

## Latest research in the Potato Industry

### POTATOES AND RHIZOCTONIA.

**R***hizoctonia* diseases in Australia and New Zealand are causing serious losses in crops such as tomatoes, capsicums, carrots, beans, lettuce and potatoes. *Rhizoctonia* is a serious fungal disease of potatoes that reduces both yield and quality costing the Australian potato industry over \$10 million annually. It has become a major problem for the washed, fresh market and seed potato growers alike. The fungus is carried on seed tubers, occurs in the soil in most potato growing area of Australia, and is difficult to contain. Biological control agents produced in Australia are reported to control the disease but there has been no critical evaluation of those products. As many growers are anxious to use these products there is an urgent need to measure the efficacy of these agents.

The severity of this disease in the potato industry has increased in recent years due to intensive cropping and the use of rotations which may also be susceptible to *Rhizoctonia*. As with other detrimental fungi, control of *Rhizoctonia* has been through the use of fungicides, however, resistance to such chemicals may arise and an alternative is imperative..... the alternative is **BIOLOGICAL CONTROL**.

The laws of physics state that, "every action has an equal and opposite reaction." This also applies to the laws of nature and occurs continuously. However, continuous cultivation has an adverse effect on the natural populations of beneficial microbes and fungi, therefore we need to constantly reapply these organisms in order to restore the balance in nature and let these beneficial organisms do their job.

Black scurf appears to be particularly severe in nutrient poor, sandy soils (Mallee type). This is perhaps because *Rhizoctonia* has less competition from other soil microbes under these conditions, and because damaged plants are less able to cope with stress in these environments.

One of the most promising aspects of biological control is the use of naturally occurring organisms to inhibit the development of the disease-causing organism. There has been numerous reports from

overseas where successful disease control has been achieved using this strategy.

### WHAT IS RHIZOCTONIA ?

**B**esides causing damping off of seedlings, *Rhizoctonia* attacks established crops at various stages of production. Some isolates of *Rhizoctonia* are able to infect a wide range of vegetable crops whereas others may have restricted host ranges.

*Rhizoctonia* diseases often have common names that describe symptoms on particular crops. On potato tubers it is commonly known as 'Black Scurf'. Symptoms appear as dry, brown cankers (Photograph 1) which develop on shoots, stems and roots. Leaves near the tops of shoots may become bunched, curl upwards and turn yellow or purple. White powdery growth covers stems just above ground level. Developing tubers may become cracked and pitted. Small dark fungal resting bodies that resemble specks of dirt form on tuber surfaces (Photograph 2) which can not be removed easily by washing.



LEFT (PHOTO 1): DRY, BROWN CANKERS DEVELOP ON SHOOTS, STEMS AND ROOTS.

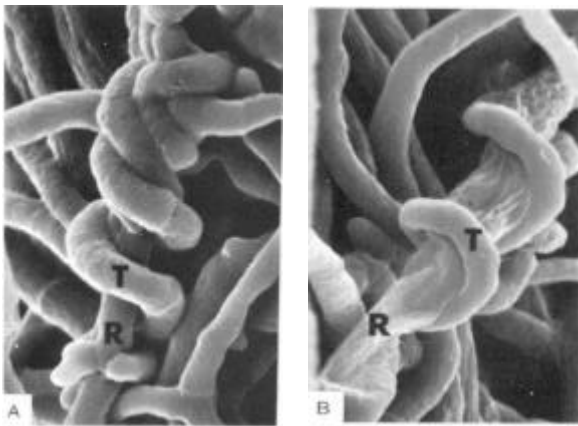
RIGHT (PHOTO 2): DARK FUNGAL RESTING BODIES FORM ON TUBER SURFACES.

### STRATEGIES FOR BIOLOGICAL CONTROL

**R***hizoctonia* in the soil is susceptible to natural parasitism by other soil organisms but this occurs at a low level in nature. However, if an aggressive organism (such as *Trichoderma spp.*) could be introduced into the soil in high numbers, substantial reduction of sclerotia numbers may occur which could reduce the subsequent disease risk of *Rhizoctonia*.

## WHAT ORGANISMS CAN ACHIEVE THIS?

A large number of microbes have been identified and isolated from vegetable soils throughout Australia and New Zealand and tested to screen them for their antagonistic activity. From this, a number of fungal antagonists were identified as potential bio-control agents for *Rhizoctonia*. Isolates of *Trichoderma* and *Gladiocladium* species were able to significantly antagonize and reduce *Rhizoctonia* within host plant tissue. These genera of fungi are well documented in literature as successful biological control agents against a range of pathogens. Pictured below is the naturally occurring antagonistic effect of *Trichoderma spp.* on *Rhizoctonia*. Therefore, these fungi clearly warrant further investigation.



LEFT (PHOTO 3): SHOWS *TRICHODERMA SPP.* ATTACKING *Rhizoctonia solani*. Hyphae of *trichoderma* coil and wrap around *Rhizoctonia*.

RIGHT (PHOTO 4): 2 DAYS AFTER INOCULATION, *Rhizoctonia* hyphae show loss in turgor and cell collapse whereas *Trichoderma* hyphae looks normal.

## TRIAL INFORMATION.

Field evaluations of the most promising biological fungus were conducted in the Riverina, New South Wales by a reputable grower in the industry. The aim of the trial was to evaluate both chemical and biological tuber seed treatments for the management of *Rhizoctonia* in the hope of minimising the use of pesticides on potatoes. High levels of *Rhizoctonia* are often associated with sandy soils as was the case in these two paddocks.

