate with products from different chemical groups with a different mode of action, and consider use in IPM programmes.”

x) All products with a recommendation for whitefly control

- a) Products containing active ingredients from the pyrethroid or organophosphorus groups, or the active ingredient pyrethrins, for the control of glasshouse whitefly:

“Glasshouse whitefly strains resistant to one or more groups of insecticides are widespread. Where strains resistant to products containing [*pyrethroid, pyrethrin, organophosphorus*] insecticides occur, [*product name*] is unlikely to give satisfactory control.

Note: resistant strains of the tobacco whitefly are also known to occur.”

- b) Products containing buprofezin

“Note: strains of tobacco whitefly resistant to buprofezin are known to occur. Where present, reduced or ineffective control is likely to result.”

xi) All products with a recommendation for the control of pear sucker and containing active ingredients from organophosphorus or pyrethroid groups

“Pear suckers resistant to one or more groups of insecticides are widespread. Where strains resistant to products containing [*organophosphorus, pyrethroid*] insecticides occur, [*product name*] is unlikely to give satisfactory control. Where repeat treatments are necessary use different active ingredients.”

xii) All organophosphorus products with a recommendation for the control of fruit tree spider mite or two spotted spider mite

“Strains of ‘spider mites’ resistant to one or more groups of acaricides are widespread. Where strains resistant to products containing [*active ingredient*] occur, [*product name*] is unlikely to give satisfactory control.

xiii) Acaricides containing Mitochondrial Electron Transport Inhibitors

“To reduce the possibility of the development of resistance no more than one application of [*product name*] should be made to any ONE crop in any ONE growing season. Other METI (mitochondrial electron transport inhibitor) acaricides should not be applied to the same crop in the same season as [*product name*] either separately or in mixture.”

xiv) All organophosphorus products with a recommendation for the control of stored product pests (saw toothed grain weevil, flour mite or rust-red flour mite beetle)

“Strains of saw-toothed grain beetle and flour mite resistant to some organophosphorus compounds are widespread and resistant strains of rust-red flour beetle have also been found. Where strains resistant to products containing organophosphorus compounds are present [*product name*] is unlikely to give satisfactory control.”

xv) Products with recommendations for housefly control

- a) Residual pyrethroids or mixtures containing residual pyrethroids :

“This product must not be used against houseflies in intensive or controlled environment animal houses because it is likely to cause control failure due to insecticide resistance”

- b) Space sprays

Space sprays containing pyrethrins or pyrethroids must not be used more than once a week against houseflies in intensive or controlled environment houses as they could cause control failure due to insecticide resistance. If more frequent treatments are required, use a product with a different mode of action and if necessary a different control method (such as a bait).”

- c) Insecticide baits for use against houseflies in animal husbandry

“This product should not be used continuously against houseflies in intensive or controlled environment units as this could cause control failure due to insecticide resistance. If sequential treatments are required, use a product with a different mode of action and if necessary a different control method (such as space sprays).”

xvi) HOME GARDEN PRODUCTS

Resistance is a complex issue requiring a degree of knowledge of pest identification, consequently a general warning for home garden products is used. All such products containing any of the active ingredients or active ingredient groups detailed in i), ii), vi), vii) and viii) with a recommendation for control of any of the stated pests must have the following standard label phrase:

“Pesticide resistance in [*glasshouse whitefly, pear sucker, some aphids, spider mites*] is widespread. Where resistant pests are present [*product name*] is unlikely to give control.

Explanatory notes

Where labels have recommendations for control of more than one of the pests detailed above, then the phrases shown must be combined e.g. for a product with a recommendation for the control of aphids on arable crops and hops, and the control of fruit tree spider mite and two spotted spider mite, the following label phrase would be inserted:

“Strains of some aphid species are resistant to many aphicides. Where aphids resistant to products containing [*active ingredient*] occur, [*product name*] is unlikely to give satisfactory control. Repeat treatments are likely to result in lower levels of control.

Note. for damson-hop aphid, wherever possible use different active ingredients in a programme of treatments.”

“Strains of ‘spider mites’ resistant to one or more groups of acaricides are widespread. Where strains resistant to products containing [*active ingredient*] occur, [*product name*] is unlikely to give satisfactory control.”

With several neonicotinoid approved uses it is likely that more than one of the phrases and restrictions described above may be relevant for a particular product. The phrases should be combined appropriately and, to avoid confusion, any restrictions should specify the named crops they apply to.

For example, for a product approved for use on tomatoes, peppers, lettuce and baby-leaf production, the following wording would be used :

“Use no more than two applications of any neonicotinoid insecticide (e.g. clothianidin, imidacloprid or thiacloprid) on tomatoes, peppers and lettuce. Where a neonicotinoid insecticide has previously been used on the crop (e.g. as a seed treatment or soil treatment), use no more than a single foliar application of any neonicotinoid.

Use no more than a single application of any neonicotinoid insecticide on any crop grown for baby-leaf production. Do not use [*product name*] as a foliar spray if a seed treatment or soil treatment containing a neonicotinoid insecticide (e.g. clothianidin or imidacloprid) was used in the crop.

