

Brachychiton × *carneus* Guymmer, (*B. garrawayae* × *B. grandiflorus*) has produced some interesting responses to insect attack possibly fruit-piercing moth. This response was a particularly strong terminal panicle that flowered over 3 months from both tips affected. This may indicate the possibility of using growth regulators to promote flowering, for breeding, and display purposes.

The breeding has resulted in the production of 100 of *B. bidwillii* × *B. grandiflorus* and 120 *B. bidwillii* × *B. carneus* which are 2 years old and planted out in test blocks at 3 m spacing for assessment.

The next batch consists of *B. garrawayae* × *B. bidwillii*, *B. grandiflorus* × *B. velutinosus*, *B. garrawayae* × *B. sp.* 'Exmore Station', and *B. bidwillii* × *B. sp.* 'Exmore Station' and consists of 300 plants that will be planted in the trial block in spring.

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Unconventional Pesticides[®]

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The pesticides I want to talk about are being termed "bio-rational pesticides". The term did make me pause to consider if all the chemicals we have been using are by definition bio-irrational pesticides.

Our single biggest selling plant is *Amelanchier* or juneberry. It is a native American small tree that has four-season interest; white flowers in April, edible fruits in June, excellent red fall color, and attractive smooth gray bark in winter. The problem with *Amelanchier* is that it is very susceptible to powdery mildew. We can have a greenhouse filled with lilac, the plant we think of as a magnet and indicator for powdery mildew. The lilac will be perfectly clean while the *Amelanchier* get mildew seemingly overnight. We had been using a rotational spray of Cleary's 3336 and Milban and have been getting mixed results. We were also having trouble with occasional root rot in our summer-blooming azalea transplants. At that point we began to look at some alternative fungicides. You do need to be careful, as some of the treatments I'm going to talk about may not be registered for the use I'm suggesting in your situation.

DISEASE CONTROL

ZeroTol™. ZeroTol is a liquid chemical manufactured by BioSafe Systems in Glastonbury, Connecticut. The active ingredient is 27% hydrogen dioxide. ZeroTol is marketed as a broad-spectrum algacide/fungicide for preventative treatment on ornamentals and turf. It can be used as a drench to control soil-borne plant diseases such as *Pythium*, *Phytophthora*, *Rhizoctonia*, and *Fusarium* at transplanting or seeding. We used it as a drench when we transplanted our summer-blooming azaleas. The label says that it can also be used as a foliar spray as an initial (curative) application to kill fungal spores on contact with any plant surface, then at a more dilute rate as a weekly preventative treatment.

Basically this means you run ZeroTol through your water lines all the time. If you believe the ZeroTol label it controls all fungus diseases both on the foliage and in the soil. People on the front line of greenhouse management swear by it. Accredited pathologists maintain it does no good at all. But recently, a local greenhouse customer challenged BioSafe Systems to prove conclusively that using ZeroTol as a water treatment is an effective and economical way to kill pathogens before they infect growing plants. In a study by researchers in the Department of Microbiology, University of Massachusetts (Wick and Dicklow, 2003), ZeroTol was tested for its ability to kill *Pythium* and *Phytophthora*, the most common water-borne pathogens. The study found that at rates as low as 1 : 2000 ZeroTol killed 100% of the pathogens.

There are shipping restrictions as in the concentrated form it is considered a hazardous material and our UPS won't touch it. But the good news is when ZeroTol is used in a greenhouse there is no reentry interval (REI) so work can go on as normal. ZeroTol is unstable once mixed and must be made fresh for each use.

Hydrogen Peroxide. Hydrogen peroxide is readily available and reported to have good control of mildew when used as a 1% foliar spray. The recommendation is that the last thing you do at the end of the day, just before closing houses for the night, is spray with hydrogen peroxide (MacKentley, 2003). Most antiseptic solutions sold in drug stores are a 3% solution. Obtaining more of a concentrated formulation might be a problem.

