

THE APPLICATION AND USES OF TERRAZOLE SOIL FUNGICIDE

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Although Terrazole soil fungicide is a relatively new chemical to us here in New Zealand, having only been registered since November 1974, development and research work has been going on in the United States and other overseas countries since the early 1960's.

The early registrations of Terrazole in New Zealand were for use on turf and ornamentals but recently registration has been granted, extending the area for use into vegetable seedlings.

Chemical and Physical Properties: Terrazole is a soil fungicide used for prevention and control of diseases caused by pythium and phytophthora, commonly called water moulds. It is both fungicidal and fungistatic. That is, it kills the organism as well as prevents reinfection.

Terrazole's chemical name is 5 ethoxy-3-trichloromethyl-1, 2, 4-thiadiazole, but don't let that put you off as "chloroethidiazole" has been proposed as the common name and this is much more pronounceable.

The technical material is a pale yellow-brown liquid of 95% purity. We receive it in New Zealand in this form and formulate our own emulsifiable concentrate. The wettable powder is received in New Zealand in its manufactured form.

Formulating can have its problems as one of the physical characteristics of the technical material is that it freezes, or solidifies, at 19.9°C (68°F), so on a day that is very pleasant for you and me to be out in, Terrazole technical material will remain quite firmly in its drum. This characteristic could also be the reason for some growers having had difficulty in mixing the wettable powder form with water. If this problem does occur, try adding a small quantity of warm water to bring the temperature above the freezing point for Terrazole technical.

Toxicology:

Animal Studies:

Acute L. D.₅₀ (single oral dose)

Mice : 2,000 mg/kg

Rats: 1,077 mg/kg

Dogs: 5,000 mg/kg (premedicated with morphine)

Rabbits: 799 mg/kg

No major pathological effects developed in dogs receiving

1,600 ppm of Terrazole in the diet for 90 days, or in rats receiving 1,250 ppm in the diet for the same period.

Fish Studies:

Bluegill: More than 7.5 mg/l at 18°C (water)

Rainbow trout: More than 4 mg/l at 13°C (water)

Terrazole is toxic to fish. Do not contaminate lakes, streams, ponds or any other body of water by application, run-off, or the cleaning of equipment.

Dermal Toxicity:

Acute L. D.₅₀ Rabbits: 1,366 mg/kg

(200 mg/kg caused only slight irritation which subsided after 72 hours. The injured area recovered normally and growth and survival were not affected).

Acute Inhalation: Rats exposed to aerosolized technical Terrazole at 200 mg per litre of air for one hour showed no mortality or toxic effects over a 14 day observation period.

From this data it can be seen that Terrazole is a reasonably safe chemical to use, although the usual precautions for handling chemicals should be observed.

Applications: Present day practice is for most commercial propagators and nurseries to raise seedlings in a pathogen-free environment by growing seedlings in a steam or chemically treated soil. However, the effects of such treatments are often not long term and can create an environment ideally suited to fungi multiplying rapidly in a competition-free medium if reinfection does take place. In spite of these treatments, outbreaks of damping-off diseases can, and do, occur. This is because the fungi can be reintroduced by way of dirty soil, unclean implements, unsterilized seedboxes and via water supplies. I am sure you have all experienced this type of disaster.

The current trend, both here in New Zealand and overseas, is to use soil-incorporated fungicides in the soil mix and to follow up with fungicidal drenches. The aim of this practise is not only to prevent expensive losses while the seedlings are in their very early stage of growth, but to produce plants that will continue to grow at their potential rates.

It is a mistake to consider losses from damping-off fungi as being restricted only to juvenile plants, as the same fungi that cause losses in seedlings can also cause major losses at a later stage of the plant's growth. Propagators have given considerable attention to controlling plant diseases, but in many instances have neglected to control the soil pathogens that can be just as serious. The aim should be to produce plants free of pathogenic organisms, not merely free from disease. Hence the importance of using a sterilized soil medium and further supporting this sterili-

sation process by the incorporation of fungicidal and fungistatic chemicals as routine practice.

Here I should give a word of warning. Terrazole is particularly effective and very efficient in the control of pythium and phytophthora but is not a broad spectrum fungicide. The control of other fungi must also be attained to produce strong, healthy and well-grown plants.

Formulations: Terrazole is available in two formulations — a 35% wettable powder which mixes well with water but does require agitation to maintain a consistent suspension, and a 25% emulsifiable concentrate which is readily dispersible in water. Both formulations have a long shelf life and are very stable in sunlight. This, of course, gives it the advantage of being able to be used irrespective of weather conditions and, if your weather forecasting has been “off course,” the effectiveness of the chemical, and its control, will not be affected.

It would be worthy of mention here that Terraclor, which has proven outstandingly effective against rhizoctonia, has been withdrawn from the New Zealand market as have all other P.C.N.B.-based chemicals.

