TRICHODERMA HARZIANUM RIFAI ISOLATE T-39

in the products

TRICHODEX BIOLOGICAL FUNGICIDE
and
TRICHODEX BIO-FUNGICIDE

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EXECUTIVE SUMMARY

Introduction

The purpose of this document is to provide a summary of the data reviewed and an outline of regulatory considerations for the proposed registration of the biological active constituent *Trichoderma harzianum* Rifai isolate T-39 in the identical products TRICHODEX BIOLOGICAL FUNGICIDE and TRICHODEX BIO-FUNGICIDE as fungicides for the control of Grey mould caused by the fungus *Botrytis cinerea* in grapevines.

The National Registration Authority for Agricultural and Veterinary Chemicals (NRA) invites public comment before deciding whether to proceed to approve these products for use in Australia.

The NRA has completed an assessment of the data submitted by the applicant in support of this use of *Trichoderma harzianum* Rifai isolate T-39 and has provided the following information for public comment:

Agricultural Aspects

TRICHODEX BIOLOGICAL FUNGICIDE and TRICHODEX BIO-FUNGICIDE are new biological fungicides containing 10^9 colony forming units per g of *Trichoderma harzianum* isolate T-39. The mode of action of the fungicides is thought to involve competitive exclusion of the target fungal species, *Botrytis cinerea*, rather than any mycotoxic or antibiotic secretion by *T. harzianum* T-39. The product is for use by ground spray and is recommended to be used in rotation with a chemical fungicide at 2 kg/ha or alone or at 4 kg/ha.

Efficacy data provided demonstrate that Trichodex fungicides control Grey mould in grape vines when used according to label directions.

Environmental Aspects

Environmental exposure to Trichodex fungicides will primarily involve the soil and vegetation, as the products are to be sprayed as wettable powders. *Trichoderma* species are widely distributed throughout soils and on leaf surfaces throughout the world. The company claims that levels of *Trichoderma* will decline to background levels within two to three weeks after fungicide application, and has provided some data in support of this claim.

Ecotoxicity testing has shown that *Trichoderma* is not toxic to birds. Fish and bees were found to be susceptible to the application of Trichodex fungicide at the two highest tested levels of application, but these effects are thought to be due to physiological disruption of respiration rather than inherent toxicity of the fungicide. Literature data provided indicates that most invertebrates will not be affect by the particular strain of *Trichoderma* to be used in Trichodex. Soil micro-organisms were not tested with the particular strain of *T. harzianum* to be used in the current fungicides under review, but

testing with other *T. harzianum* strains demonstrated no toxic effects to the majority of species examined.

Overall, Trichodex fungicides should represent a low hazard to terrestrial and aquatic fauna and flora.

Public Health Aspects

Toxicology

Acute studies have been conducted using the products to be marketed in Australia. These studies indicate that Trichodex is of low acute oral, dermal and inhalational toxicity in rats. Additionally, there was no evidence of pathogenicity or infectivity. Trichodex was not a skin irritant but was a moderate eye irritant in rabbits, and caused skin sensitisation in guinea pigs. No longer term studies are available, however, in the absence of effects following acute exposure and the non-pathogenic mode of action, chronic effects are not expected. Trichodex did not produce chromosomal damage in mice, and is not expected to damage genetic material.

Based on an assessment of the toxicology, it is considered that there should be no adverse effects on human health from the use of the Trichodex products, containing *Trichoderma harzianum* Rifai isolate T-39.

Residues in Food

The active constituent of the products is a naturally occurring fungus which does not produce toxins. Residues of the fungus are not considered a health hazard and therefore no MRL is considered necessary.

Trade

Trichodex fungicides are used in a number of countries with a similar use pattern to that proposed for Australia. Residues are not considered a health hazard.

No trade effects are likely from the use of Trichodex Biological Fungicide and Trichodex Bio-Fungicide when used according to the label for control of *Botrytis cinerea.*

Occupational Health and Safety

Worksafe Australia has conducted a risk assessment on the products and conclude that the products can be used safely by workers when handled in accordance with appropriate control measures.

The products are considered to be hazardous substances as they may cause eye irritation and skin sensitisation. The products will be imported into Australia fully formulated in retail packaging as wettable powders. Dust composed of spores and carrier may be

associated with the products. Inhalation of fungal spores as dust or within spray mist raises the possibility of occupational respiratory disease.

