METHYL BROMIDE FOR PREPLANT SOIL DISINFESTATION IN TEMPERATE HORTICULTURAL CROPS IN AUSTRALIA IN PERSPECTIVE

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Research has identified several alternative fumigants to methyl bromide which offer similar disease and weed control for production of strawberry runners and fruit, and flower bulbs in Australia. Although effective, most of these treatments will not be adopted by growers until methyl bromide becomes scarce or is phased out. This is because the alternatives are generally more difficult to apply, have longer plant back times, pose greater human risks and are extremely noxious. For these reasons, research programs in Australia are also evaluating soil disinfestation strategies which provide more sustainable and safer approaches to soil disinfestation.

A Successful IPM Program in Flower Bulbs in Southern Australia

A successful IPM strategy developed for the Victorian flower bulb industry has eliminated the need for preplant soil disinfestation with methyl bromide to control sclerotium rot, once the major soilborne pathogen of flower bulbs in Australia. The program, which relies on use of clean planting material, monitoring of soil sclerote levels in soil, minimal cultivation and strategic use of fungicides (fluazinam, tebuconazole, diniconazole), has successfully reduced disease incidence from 80% to less than 5%, the same level obtained with soil disinfestation with methyl bromide.

Table 1. Comparative costs of Dutch Iris produced using an IPM strategy or with soil treated with preplant applications of methyl bromide/chloropicrin (70:30)

	Methyl bromide $/ha	IPM $/ha
Fumigation	6,500	nil
Plastic removal & disposal	100	nil
Soil sampling and sclerote extractions	nil	*300*
Bulb dips, pre-sowing	nil	200
Other fungicides	2,500	2,500
Herbicides	900	900
Hand weeding	600	600
Extra Herbicides	nil	@160 x2 =320
Extra hand weeding	nil	600
Total costs	10,600	5,420 *(5,120)*

NB: In general, costs which are identical to both programs have not been included, eg. planting, pre-storage dips, etc. Labour costs have been calculated @ $AUS17.50 /hour

In 1996/97 trials evaluated the IPM program on a traditionally fumigated site and a site without a history of fumigation. The program effectively controlled sclerotium rot at both sites. At the site without a history of fumigation, the IPM program was more cost effective and produced more flower stems than the fumigated plots. Irrespective of the increased

flower numbers produced, the program cost $AUS5000 less per hectare even though extra costs were involved, mainly for additional labour incurred with weeding (see Table 1.) At the site which had traditionally been fumigated, yields of healthy bulbs from IPM treated plots were approximately 15% lower than those in methyl bromide treated plots. The bulbs were unaffected by any obvious diseases. This response may reflect the need for soils with a long history of MeBr fumigation, to be treated with cover crops or left to recover for several years before the IPM program will be totally effective in these soils.

Alternatives to Methyl Bromide in Strawberry and Flower Bulb Production

During 1995-1997, field trials in the southern Australian strawberry fruit and runner industries, and the flower bulb industry have evaluated a range of preplant soil fumigants at rates from 325 to 500 kg ai./ha as follows: methyl bromide/chloropicrin 70:30 (Bromafume®), MeBr/C 50:50 (Vertafume®), MeBr/C 30:70 (Fungafume®), dazomet (Basamid®, AgrEvo), metham sodium (Metham®, Nufarm), 1,3 dichloropropene/C (Telone C35®, Dow Elanco) and chloropicrin at 125, 250 and 500 kg/ha alone or combined with dazomet or metham. Other treatments have included calcium cyanamide, lime, a biofumigant product (mustard meal), and selective herbicides.

A) Strawberry Fruit and Runner Production

Broad acre fumigation has been conducted in runner trials and strip fumigation in strawberry fruit trials. Fruit yields, vegetative plant growth, disease, weed numbers, the plantback time between fumigating and planting for fruit production, and the performance of runners produced in soil fumigated with alternative fumigants have been compared to the current industry standard (MeBr/C, 70:30).

Results showed that fumigant mixtures containing either lower ratios of methyl bromide (MeBr/C, 30:70 & 50:50) or other fumigant products mixed with chloropicrin gave yields, runner number and quality which were equivalent or better than the commercial treatment (MeBr/C,70:30) (Figs 1 & 2). Research supports the use of mixtures containing less methyl bromide and these products are being increasingly adopted in southern Australia.

