A bacterium with an appetite for algae

IN the summer of 1992, University of Queensland student David Bourne began hunting for an ally in the fight against toxins produced by *Mycrocystis* cyanobacteria (blue-green algae). These toxins, which cause countless stock deaths each year, are also linked with possible liver disease in people, while rendering water supplies unusable for long periods.

Bourne's mission, assigned by Dr Gary Jones from CSIROs Division of Water Resources at Griffith, was a great success, and may result in a treatment to speed the recovery of storages in the wake of algal outbreaks.

Troublesome *Mycrocystis* blooms generally are killed with an algacide such as copper sulfate. When the cells die, they break open (lyse), releasing high levels of poison that may persist in the water for weeks or even months.

Bourne and Jones noticed that once degradation of the toxin commenced, its disappearance was rapid. They suspected this to be the work of a bacterium in the water that fed on the *Mycrocystis* toxins, reducing them to harmless substances. To test their idea, the bacterium had to be found.

During his initial three months at the division, Bourne discovered and isolated the bacterium. First he took water samples from the Murrumbidgee River and irrigation channels near Griffith. He then added the *Mycrocystis* toxin to the samples as a source of carbon and nitrogen. The bacteria that grew were those able to use *Microcystis* as a nutrient source. Bourne has since categorised the bacterium as a member of the genus *Sphingomonas.*

The bacterium produces an enzyme (microcystinase) that breaks down the most powerful toxin produced by *Microcystis,* microcystin LR. This toxin consists of seven amino acids in a ring-shaped structure called a cyclic peptide. The enzyme breaks the bond between two of the amino acids in the ring, reducing it to a linear chain which is 100 times less toxic. Two more enzymes made by the bacterium cause further breakdown of the chain to single, harmless amino acids.

In time, the bacterium may be mass-produced and released on a wide scale in rivers, lakes and dams during summer when conditions are ripe for blooms. With this goal in mind, Jones's research team is experimenting with freeze-drying the bacteria in a powder form to see whether it 'comes back to life' when added to farm dams. They believe that by releasing freeze-dried preparations of the bacterium into the water in bulk, *Mycrocystis* toxins can be 'mopped up' in days.

The findings have also enabled the development of 'gene probes' to search for other bacteria containing toxin-degrading genes.

Within the *Sphingomonas* bacterium are genes that code for the enzymes that break down the microcystin toxins. These DNA gene sequences have been characterised. Using this information small fragments of DNA can be made which exactly match the mycrocystinase gene. The fragments can then be used as 'gene probes' to see if bacterium containing the toxin-degrading genes are present. The results may be extended to fighting other types of algal blooms.

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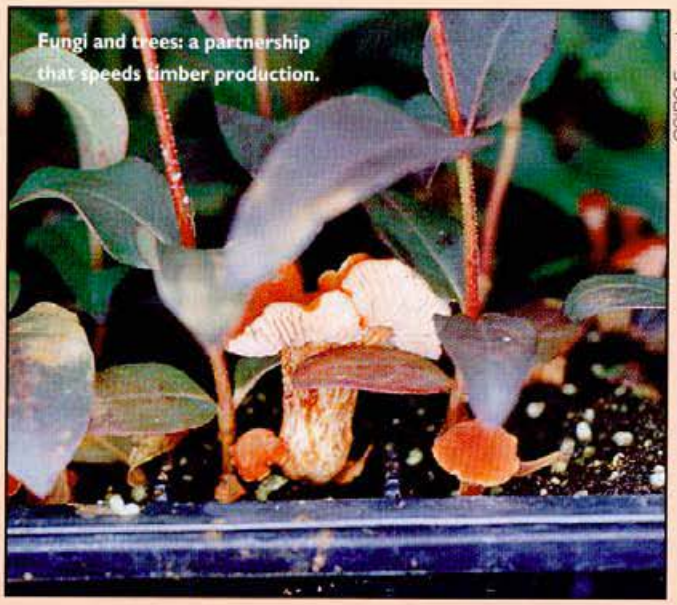
Packaged fungi speed plantation growth

COLLABORATION between CSIRO s Division of Forestry and industry in Western Australia has shown that inoculation of plantation blue gum (*Eucalyptus globulus*) seedlings with entomycorrhizal fungi can produce big increases in growth rates. The work has led to the development of commercial inoculation techniques.

In association with Bunnings Treefarms, Nick Malajczuk and his team at the division screened large numbers of isolates collected in blue gum forests in Tasmania and Victoria for the ability to form production associations with seedling roots. He then worked with Biosynthetica Pty Ltd to develop a cost-effective inoculum.

The collaboration resulted in the development by Biosynthetica of Mycobeads , made of fungal mycelia immobilised in a beaded gel. Tests have shown the beads generate extensive mycorrhiza when placed with blue gum seeds in sandy soil. And in trials at a commercial nursery, they were used successfully in a fluid drill mechanised process in the production of more than 80 000 seedlings. Field trials with inoculated blue gum seedlings on recently cleared bush sites demonstrated the value of ectomycorrhizal fungi in helping trees extract phosphorus and other nutrients from infertile soil. We recorded up to 30% growth increases, Malajczuk says.

Results from trials on farm land, much of which has been fertilised in the past, were not as impressive. Malajczuk says the effect of the fungi was fairly minimal on these sites, except on some poor soils. This relates back to the function of mycorrhiza in aiding the scavenging of nutrients from the soil. Where nutrients are plentiful, trees rely less on the fungi.



Fungi and trees: a partnership that speeds timber production.

CSIRO Forestry

But Malajczuk believes that inoculated seedlings will play a role in fast-rotation farm plantations of the future. The rotation period may be as short as five or 10 years and the nutrient supply in the soil will diminish following a number of harvests, he says. The value of mycorrhiza will increase when the nutrient supply diminishes.

This article is sourced from Onwood, *a newsletter produced by the CSIRO divisions of Forestry and Forest Products. Contact Mick Crowe, CSIRO Division of Forestry, PO Box 4008, Queen Victoria Terrace, ACT 2600, (09) 387 0672, fax (09) 387 8991.*