Total reliance on one pesticide will hasten the development of resistance. Pesticides of different chemical types or alternative control measures should be included in the planned programme. Alternating insecticides with different modes of action is a recognised anti-resistance strategy and [*product name*] should always be used in conjunction with other insecticides of a different mode of action. This includes consideration of sequences involving seed or soil treatments followed by foliar sprays. Where a neonicotinoid seed or soil treatment has been used, the first subsequent foliar spray should be a non-neonicotinoid containing product with a different mode of action.”

For a product approved for use on potatoes and oilseed rape, the following wording would be used:

Use no more than one application of any neonicotinoid insecticide on ware potatoes, and no more than two applications of any neonicotinoid insecticide on seed potatoes.

Use no more than one foliar application of any neonicotinoid insecticide on oilseed rape.

Total reliance on one pesticide will hasten the development of resistance. Pesticides of different chemical types or alternative control measures should be included in the planned programme. Alternating insecticides with different modes of action is a recognised anti-resistance strategy and [*product name*] should always be used in conjunction with other insecticides of a different mode of action. This includes consideration of sequences involving seed or soil treatments followed by foliar sprays. Where a neonicotinoid seed or soil treatment has been used, the first subsequent foliar spray should be a non-neonicotinoid containing product with a different mode of action.”

Appendix 1: Insecticide chemical groups for UK approved active substances

The relevant insecticide groups for UK approved active substances are provided. This list is not exhaustive and for the complete list of all chemical groups and active substances users should refer to the IRAC mode of action classification (www.irac-online.org). For completeness, all UK active substances have been included in each chemical group. Users must refer to individual products to determine which active substances have approved uses affected by the resistance phrases and restrictions described in this guideline.

Main site of action	Chemical group	Mode of action classification group	UK approved active substances
Acetylcholine esterase inhibitors	Carbamates	1A	Benfuracarb, carbosulfan, methiocarb, methomyl, oxamyl, pirimicarb, thiodicarb
	Triazamate		Triazamate (expiry 04/01/2007)
	Organophosphorus	1B	Chlorpyrifos, chlorpyrifos-methyl, dimethoate, ethoprophos, fosthiazate, malathion, pirimiphos-methyl
GABA-gated chloride channel antagonists	Phenylpyrazoles (Fiproles)	2B	Fipronil
Sodium channel modulators	Pyrethroids	3	Bifenthrin, beta-cyfluthrin, lambda-cyhalothrin, alpha-cypermethrin, cypermethrin, zeta-cypermethrin, deltamethrin, esfenvalerate, fenpropathrin, tau-fluvalinate, phenothrin, resmethrin, tefluthrin, tetramethrin
	Pyrethrins	3	Pyrethrins
Nicotinic acetylcholine receptor agonists/antagonists	Neonicotinoids	4A	Acetamiprid, clothianidin, imidacloprid, thiacloprid, thiamethoxam
	Nicotine	4B	Nicotine
Nicotinic acetylcholine receptor agonists (allosteric)	Spinosyns	5	Spinosad
Chloride channel activators	Avermectins	6	Abamectin
Juvenile hormone mimics	Fenoxycarb	7B	Fenoxycarb
Compounds of unknown or non-specific mode of action (selective feeding blockers)	Pymetrozine	9B	Pymetrozine
	Fonicamid	9C	Fonicamid
Compounds of unknown or non-specific mode of action (mite growth inhibitors)	Clofentezine	10A	Clofentezine

Main site of action	Chemical group	Mode of action classification group	UK approved active substances
Microbial disruptors of insect midgut membranes	<i>Bacillus thuringiensis</i>	11B2	Subsp. <i>kurstaki</i>
Inhibitors of oxidative phosphorylation , disruptors of ATP formation (inhibitors of ATP synthase)	Organotin miticides	12B	Fenbutatin oxide
Inhibitors of chitin biosynthesis, type 0, Lepidopteran	Benzoylureas	15	Diflubenzuron, teflubenzuron
Inhibitors of chitin biosynthesis, type 1, Lepidopteran	Buprofezin	16	Buprofezin
Ecdysone agonists/ moulting disruptors	Diacylhydrazines	18A	Methoxyfenozide
Mitochondrial complex I electron transport inhibitors	METI acaricides	21	Fenazaquin, fenpyroximate, tebufenpyrad
	Rotenone	21	Rotenone
Voltage-dependent sodium channel blockers	Indoxacarb	22	Indoxacarb
Inhibitors of lipid synthesis	Tetronic acid derivatives	23	Spiromesifen
Neuronal inhibitors (unknown mode of action)	Bifenazate	25	Bifenazate

Appendix 2: Historical resistance phrases

The following active ingredients or insecticide groups carried resistance phrases for uses no longer approved :

- ❖ Diazinon – included in phrase iv)- for aphids under protection.
- ❖ Lindane and carbamate group – included in phrase x) for glasshouse whitefly.
- ❖ Carbamate group – included in phrase xi) for pear sucker.
- ❖ Organochlorine group and tetradifon – included in phrase xii) for mites.
- ❖ All organophosphorus products with a recommendation for the control of sciarids in mushroom production: “Strains of sciarid flies resistant to organophosphorus insecticides are widespread in mushroom production. Where resistant strains occur, [*product name*] is unlikely to give satisfactory control.”
- ❖ Cyromazine containing products with a recommendation for housefly control: “This product should not be used continuously against houseflies in intensive or controlled environment animal units. If treatment in subsequent stocking cycles is required, use a product with a different active ingredient and a different control method (such as space sprays or baits).”