Skin, eye and respiratory protection is therefore recommended for workers handling the wettable powders and respiratory protection is needed when spraying. The label warns against entry into treated areas until the spray has dried.

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INTRODUCTION

The purpose of this document is to provide the public with a summary of the data reviewed and an outline of the regulatory considerations for the proposed application of *Trichoderma harzianum* Rifai T-39 in the products Trichodex Biological Fungicide and Trichodex Bio-Fungicide for control of Botrytis in grape vines, and to seek public comment prior to the products being approved for use in Australia. Responses to the public consultation will be considered prior to registration of the products and will be taken into account by the NRA in deciding whether the products should be registered and in determining appropriate conditions of registration and product labelling. Copies of full technical reports are available on request from the NRA.

Comments should be received by 12 December 1996 and sent to:

Applicant

A joint application for registration was received from Abbott Australasia Pty Ltd and Makhteshim-Agan (Australia) Pty Ltd for registration of two identical products based on the fungus *Trichoderma harzianum* Rifai isolate T-39 produced in the Makhteshim Chemical Works in Israel.

Product Details

The fungus *Trichoderma harzianum* T-39 will be marketed under the trade name Trichodex Biological Fungicide by Abbott Australasia Pty Ltd and the trade name Trichodex Bio-Fungicide by Makhteshim-Agan (Australia) Pty Ltd as a powder formulation containing 10^9 colony forming units per gram of product.

Trichodex Biological Fungicide and Trichodex Bio-Fungicide will be imported into Australia fully formulated and packed.

The Trichodex products will be marketed in all States of Australia for control of Grey mould caused by *Botrytis cinerea* in grape vines

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The fungus *Trichoderma harzianum* T-39 acts by competing with plant pathogenic fungi for nutrients and/or space on the plant surface (competitive exclusion) and is not itself pathogenic to plants.

BIOLOGICAL PROPERTIES

Trichoderma harzianum Rifai is a naturally occurring organism. Trichoderma is a naturally occurring ubiquitous genus indigenous all over the world. Taxonomically it belongs to the class Hyphomycetes of the subdivision Deuteromycetes which is part of the kingdom Fungi.

The type species is *Trichoderma viride* and *T. harzianum* has been described as the smooth spored counterpart of *T. viride*. It is typically identified on malt or oat agars and exhibits the following characteristics:

- colonies are green;
- conidiophores are long and slender, without sterile hyphal elongations: conidiophores have a complicated dendroid branching system;
- phialides are regularly disposed in numbers of 3 or more;
- the conidia are smooth walled: they are globose, sub-globose or short-ovoid, with length:width ration of less than 1.25.

T. harzianum is the most common species of the genus and world-wide occurrence on the most varied substrates are assumed. It has been isolated in all continents, including Australasia. The specific T-39 strain was isolated from the natural microflora of the phylloplane of cucumber fruits in Israel. It is not related to pathogens of plant or vertebrate species. *T. harzianum* can be found in the phylloplane of grapevines all over the world.

The mode of action is by competitive exclusion of *B. cinerea* from nutrients and/or location on the plant surface. It prevents *B. cinerea* conidia from germinating and penetrating the host tissue.

T. harzianum T-39 requires high relative humidity and temperatures between 10-20°C for optimum survival in the field. Under field conditions the population of *T harzianum* on the grape leaf returns to normal within or three weeks.

AGRICULTURAL ASSESSMENT

Justification for use

Grey mould caused by *Botrytis cinerea* is a serious disease of vines, with the greatest potential of all fungi to affect grape quality. Although it can be beneficial to wine, in the form of "noble rot", it generally causes major damage to berries of susceptible varieties, resulting in severe loss of yield and off-odours. It is particularly damaging in areas where it is difficult to control lightbrown apple moth, *Epiphyas postvittana* (Walker).

The range of fungicides available for Botrytis spray programs include single site fungicides dicarboximides and benzimidazoles pyrimethanil, plus the multi-site fungicide chlorothalonil, as well as the anilinopyrimidine pyrimethanil. Spray programs are not always effective due to the development of resistance to single site fungicides. There is a need for introduction of new fungicides with different chemistry or "biological fungicides" such as Trichodex with different modes of action. This is important as fungicide resistant strains of Botrytis increase, especially in cool climates. For growers who do not wish to use chemical fungicides, Trichodex provides a biological alternative.