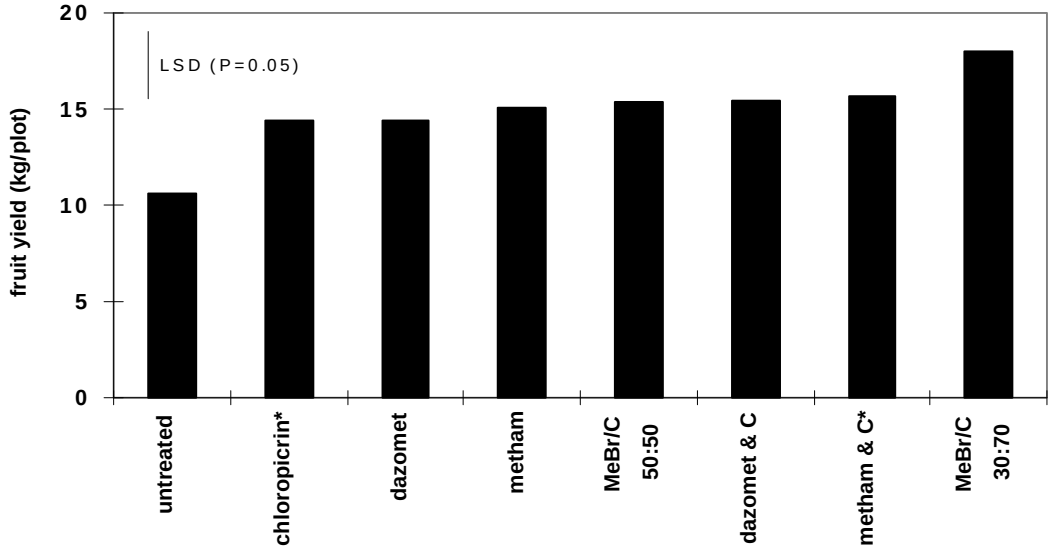

Figure 1: Effect of preplant soil fumigation at 500 kg/ha (*chloropicrin at 250 kg/ha) on the yield of strawberry fruit (var. Seascape) at Main Ridge, Victoria, in 1996/7

Cropping frequency, fumigation history and planting dates have also dramatically influenced trial results. In the first season of a fruit trial, no difference in total fruit yields was observed in the first season, but plots fumigated with a range of fumigant combinations containing chloropicrin, and dazomet alone, yielded 35% better than untreated plots in the second season (Fig 3).

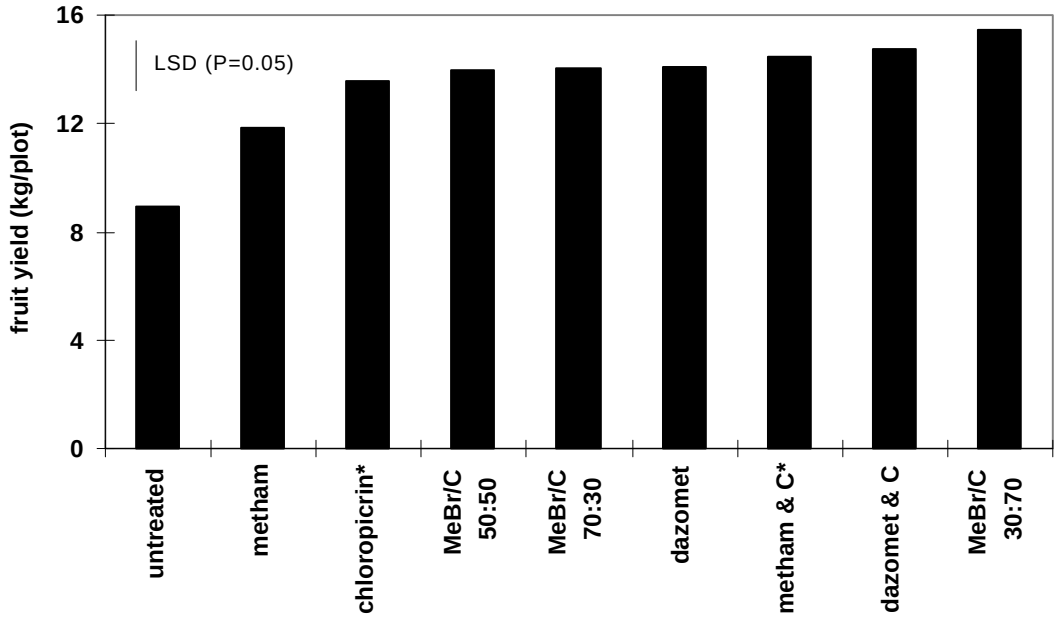

Figure 2: Effect of preplant soil fumigation at 500 kg/ha (*chloropicrin at 150 kg/ha) on the yield in the second season of strawberry fruit (var. Selva) at Wandin, Victoria, in 1996/7

In a runner trial at a site with a long history of fumigation with MeBr, no difference was found in the efficacy of a range of fumigants on the number and quality of runners compared to non fumigated plots. Clearly, the response to fumigation is site dependent (eg. disease history, level of weed seeds) and will impact on the components required in any alternative strategy that is adopted (eg. pre-plant fungicide dips, selective herbicides, modified fertiliser practices).