Phytotoxicity: The dangers of phytotoxicity are something that propagators must always be aware of and Terrazole has proved to be very safe in this area, providing it is used at the rates recommended on the label. Work done at Massey University by Murray Richards, has indicated that rates up to 4 times the recommended rate are considered unlikely to cause any serious phytotoxicity hazard when incorporated into the growing medium. However, we do suggest that growers carry out limited trials on their own account before putting a previously untried cultivar to hazard. Further experimental data is available from Olin Corporation regarding the rates of Terrazole on a wide range of crops.

Methods of use:

Seed Treatment: Seed treatment has an important place in prevention of pre-emergence damping-off and is, therefore, particularly important when seed is sown in the field. The dusting of seed with a fungicide before planting creates a small zone of protection about the seed, giving protection for a short time to the seed and emerging seedling from attack by pathogenic soil fungi.

Seed treatment is of little value in controlling pathogens which have completely penetrated the seed. Likewise it is of little value against post-emergent damping-off but, nevertheless, does have its uses in particular areas.

The first area of use is obviously in the growing medium. Control of, and protection from, pythium and phytophthora at-

tacks can be obtained here by incorporating 50g to 100g of Terrazole 35% wettable powder per cubic metre of mix. As this is a very low ratio of fungicide to mix, blending will be improved by first pre-mixing the fungicide with 5 or 6 parts of mix and then incorporating into the larger volume. This will give control for 5 to 10 weeks, depending on conditions, at a cost of approximately \$1.60 per cubic metre or, if potting into 15 cm pots, just under ½ cent per pot.

Drenching: To maintain an adequate concentration of Terrazole in the mix, we recommend that the initial application be followed by drenching at 5 to 10 weekly intervals.

The wettable powder or the emulsifiable concentrate can be used for this treatment but in either case it is advisable to follow up the drench with an equal quantity of water to ensure that the fungicide penetrates into the mix.

Irrigation: Terrazole is also being applied through overhead sprinkler systems, and trickle irrigation systems on a regular schedule as a means of preventing reinfection by fungi. Through overhead sprinkler systems a concentration of 1 litre (0.45 gallon) of Terrazole 25% E.C. to 2,000 litres (445 gallons) of water applied to an area of 0.4 hectare (1 acre) has proven effective in giving control.

Terrazole can also be introduced into trickle irrigation by first mixing 9 litres (2 gallons) of 25% E.C. in the 160 litre (36 gallon) container of a Cameron diluter. This solution is then incorporated into the irrigation system at the rate of 4.5l (1 gallon) per 450 litres (100 gallons).

The Future: Research and experimental work is continuing both in New Zealand and overseas into new areas of application and registration. Crops at present being investigated include sugarcane, pineapples, avocados, macadamia nuts, pears, citrus, passionfruit, peaches, potatoes, kiwifruit, boysenberries, hops, tobacco, coffee and taro.

There are also reports that Terrazole has certain algacidal properties and where used in sprinkler and misting systems assists in reducing algae growth. This has not yet been fully investigated but future research will be directed into this area of application.

Summary: In summary, I would suggest that Terrazole has a place in every soil, or soil-less mix, where losses from pythium and phytophthora occur or are likely to occur. By incorporating the wettable powder into the growing medium, and by drenching at 5 to 10 weekly intervals, losses caused by these fungi can, and should be eliminated completely.

Question — What is the effect of Terrazole on useful micro-organisms?

Answer — At this stage no damage has been established, but trials are still under way.

THE PURPOSE AND OPERATION OF A NUCLEAR STOCK UNIT

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1. (a) **Purpose.** A Nuclear Stock Unit is based on the concept of an enclosed insect-proof area where plant material can be maintained in a "virus-free" or "high-health" status, and kept true to type. "Virus-free" — usually means free of known viruses. "High-health" — free of viruses of known economic importance.

Although insect-proofing is of prime importance to the maintenance of the high level of plant health required, strict observation of plant-hygiene is of equal importance and includes regular application of plant therapeutants for the control of pests and diseases with a special emphasis on the control of the main virus vectors, i.e. aphids, leaf hoppers and nematodes. The Unit becomes the source of nuclear plant material for research and for distribution of "Clean Stock" to growers.

(b) **Establishment and Layout.** The present Nuclear Stock Unit at the Horticultural Research Centre in Levin was built in 1967 and replaced a smaller temporary unit that had been in existence since 1961. It consists of a central service shed 13.70 x 3.95 m with two 15.20 x 3.55 m glasshouses on one side and three 30.45 x 6.10 m screenhouses on the other.

The unit is proofed against all insects as large or larger than winged aphids by screening glasshouse vents and service shed windows with a 24 x 24 mesh woven plastic gauze. The gauze completely covers the screenhouses. Entrance to the Unit is by a double door airlock in which an aerosol insecticide is released manually immediately after the outside door is closed.

(c) **Operation: Glasshouses.** The glasshouses are lined with clear plastic sheeting for increased heat retention in the winter and at night, and a shading compound is applied to the outside of the glass for the duration of the hotter months (September to May), to reduce overheating.