Proposed use pattern

Trichodex can be applied by ground spray alone or in rotation with another Grey mould fungicide. The label recommends that Trichodex is applied at 2 kg/ha when it is being used in conjunction with another fungicide and at 4 kg/ha if Trichodex is the only fungicide applied for the control of Grey mould.

The label recommends that Trichodex should be first applied at early flowering followed by the other fungicide at 80% capfall. Additional applications are recommended 3 to 4 and 1 to 2 weeks pre-harvest. The maximum number of applications is four in one season.

Trichodex Biological Fungicide is compatible with most commonly used pesticides although products with antibiotic action (eg copper) should not be applied within 24 hours after application of Trichodex. Copper can be applied with or beofore Trichodex without restriction. The label warns that Trichodex should not be tank mixed with benomyl or triadimenol as reduced efficacy may result.

Evaluation of efficacy

Australian trials were conducted over two seasons to evaluate the efficacy of Trichodex fungicides against *Botrytis cinerea* (Grey mould) in grapes and to test for crop safety. Efficacy data from 11 field trials were presented. The reviewers considered that the tests supported use of the products at 2 to 4 kg of product per hectare in commercial situations in Australia.

Phytotoxicity

No phytotoxicity was recorded on grapevines when Trichodex was applied at 2 or 4 kg/ha. Data presented indicated no adverse effects on fermentation and wine production.

IPM

Trichodex fungicides would be suitable for IPM programs. No toxins are produced by the fungus and therefore non-target effects are not expected.

One of the most damaging pests in grapes is the tortricide moth *E. postvittana.* The larvae feed on the surface of berries within bunches. The high humidity and damaged skin provide an excellent location for *B. cinerea* infection. An infection rate of as little as 1% of bunches is capable of down grading white wine grapes through discolouration of the final product.

Current programs for control of *E. postvittana* are based around the use of either broad spectrum insecticides or products based on the endotoxins of *Bacillus thuringiensis* var. *kurstaki*. There are now a number of IPM programs which also combine the use of *Trichogramma* spp (Hymenoptera), egg parasitising wasps.

Although conventional fungicides are not considered to have strong insecticidal characteristics, there are a number of cases where species such as longtailed mealybug, *Pseudococcus longispinus* (Tangioni-Tozzetti) appear to have had population controls imposed by Encyritid wasps removed after the application of some fungicides.

The removal of conventional fungicides is likely to assist in the development of IPM programs for insect pests such as *E. postvittana* and *P. longispinus*.

ENVIRONMENTAL ASSESSMENT

Environmental Fate

Trichodex Fungicides are formulated from a naturally occurring fungus of ubiquitous distribution. These fungicides will be applied several times per season to grapes, with numbers of application dependent of severity of Grey mould infection, possible fungicide resistance exhibited by *B. cinerea* and whether Trichodex is applied in conjunction with another form of fungus control.

It is anticipated that numbers of *T. harzianum* spores will remain in the soil and on plants after application, but that numbers of colonies will fall to background levels within two to three weeks, necessitating re-application as required for fungus control. Some movement of spores through soil pore water and into waterways is expected, but the spores are not expected to persist under these conditions. Large scale spray drift is not expected to occur, under the proposed application methods, though spores from the surface of plants may be expected to be carried and spread in the air.

The applicants have provided some evidence that spores may be ingested by soil organisms, and that viability will decline over time. Stability testing of the products under storage conditions demonstrated a decline in viability of spores with increasing temperature, ranging from viability for over 12 months at 20°C, to approximately one month at 37°C. Literature data were supplied by the applicants to demonstrate the decline in spore viability in the field, with the greatest survival of spores occurring under conditions of high humidity and lower temperatures. Host plant condition and nutritional status, leaf age, time and other soil organisms were all seen as factors that would influence spore survival and viability in the field.

Environmental Effects

Birds

Acute oral tests indicate that Trichodex is practically non-toxic to both bobwhite quail and mallards, using US EPA criteria. No clinical or behavioural abnormalities were observed in any of the tested birds.

