SUCCESSFUL ALTERNATIVE STRATEGIES TO METHYL BROMIDE FOR SOIL DISINFESTATION IN HORTICULTURAL INDUSTRIES IN AUSTRALIA?

Ian J. Porter*, Robyn W. Brett, Bronwyn M. Wiseman, and Peter R. Merriman
Institute for Horticultural Development, Agriculture Victoria, Private Bag 15, South Eastern Mail Centre, 3176, Australia

National Coordination Assists Research

The initiation of a National Methyl Bromide Consultative Group by EPA in 1995 has assisted the development of Australia's stance at the Montreal Protocol Meetings on phasing out methyl bromide, and ensured national coordination of research. An R & D subcommittee prioritises research and provides funds from a voluntarily levy of 20c/kg imposed on importers of methyl bromide, and this is matched by Federal funding from the Rural Industries Development Corporation and the Horticultural Research and Development Corporation. Two key areas of research assisted by this funding are the development of alternative integrated disease control strategies for the flower bulb and strawberry fruit and runner industries in Australia.

Alternatives to Methyl Bromide in Flower Bulb Production

Since 1992, an alternative IPM program has been developed for the Victorian bulb industry which produces approximately two thirds of Australia's flowering bulbs. This industry has been solely dependent on fumigation with methyl bromide/chloropicrin mixtures (MBr/C 70:30) for over 20 years. Soil disinfestation is used mainly for control of diseases, predominantly *Sclerotium rolfsii*, but also for weed control and the uniform growth obtained after fumigation. Contract application of MBr/C also provides growers with a simple once off treatment and minimal management costs. The high crop value means that growers can absorb the high cost of fumigation (up to $A12,500), but also means that alternative programs need to produce the same high yields and high quality bulbs and flowers obtained after fumigation with methyl bromide. In addition, alternative programs which are implemented into previously fumigated areas need to be evaluated over long periods (5 years or more) to identify the true economic cost/benefits.

A current trial on Dutch iris is evaluating the economic benefits of an IPM program which is presently supplementing, and could eventually replace soil disinfestation with methyl bromide in the flower bulb industry in Victoria The program, which relies on use of clean planting material, monitoring of soil sclerote levels in soil, minimal cultivation and strategic use of fungicides (diniconazole, fluazinam, tebuconazole), has successfully reduced disease incidence from 80% to less than 5%. In this trial, costs of controlling weeds and pathogens (pesticides and labour), and the market value of cut flowers and harvested bulbs are being compared for fumigated and non-fumigated sites at a high inoculum (>1 sclerote/kg of soil) site and a low inoculum (<1 sclerote/kg of soil) site. However, with this program the rate of decline in sclerote population densities in soils is relatively slow, therefore growers need a method of soil disinfestation that eradicates the pathogen.

For these reasons, another trial is evaluating a range of alternative fumigant options compared to the standard broadacre soil treatment of Bromafume® [MBr/C 70:30]at 500 kg/ha. Treatments applied included, 500 kg/ha of Vertafume®, [MBr/C 50:50], Fungafume® [MBr/C 25:75], Metham sodium [MS], Dazomet [D] and 150, 250 and 500 kg/ha of Chloropicrin [C1 and C2, C3 resp.] and mixtures of dazomet and metham sodium with the low rate of chloropicrin. Results from fumigated soils covered with plastic for 6 weeks (Fig 1.) showed that five treatments gave similar or greater control of *S. rolfsii* compared to Bromafume. This corresponded to a yield increase of unaffected bulbs of up to 180%. It was concluded that Vertafume and Fungafume are as effective as Bromafume and this helps reduce the amount of methyl bromide being applied to soil, and mixtures of fumigants (ie. D & C1, MS & C1) offer excellent potential MBr alternatives. The effect of treatments on weed control, plant back periods and soil microbial populations were also assessed. The long term effects of alternative strategies will be evaluated in future trials.