An important note is that the variety Shepardys potatoes is extremely susceptible to *Rhizoctonia*.

### Chemically Treated Paddock.

A 20 hectare paddock of potatoes, variety Sebago, was treated with a standard chemical used in the industry to combat *Rhizoctonia*. 600mL of this chemical was applied per tonne of seed tubers. Potatoes were only treated at time of planting .

### *Trichoderma spp.* Treated Paddock.

The neighbouring 20 hectare paddock of potatoes, variety Shepardys, was treated with **Tri-D25**, a product containing two strains of *Trichoderma*; *Trichoderma koningii* and *Trichoderma harzianum*. The rate used was 1kg of **Tri-D25** per tonne of seed tubers. Potatoes were only treated at time of planting.

The method of application for the *Trichoderma* product can be easily incorporated into the existing planting regimes used by growers.

## TRIAL RESULTS TO DATE

As mentioned previously, the plants were only treated at planting time. The results from this one application proved to be significantly different.

### Visual assessment.

A visual assessment of the paddock was made and photographs 5 and 6 below show the difference in vigour between the two paddocks. Photograph 5 illustrates the visual appearance of the chemically treated paddock 6 weeks before harvest. Above ground symptoms include patchy emergence, reduced stem numbers, stunting of individual plants and cupping of the leaves. In extreme patches throughout the paddock, particularly after hot dry weather, several plants in the area wilted and died leaving bare patches in the crop.



Photograph 6 illustrates the visual appearance of the paddock treated with Tri-D25. The difference in vigour and crop health is clearly evident. Plants looked greener, healthier, very little patchiness and/or plant death existed and most importantly, the vigour of the crop reflects the yield potential of this paddock.

### Assessment of root system.

*Rhizoctonia* affects the underground parts of potato plants. Plants were randomly uprooted from each paddock and a visual assessment was made to determine the effects of *Rhizoctonia* on the root system.

### Chemically Treated Paddock.

Damage to sprouts, stems and stolons are evident in this paddock. Furthermore, root development (feeder roots) is almost non-existent. A minimal number of spuds had formed throughout this paddock 6 weeks before harvest. Photograph 7 (below) illustrates the condition the root system was in.



PHOTO 7.  
LITTLE ROOT SYSTEM, NO  
SPUDS DEVELOPED 6  
WEEKS BEFORE HARVEST

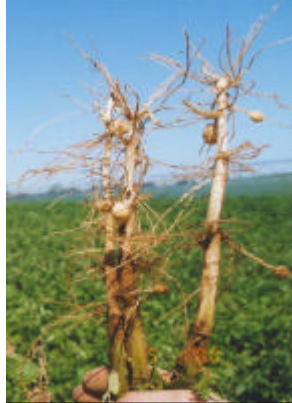


PHOTO 8.  
VIGOROUS ROOT SYSTEM,  
WHITE HEALTHY FEEDER  
ROOTS, SPUDS  
DEVELOPED

### Trichoderma Treated Paddock.

As can be seen above (Photograph 8), seed tubers treated with *T. koningii* and *T. harzianum* (as found in Tri-D25) simultaneously show vigorous root growth, including both tap root and feeder root systems. There was also a large number of spuds which had developed on each plant (approx. 6), thus indicating minimal disease attack on plants in this paddock.

### SUMMARY.

It is clear from the results 6 weeks before harvest that *Trichoderma spp.* contained in Tri-D25 were beneficial soil inoculants and that *Trichoderma*, as a fungus, has great potential for use in the potato and vegetable industries. It is evident that the *Trichoderma* (Tri-D25) treated paddock gave better resistance to *Rhizoctonia* during the growing season than the standard fungicide.

This outstanding result was achieved with just one single application before and/ or at planting time. It is expected that even greater suppression could have been achieved with further *Trichoderma* (Tri-D25) applications made to the soil surface at various intervals throughout the growing period in the same manner as repeated fungicide sprays.

Comments from the grower indicated that the usual yield per plant attained by the Shepardys variety was 4 spuds on average. However, each

plant uprooted during the trial showed a count of at least 6 spuds, therefore there is an indication that *Trichoderma* also has growth promoting characteristics.

Further studies will concentrate on combinations of treatments to further improve the level of diseases suppression. At present, seed treatments have been the main method of *Rhizoctonia* management, however, to date, there has been no known chemical control for *Rhizoctonia* spores in the soil.

It is therefore imperative to place beneficial soil inoculants such as *T. koningii* and *T. harzianum* (only found in Tri-D25), INTO the soil. Growers using certified seed tubers are still at risk of *Rhizoctonia* as it is a soil borne pathogen, therefore the application of *Trichoderma spp.* to the soil once or twice throughout the growing season is of major economic benefit to all growers.

Biological control has the potential to be used in combination with other control measures such as better crop nutrition and clean seed tubers to provide better management of diseases. Alternatively, biological control may play an important role in organic production systems where currently there are limited options available to growers for the management of *Rhizoctonia*.

Keep an eye out for further information about the benefits of using *Trichoderma spp.* to aid in the management of soil borne pathogens.

As was mentioned previously... “every action has an equal and opposite reaction.” So let **fungi fight fungi**.... the outcome can only be positive.

## ZADCO NEWS

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