Aquatic Toxicity

Test results for Trichodex indicate that the fungicide is toxic to fish only at the higher levels tested (i.e. 105 and 106 cfu/mL, with NOELs of approximately 30 and 40 ppm for trout and zebra fish, respectively), and falls into the category of 'slightly toxic' to fish, using US EPA criteria. Toxicity occurred in both active and de-activated cell spore preparations, and this fact, coupled with the observation of suspended particulate material in test solutions at these concentrations, suggests that Trichodex interfered with normal respiration of the tested fish, rather than any toxic action from the fungal spores. Pathogenicity and infectivity were not examined under the conditions of these short (4 day) tests.

Non-target invertebrates

Bees were the only non-target invertebrate group for which toxicity test reports were provided. It was concluded that Trichodex administered in honey was practically non-toxic to bees. Contact toxicity was assessed by dusting bees with the equivalent of 7000 ppm of fungicide. Statistically significant mortality occurred in both the active and de-activated spore treatment groups, with greater mortality in the de-activated treatment. As was the case for fish toxicity testing, physical occlusion of respiratory pathways was thought to be responsible for these deaths. Differences noted between active and de-activated treatment groups were thought to be an artefact of the sampling design, and were not believed to be due to either direct toxicity or mycotoxin production. Again, pathogenicity/infectivity was not examined as test duration was too short.

The effect of *Trichoderma harzianum* (isolate not specified) on other invertebrates has been examined by a number of authors, and it was generally found that *T. harzianum* culture extracts did not produce toxic effects. Insects are being used successfully as vectors to carry *T. harzianum* spores to trees infected with Dutch elm disease, to plants with other diseases, and to other insects.

Soil Micro-organisms

Literature provided by the applicants outlined the effects of spent *T. harzianum* culture media on a variety of soil micro-organisms. In one case only, using *Pseudomonas aeruginosa*, was any inhibition of growth noted. Concentration of T-39 culture extracts (extracted using solvents from grape juice fermentation) up to 300X was found to inhibit growth of *B. cinerea*, although inhibition for many fungal species at this level of concentration was claimed to be a common observation.

Production of mycotoxins and/or antibiotic secretions

A number of studies have examined the possibility that *T. harzianum* may produce mycotoxins and/or antibiotic secretions. Mycotoxin production in *T. harzianum* has been suggested as a possible mechanisms for control by some authors, although the applicants claim that *T. harzianum* T-39 merely outcompetes *B. cinerea*, and does not kill its spores. Evidence for this claim is that *B. cinerea* population build up as levels of *T. harzianum* T-39 decline. In addition, the applicants have provided some literature support to indicate that the particular isolate to be used in Trichodex (T-39) does not appear to possess any antibiotic or inhibitory action/properties.

Phytotoxicity

No adverse effects were noted on grapevines during field trials. Given the probable presence of Trichoderma in soils and on plants currently, no phytotoxicity would be expected as a result of increased populations arising from application of Trichodex fungicides. The apparent lack of antibiotic/mycotoxic production by this particular strain of *T. harzianum* also suggests that there should be little phytotoxicity.

Environmental Hazard

No wildlife hazard is anticipated from the proposed use of Trichodex, as the fungus has low toxicity to terrestrial organisms. Possible respiratory inhibition of non-target organisms could occur at high levels of exposure, but such levels are not anticipated under proposed rates of use.

Expected environmental concentrations of Trichodex, assuming use at the highest rate of application four times in the one season, should be approximately 2 ppm in the top 15 cm of soil. A worst case scenario of direct overspray of Trichodex to 15 cm of standing water at the highest proposed use rate would result in an expected environmental concentration of 0.533 ppm, well below the 96 hour NOELs for fish of approximately 40 ppm.

The possible effects on fungi other than *B. cinerea* has not been assessed by the applicants, although literature sources suggest that *T. harzianum* may disrupt cell walls and normal growth of such fungi. However, given that *T. harzianum* levels appear to fall to background levels within two to three weeks of Trichodex application, such disruption should not have a major effect on normal soil processes.

Conclusions

Overall, the use of Trichodex fungicides to control Grey mould in grapevines as proposed, and according to good agricultural practice, is not likely to lead to significant environmental contamination or effects on non-target species.

It appears that *T. harzianum* T-39 produces no toxins that may affect other organisms. Therefore, it should present little hazard to either native flora or fauna, although there is the possibility of some disruption to native fungi.