Milk. Published research reports from the University of Adelaide (Crisp, 2002) state that researchers used milk and whey to control powdery mildew on grapes. The most successful treatments were milk diluted to 1/10th of normal strength and whey to 1/3rd. At these rates, the quality of grapes was unaffected. Earlier Brazilian work (Bettiol, 1999) on mildew on zucchini demonstrated that a 10% milk solution reduced the severity of powdery mildew infection by 90%.

We used a spray of whole milk undiluted. Our results were less than satisfactory — and if we had read the Brazilian research before we sprayed we would have known that at concentrations above 30%, an innocuous but very unsightly fungus would grow on the leaves. But we were lead to believe it was the high fat content of the whole milk that was the effective ingredient — it would keep mildew from growing.

Melon growers in New Zealand (Hamie, 2003) are saving thousands of dollars every year by spraying their crops with milk instead of synthetic fungicides. The Brazilian research used fresh milk straight from the cow. The New Zealand research found that using skim milk was just as effective. Not only was it cheaper, but the fact that the milk had no fat content meant that there was less chance of any odors. So much for our belief that it was the fat that counted!

Baking Soda. Using baking soda, whether sodium or potassium bicarbonate, is not an especially new idea as using 1 oz/gal of water was mentioned in a 1933 book to control powdery mildew on roses. Some work at Cornell University (Kuepper, et al., 2003) focused on fungal diseases on cucurbits. A single spray application of 0.5% (wt/vol) baking soda plus 0.5% (vol/vol) SunSpray horticultural oil (Sun Company, Inc., Philadelphia, Pennsylvania) almost completely inhibited powdery mildew on heavily infected pumpkin foliage. Maryland researchers reported that a combination of horticultural oil and baking soda was not significantly different from the application of horticultural oil alone in controlling powdery mildew on lilac. The application of sodium bicarbonate without oil failed to control powdery mildew. Is

this because it did not adhere to the leaf surface or was the oil the significant controlling factor?

WEED CONTROL

We can have a terrible problem with weed outbreaks in our greenhouse. The most troublesome weed is *Cardamine* or Bittercress, a member of the mustard family. If we miss one plant and it goes to seed we can spend hours hand weeding. We investigated the possibility of using a preemergent herbicide like Surflan. The problem is that it doesn't work well with an organic (peat moss) planting mix. Further, it isn't registered for greenhouses so using it would be illegal and it very well might volatilize and do significant damage to the crop.

Vinegar. We had heard reports that using household vinegar might work. We found it did. Once our crops had lost their leaves in the fall, we could easily kill the weeds with a single spray. Household vinegar is a 5% concentration of acetic acid, but there are commercial formulations available with a higher concentration. Bradfield Natural Horticultural vinegar is 20% acidity and has yucca extract as a natural surfactant. It is important that the crop you want to protect is dormant — if not it is just as susceptible to the vinegar as the weeds. However, it can still be used under benches and around the perimeter for basic sanitation. Vinegar has also been used to control liverworts.

TerraCyte™. Again offered by BioSafe Systems, the same folks that market ZeroTol, TerraCyte is an environmentally friendly granular broad-spectrum algaeicide/fungicide that can be applied directly to potted plants, liners, and turf for the prevention and control of liverwort, moss, algae, slimes and molds. Reported to be fast acting as it kills liverwort and mosses in 24 to 48 h. TerraCyte does have a 4-h REI in greenhouses.

We have had problems with liverwort getting established in liners in our greenhouse, particularly in winter when the houses are cool and very humid. The addition of circulation fans entirely eliminated the problem for us.

There are always new bio-rational controls being introduced. We listened to Prof. Peter Bavistock (2003) talking about terpidene — T4 oils from *Melaluca alternifolia* to control bacteria. *Pseudomonas* can be a serious problem on lilacs and we have few effective control agents. I heard a suggestion that the T4 oil may also control fungi — hope springs eternal!

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