CROP & FOOD RESEARCH
Mana Kai Rangahau

media statement

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Controlling head rot in broccoli

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The number of broccoli heads that are unmarketable due to head rot can be minimized by not applying too much nitrogen before planting and during growth. Head rot can also be reduced by ensuring good control of pests and disease before the head maturing stage to eliminate or at least minimize pesticide applications that can help the rot establish in mature heads.

These were key findings in Crop & Food Research experiments at Pukekohe – part of the Advancing Integrated Pest Management (IPM) in vegetable brassica project that was funded by the Fresh Vegetable Product Group of Horticulture New Zealand and the Ministry of Agriculture and Forestry's Sustainable Farming Fund..

The experiments looked at the effect of nitrogen and calcium applications on the incidence of head rot and the effects of copper sprays and commercial surfactant adjuvants on the disease in broccoli.

Head rot is the brown or black coloured soft decay that occurs in broccoli heads and it is caused by the soft-rotting bacteria *Pseudomonas fluorescens* and *Pseudomonas marginalise*. The disease first appears after periods of rain and humidity, particularly if the heads have remained wet for several days.

Soil bacteria are splashed up onto the head where they produce biosurfactants and enzymes. The biosurfactants help the bacteria to establish and the enzymes macerate plant tissues resulting in the unsightly water-soaked appearance of the rot.

In April 2006, two field experiments were carried out at Crop & Food Research's Pukekohe Research Centre. The first investigated the effects of nitrogen and calcium on head rot of broccoli, and the second experiment looked at the effects of copper sprays and commercial surfactant adjuvants on head rot of broccoli.

For both experiments, broccoli plants, cv. Gaucho, established as cell plants, were planted on 6 April 2006 in sixteen two-row beds. Plots were 5 m long x 2 beds wide and separated by buffer zones of 1.2 m. Each plot contained 40 plants – 10 plants spaced 0.5 m apart along each inside row of the 2 beds.

Experiment 1

Prior to planting, 400 kg 12:10:10 (50 kg N/ha) was applied. Twelve treatments comprising combinations of three nitrogen treatments and four calcium treatments were carried out. The N treatments, as side-dressings of calcium ammonium nitrate (CAN), were made eight weeks after planting. The nitrogen treatments were: 'low N' (50 kg N/ha), 'medium N' (100 kg N/ha), and 'high N' (150 kg N/ha). The calcium treatments were:

1. No Ca

2. Pre-plant $CaSO_4$ (gypsum) at 5 t/ha

3. Six foliar applications of Stopit (16% calcium as $CaCl_2$) at 4 L in 1000 L water/ha applied at 7-day intervals from early head formation (13 June)

4. Pre-plant $CaSO_4$ (gypsum) at 5 t/ha and Stopit foliar applications applied as in treatment 3.

A bacterial suspension of *Pm* (ICMP 6039) and *Pm* (ICMP 8127) (both at 10^8 cfu/ml) was sprayed on to maturing broccoli heads to the point of runoff using a knapsack sprayer on 24 July. One week after inoculation disease assessments were carried out.

The incidence of head rot was significantly higher in 'high nitrogen' heads compared to those in 'low nitrogen'. Neither pre-plant calcium (gypsum) or foliar-applied calcium (Stopit) individually reduced

head rot, but the combination of both gypsum and Stopit was effective, significantly reducing head rot incidence. There was no significant interaction been nitrogen and calcium, although 'low nitrogen' together with pre-plant and foliar calcium applications gave the best control of head rot (5% infected heads).

Experiment 2

There were eight treatments comprising combinations of four surfactant treatments (no surfactant, Actiwett®, DuWett™, and NuFilm-17® – all at 50 ml/100 L of spray mix), and two copper treatments (no copper and copper oxychloride at 400 g/100 L water at 600 L/ha).

Actiwett® is a non-ionic surfactant containing 98 g/L linear alcohol ethoxylate, DuWett™ is a non-ionic surfactant/organosilicone wetter blend, and Rainguard™ is a non-ionic surfactant/pinolene sticker blend. The surfactant/copper treatments were applied to mature broccoli plants on 21 July and 27 July 2006 – 3 days before and 3 days after the heads were sprayed to run-off with bacterial suspensions of *Pm* (ICMP 6039) and *Pm* (ICMP 8127) (both at 10^8 cfu/ml) on 24 July.

Copper sprays, applied three days before and after inoculation of broccoli heads with soft-rotting bacteria, did not reduce the incidence of head rot. However, surfactant applications did significantly increase disease incidence. Broccoli heads in the 'no surfactant' treatment had a lower average incidence of head rot (23%) than broccoli heads in the Actiwett® (37%), DuWett™ (35%), and NuFilm-17® (34%) treatments.

To control head rot in broccoli, I recommend avoiding high rates of nitrogen with both pre-plant and foliar fertiliser applications. In addition, to optimise use of nitrogen and calcium and other fertilisers, head rot-tolerant cultivars should be chosen and practices that modify the crop microclimate and limit disease development are recommended.

To prevent maturing broccoli heads being exposed to adjuvant surfactants, it is recommended that the grower achieves good control of pests and diseases before the head maturing stage. If a pesticide must be used at this time, applications should be made when rain is not forecast.

CAPTIONS:

1. Peter Wright of Crop & Food Research checks for head rot.

2. Head rot in broccoli

ENDS

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