Both applicants have undertaken to report any adverse effects that may arise from the use of Trichodex fungicides in Australia. Reports of any antibiotic or inhibitory secretions from *T. harzianum* T-39 that may come to light in the future will also be forwarded to the EPA as soon as possible.

PUBLIC HEALTH AND SAFETY ASSESSMENT

EVALUATION OF TOXICOLOGY

Toxicokinetics and Metabolism

Studies addressing the metabolism of Trichoderma are not available, and are not considered relevant to a product consisting of fungal spores. Other exposure studies indicate that Trichoderma *is* not pathogenic or infectious.

Acute Studies

Acute studies have been conducted using the formulation to be marketed in Australia as Trichodex Biological Fungicide and Trichodex Bio-Fungicide. These studies indicate that Trichodex is of low acute oral, dermal and inhalational toxicity in rats. Additionally, there was no evidence of pathogenicity or infectivity. Trichodex was not a skin irritant but was a moderate eye irritant in rabbits, and caused skin sensitisation in guinea pigs. The moderate eye irritancy was considered to te related to the physical nature of the product, which contains diatomaceous earth . Extensive searching did not provide any references to any toxic, infective or pathogenic effects of the fungus to other than mircrobial life forms.

Repeat Dose Studies

No repeat dose studies are available. It is considered that in the absence of toxicity, pathogenicity or infectivity in acute studies using Trichodex, there is no justification to proceed to repeat dose studies. Chronic toxicity, including reproductive or developmental effects, is not expected.

Genotoxicity

The Ames bacterial mutagenicity test could not be performed due to methodological problems (viz. high levels of histidine in extracts of Trichodex). An *in vivo* micronucleus test in the mouse gave a negative result for clastogenicity (chromosomal effects). Additionally, it is considered that since the mode of action of Trichodex (see above) does not involve the secretion of toxins which could penetrate cells gaining access to the genetic material, genotoxic effects are not expected to occur.

PUBLIC HEALTH STANDARDS

Poisons Scheduling

The National Drugs and Poisons Scheduling Committee (NDPSC) considered the potential for toxicity of the product and its active ingredient, and assessed the necessary controls to be implemented under States' poisons regulations to prevent the occurrence of poisoning.

The committee considered that in view of the low toxicological and infective/pathogenic hazard posed by *Trichoderma harzianum* Rifai isolate T-39, poisons scheduling was not required. There are provisions for appropriate safety directions on the product label.

No Observed Effect Level / Acceptable Daily Intake

The establishment of a No Observed Effect Level/Acceptable Daily Intake is considered unnecessary, in view of the low toxicological and infective/pathogenic hazard posed by *Trichoderma harzianum* Rifai isolate T-39.

RESIDUES AND TRADE EVALUATION

The fungus contained in these two products, *Trichoderma harzianum*, is of widespread occurrence throughout the world. The fungus is not considered pathogenic nor infective. The issue of potential production of mycotoxins is not considered a significant risk as evidenced by the toxicology assessment. As a consequence, residues are not considered a health hazard and therefore no MRL is required for its use in grapes.

The MRL Standard will reflect this recommendation through an entry in Table 5 as follows:

Trichoderma harzianum	Fungicide on grapevines

Trade implications

The same formulation is currently registered for Botrytis control in grapes in a number of countries including Bulgaria, Chile, Columbia, Croatia, Greece, Guatemala, Hungary, Israel and Romania. Dose rates are 2-4 kg/ha, the same as those proposed for Australia. The number of registered applications varies from 1 to 6 times per season, applied at either pre bloom to fruit set or blossom to harvest. Australia recommends a maximum of 4 if used alone, but preferably 2, when used in alternation with a chemical fungicide.

No countries have set MRLs for *Trichoderma harzianum* and Codex has not considered the product to date. The following factors minimise concerns about residues in exported produce:

- *T harzianum* is a naturally occurring organism in Australia and world wide and any residues of Trichodex will be no different to natural residues found on grapes at any time.
- The field life of the organism of 10-20 days: the last field application time before harvest is 7 days if Trichodex is used alone, but in the preferred rotational program the last Trichodex application would be 21 days prior to harvest.
- Most organic residues are precipitated by low pH of grape juice and wine and cannot leave detectable residues in wine.
- No chemical, as such, is produced during the vinification process.