B) Flower Bulb Production

In trials in 1995 and 1996, the proportion of healthy (ie. not affected by sclerotium rot) Dutch Iris bulbs recovered from soil treated with chloropicrin or fumigant mixtures containing chloropicrin was significantly greater (at least 190%) than yields of bulbs recovered from untreated, lime and Ca cyanamide treated plots and at least equivalent to the standard methyl bromide treatment. As with strawberries, results showed that products containing reduced concentrations of MeBr/C (30:70 and 50:50) gave yields of Dutch Iris free of sclerotium rot which were comparable or better than the standard MeBr/C (70:30)(Fig. 3).

In the 1996 trial, there was no significant difference between yields of healthy bulbs obtained from plots treated with either the high (425 kg ai/ha) or low (300 kg ai/ha) rate

(Fig 3). Relative to the standard MeBr/C (70:30) treatment, the greatest yields of healthy bulbs were obtained from plots treated with chloropicrin applied either alone or with metham sodium, and MeBr/C (30:70). This was the first flower bulb trial where dazomet was ineffective for control of sclerotium rot. Weed control in plots treated with dazomet or metham sodium was equal to or better than in plots treated with MeBr/C (70:30). In plots treated with MeBr/C (30:70) and where chloropicrin was used alone, total weed numbers were between 140 and 325% greater than in MeBr/C (70:30) treated plots.

In 1995 and 1996, the greatest yields of healthy bulbs were achieved when chloropicrin was part of the fumigant mix, but weed control was not effective when chloropicrin was used alone. For this reason, in 1997 a range of fumigant combinations with chloropicrin are being evaluated.

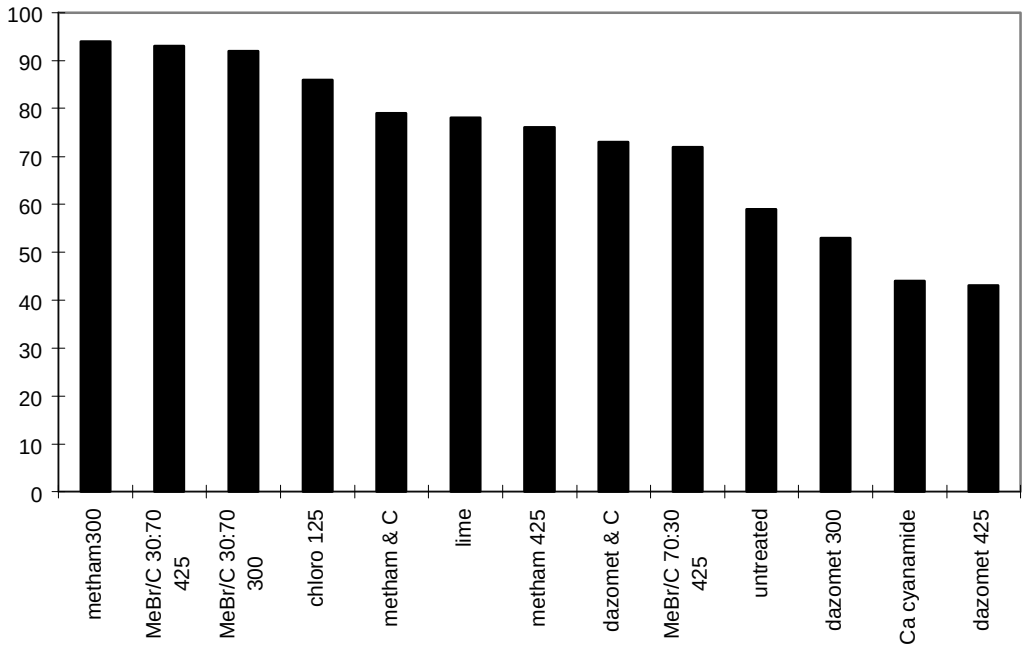

Figure 3: Effect of preplant soil fumigation at 125 kg/ha (chloropicrin), and 300 & 425 kg/ha (other fumigants) on yield (as a proportion of total recovered) of healthy Dutch Iris bulbs at Monbulk, Victoria in 1996/97

Nationally Coordinated Research into Alternatives

A voluntary levy of 20c/kg imposed on all methyl bromide imported into Australia matched by Federal funding from the Rural Industries Research and Development Corporation and the Horticultural Research and Development Corporation has enabled additional research programs to commence in Australia. New projects commenced in early 1997 to evaluate alternative soil disinfestation treatments for fresh tomatoes and strawberries produced in sub tropical regions of Australia, and to look at plant back times for alternatives used in temperate strawberry production. A national communication project is responsible for a newsletter and for informing all methyl bromide users (especially those in niche industries) of up to date international and national policy and research issues related to the phase out of methyl bromide.