Alternatives to Methyl Bromide in the Strawberry Industry

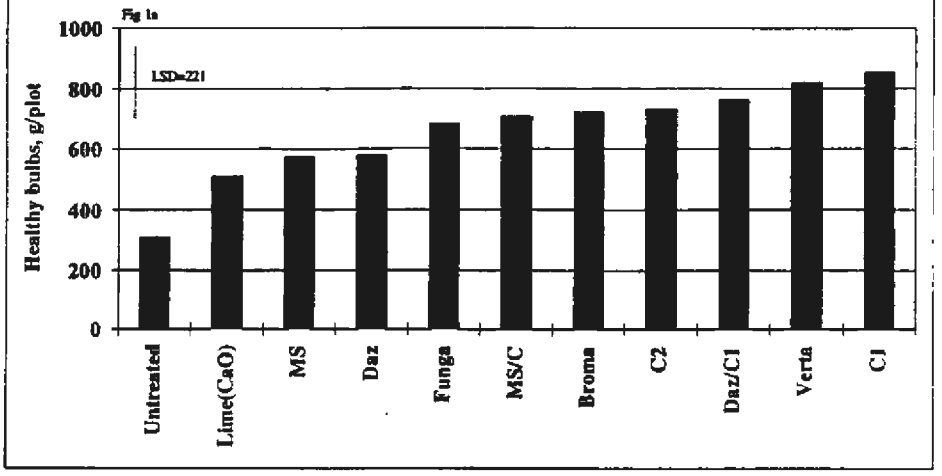
Research into alternatives to MBr for pre-plant soil disinfestation for the south-eastern Australian strawberry fruit and runner industries is a relatively new component of the National research program. In the last two years, field trials with certified strawberry runners cvs. Selva, Chandler, Seascape, have evaluated similar rates and range of treatments to that used in the flower bulb trials. Broadacre treatments have been used in the runner trials and strip treatments in fruit trials. The relative efficacy of treatments on total yield, weeds numbers and diversity, and for disease control was determined.

On a site with a previous long history of fumigation up to one year before the trial, there was no difference in total yield of strawberry fruit for the 7 month harvest period (Nov. 1995 to May 1996) between fumigated plots (with MBr or alternatives) and non-fumigated plots (see Fig. 2). The distribution of yield with time, however, varied considerably, with greater yields (up to 26%), being obtained from fumigated plots during the first 6 months after transplanting, and lower yields for the remaining 14 weeks, compared to non-fumigated plots. Plants in MBr fumigated plots also had a much greater vegetative flush, (ie. 70% more runners and larger plants), than plants from non-fumigated plots. All plots were unaffected by soilborne diseases in the first year but will be reassessed in the second season. This low disease level may reflect the previous continuous use of MBr at the site and stresses the importance of long term trials to effectively evaluate alternative treatments.

Assessment of weed numbers in both the runner and fruit trials showed that, providing plots were covered with polyethylene immediately after fumigation, soil incorporation of alternative fumigant treatments provided similar control to Bromafume.

Current trials are evaluating the long term effect of alternative treatments used in previous trials; improved efficacy of fumigant treatments by integration with fertiliser based soil disinfestant treatment, (eg. calcium cyanamide, hot lime); and development of more suitable herbicide programs for fruit and runner growers. Key diseases/pests/weeds actually controlled by MBr and the length of plant back periods for any potential alternatives are also being evaluated. Future research is aimed at developing specific management programs for both the temperate and sub tropical regions of Australia.

Figure 1a/b: Relative efficacy of methyl bromide and alternative fumigants in Dutch Iris (var. Viscount) production



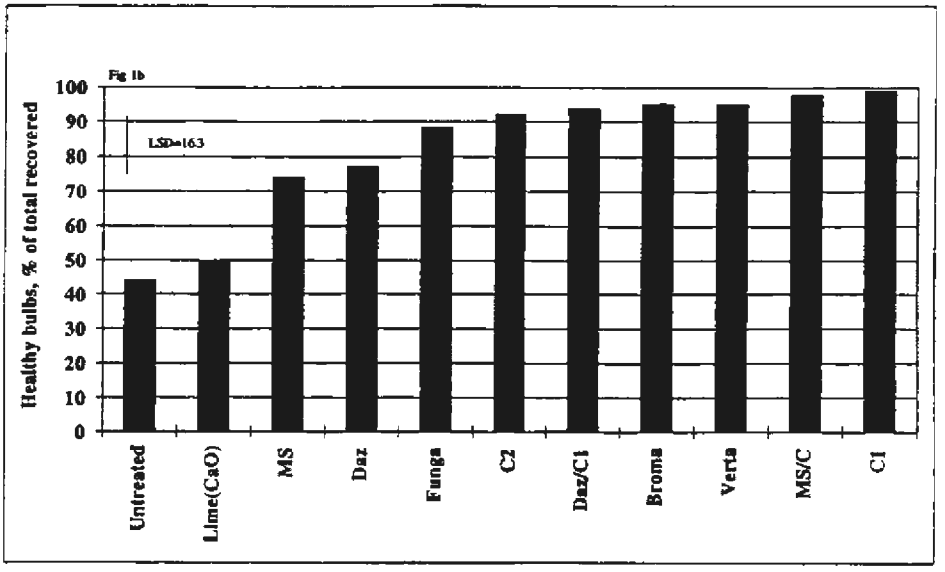


Figure 2: Relative efficacy of methyl bromide and alternative fumigants in strawberry (cv. Selva) fruit production