Conclusion

No trade effects are likely from the use of Trichodex Biological Fungicide and Trichodex Bio-Fungicide when used according to the label for control of Botrytis.

OCCUPATIONAL HEALTH AND SAFETY ASSESSMENT

Trichoderma harzianum T-39 is likely to be a hazardous substance according to National Occupational Health and Safety Commission (NOHSC) Approved Criteria for Classifying Hazardous Substances on the basis of known respiratory hazards associated with inspiration of fungal spores. An exhaustive health effects classification is not possible as there is no toxicity data relating specifically to *Trichoderma harzianum* T-39.

Trichodex Biological Fungicide and Trichodex Bio-Fungicide (Trichodex products) are determined to be hazardous substances by Abbott Australasia Pty Ltd according to the NOHSC criteria based on acute oral, dermal and inhalation toxicity, eye irritation and skin sensitisation.

Trichoderma harzianum T-39 consists of a powder of cultured spores (2 to 3 microns in diameter).

The Trichodex products are formulated as wettable powders. They consist of cultured fungal spores mixed with a diatomaceous earth carrier. Dust composed of spores and carrier may be associated with the products. Inhalation of fungal spores as dust or within spray mist raises the possibility of occupational respiratory disease.

The Trichodex products will be imported fully formulated in retail packing of 500g, 1 kg or 4 kg bags.

Trichoderma harzianum T-39 and Trichodex products are not classified as dangerous goods under the Australian Code for the Transport of Dangerous Goods by Road and Rail.

Transport, storage and retailing

Australian workers involved in transport, storage and retailing of the Trichodex products should not become contaminated with the products unless the packaging is breached.

Advice on the safe handling of the product during routine transport and storage is provided on the Material Safety Data Sheets (MSDS) for the Trichodex products.

End use

The Trichodex products are to be applied by ground air blast sprayers for the control of Grey mould, caused by the fungus *Botrytis cinerea,* in grapevines. They are used at a maximum of 4 kg/ha. The products may be used at four separate stages of crop development, from early shoot development to 1-2 weeks before harvest. Sufficient spray should be used to thoroughly cover the vines. The products may be used by owner operators or contract workers

End users may become contaminated with Trichodex products when mixing the working strength solution and applying the spray. The maximum concentration of product in the spray is 0.8%. Lower product rates should be used if the products are alternated with other fungicides in a spraying regime.

The products are not acutely toxic if ingested. However, they may cause eye irritation and skin sensitisation. There is also the possibility that inhaled spores may lodge within the lung. Long term experimental studies or worker exposure studies have not been conducted with these products. However repeated inhalation of other fungal spores is known to be associated with respiratory disease. Assessment of the short term and long term use of these products indicates that skin, eye and respiratory protection is needed for workers handling the wettable powders. When spraying, skin and respiratory protection is needed.

Safety directions on the labels contain the recommended personal protective equipment and in addition warn users of the possible irritant and allergic effects.

Entry into treated areas

As the products may be used from the period of early shoot growth until 1-2 weeks before harvest, it is likely that workers will need to re-enter treated areas for routine crop maintenance, and later, harvest. It is possible that such workers brushing against treated foliage may become contaminated with product residues and experience skin sensitisation. Accordingly, a re-entry statement is recommended for the product labels with restrictions on entry into treated areas before spray has dried.

Recommendations for safe use - all workers

No additional regulatory controls are needed for transport, storage and retail workers.

End users should follow the directions on the Trichodex product labels. Safety directions include the use of cotton overalls, goggles, elbow length rubber gloves and a half facepiece respirator.

The personal protective equipment (PPE) recommended should meet the relevant Standards Australia standard specified below:

AS 1337-1992 Eye Protection for Industrial Applications

AS/NZS 1715-1994 Selection, Use and Maintenance of Respiratory Protective Devices and AS/NZS 1716-1994 Respiratory Protective Devices

AS 2161-1978 Industrial Safety Gloves and Mittens (Excluding Electrical and Medical Gloves)

AS 3765-1990 Clothing for protection against hazardous chemicals

NOHSC included an exposure standard of 10 mg/m^3 TWA (time weighted average) for inspirable dust in the NOHSC Exposure Standards for Atmospheric Contaminants in the Occupational Environment. It is applicable for microbial spores. Employers should ensure that exposure to *Trichoderma harzianum* T-39 is not greater than this standard.

Workers who experience any respiratory discomfort should seek medical advice. A statement to this effect appears in each Trichodex product MSDS.

Re-entry period

It is not possible to specify a time period for re-entry restrictions. To warn workers against contamination with foliar residues during re-entry, the following statement is to appear on the Trichodex product labels and MSDS:

Re-entry period
Do not allow entry into treated areas until spray has dried. When prior entry is necessary, wear overalls and elbow length rubber gloves. Clothing must be laundered after each day's use.

Manufacturers and importers should produce a MSDS for Trichodex Biological Fungicide and Trichodex Bio-Fungicide. These should contain information relevant to Australian workers, as outlined in the NOHSC National Code of Practice for the Preparation of Material Safety Data Sheets. Employers should obtain the MSDS from the supplier and ensure that their employees have ready access to it.

Conclusions

Trichodex Biological Fungicide and Trichodex Bio-Fungicide can be used safely if handled in accordance with the instructions on the product labels. Additional information is available in the MSDS.

Glossary of Terms

Active constituent The component of a treatment which is responsible for its biological effect.

Acute toxicity- Immediately measurable effects of a toxin on an organism.

Conidia Asexual fungal spores

Conidiaphore A simple or brancehed hypha bearing one or more conidia

Denatured Broken down

DNA Deoxyribonucleic acid the generic component of the chromosomes which support the gene sequences.

Estimated Environmental Concentration (EEC) EEC is normally derived from set parameters, such as the concentration in water if a still water body (or soil) of 15 cm depth was sprayed at the label rate, unless evidence (use pattern, research etc) indicates otherwise (eg the herbicide is incorporated to a depth of 5 cm in soil).

Hypha elongated vegetative fungal material

IPM Integrated Pest Management. The combination of chemical and biological aspects of pest control to achieve pest management.

LC_{50} The concentration of a substance that produces death in 50 percent of a population of experimental organisms within a specified period. It is usually expressed as milligrams per litre (mg/L) or milligrams per kilogram (mg/kg) as a concentration in food, water or air.

LD_{50} The dose of a substance that produces death in 50 percent of a 'population of experimental organisms within a specified period. It is usually expressed as milligrams per kilogram (mg/kg) of body weight.

Lowest-observed-effect concentration (LOEC) Lowest test concentration in a concentration series which is statistically significantly different from the control value within a specified time period.

Manufacturing concentrate A product containing technical grade active constituent(s) and possibly non-active constituent(s), intended for use in the manufacture of a product after further formulating and repackaging (see *technical grade active constituent*).

Maximum residue limit (MRL) The maximum concentration of a chemical residue that is legally permitted in or on a food or food commodity when that chemical is applied according to GAP. The concentration is expressed in milligrams of the residue per kilogram of the food (mg/kg).

New active An active constituent that has never been approved or registered in Australia before.

No-observable-effect level/concentration (NOEL/NOEC) The highest amount or concentration of a substance, found by study or observation, to cause no detectable (usually adverse) alteration of morphology, functional capacity, growth, development or life span.

Phialide Flask shaped outgrowth of spore bearing hypha in certain fungi

Phylloplane Leaf surface as a habitat for microorganisms

Poisons schedules The schedules accompanying the States and Territories Poisons Acts listing the various poisons into categories which are based on the recommendations of the *Standard for the Uniform Scheduling of Drugs and Poisons (SUSDP)*. Agricultural chemical products generally fall into one of the following categories:

Schedule 5 - Poisons of a hazardous nature that must be readily available to the public but require caution in handling, storage and use;

Schedule 6 - Poisons that must be available to the public but are of a more hazardous or poisonous nature than those classified in Schedule 5;

Schedule 7 - Poisons which require special precautions in manufacture, handling, storage or use, or special individual labelling or availability;

The NRA keeps a list of substances previously included in SUSDP as Appendix B. These substances have been considered not to require control by scheduling, based on information available at the time of assessment.

ppm Parts per million

Protease Enzymes which break down proteins.

Proteolysis The process in which proteins chains are lysed (cut) as part of their digestion.

Schedule	The category into which a chemical is placed according to its toxicological profile

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