SOIL INJECTION OF 1,3-DICHLOROPROPENE, ALONE OR COMBINED WITH CHLOROPICRIN AND/OR PREEMERGENT HERBICIDES, FOR NEMATODE, SOIL-BORNE DISEASE AND WEED CONTROL

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INTRODUCTION

In the United States, five major crops account for 81.2% of methyl bromide use for pre-plant treatments: tomatoes (34.6%); strawberries (15.1%); peppers (11.9%); ornamental/nursery/forestry (9.8%); and tobacco (9.7%) (Crop Protection Coalition, 1995). Telone* soil fumigants are potential alternatives for methyl bromide on each of these crops.

Telone soil fumigants are registered as a pre-plant soil treatment to protect more than 120 vegetable crops, field crops, and nursery crops as well as planting sites for citrus trees, deciduous fruit trees, nut trees, and berry bushes and vines. 1,3-dichloropropene (1,3-D), the sole active ingredient in Telone II, is recognized as a superior nematicide which controls all economically significant nematode species including cyst, root knot, stubby root, lesion, ring, and dagger. 1,3-D alone does not provide effective broad spectrum control of soil-borne pathogens or weeds. Therefore, in Telone C-17, chloropicrin is mixed with 1,3-D to enhance activity on these pests. Telone soil fumigants will not control pests that are introduced into the soil after fumigation from sources such as contaminated soil, equipment, irrigation water and planting material or those pests which are able to move from soil depths into the fumigation zone after fumigant dissipation.

DowElanco has staunchly supported 1,3-D in the reregistration and special review processes. The reregistration standard for 1,3-D issued September 1986. Except for two environmental fate studies (warm climate and cold climate), all data have been submitted to the Environmental Protection Agency (EPA). The EPA issued a position document (PD) and placed 1,3-D in special review in 1986. This process requires EPA to conduct a benefit/risk analysis resulting in the issuance of a proposed regulatory decision (PD 2/3) for public comment sometime in 1995. After an appropriate comment period, EPA will consider all comments submitted and issue a notice of final determination (PD 4).

RESEARCH TRIALS SUMMARY

A number of research trials have been conducted testing Telone II, Telone C-17, or Telone C-17 combined with additional chloropicrin or herbicides as methyl bromide alternatives on various crops. The trials focused primarily on crop yield response and nematode, soil-borne disease, and weed control. Control of yellow and purple nutsedge has been of particular interest due to their importance as weed pests in numerous crops.

Numerous research trials have been conducted on tomatoes and peppers in Florida (Gilreath et. al., 1994; Noling et. al., 1994; Eger, 1995). Root knot nematode control with Telone soil fumigants was consistently equivalent to methyl bromide and was usually superior to other alternatives tested. Telone C-17 alone or combined with additional chloropicrin generally provided statistically equivalent disease control to methyl bromide treatments. Although Telone soil fumigants provided some weed control, they were not equivalent to methyl bromide. The addition of Tillam (pebulate) to Telone C-17 or Telone II treatments resulted in nutsedge control comparable to methyl bromide. Devrinol (napropamide) and Eptam (EPTC) also were effective on certain weed species although not as effective as methyl bromide and further testing is needed. Tomato yields in plots treated with Telone C-17 at 35 gpa broadcast equivalent ranged from 76-

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110% of those plots treated with methyl bromide. The overall average was approximately 95%. In a single pepper trial, yields from plots treated with Telone C-17 were 128% of yields from plots treated with methyl bromide, although the difference was not significant.

In research trials on strawberries in California, Telone II combined with chloropicrin (1,3-D/chloropicrin equivalent of 70/30) at 425, 454, and 496 lbs/acre provided comparable soil-borne disease control to methyl bromide/chloropicrin (67/33) at 325 and 381 lbs/acre (Coffey et. al., 1994; Duniway et. al., 1994). Overall in these research trials, yields for the Telone II/chloropicrin treatments were nearly the same and not significantly different from those for the methyl bromide/chloropicrin treatments. In one trial, cumulative fruit yields were 3731 and 3845 cartons/acre for the methyl bromide/chloropicrin and Telone II/chloropicrin treated plots, respectively, compared to yields from nontreated fields of 2120 cartons/acre.

In research trials on tobacco and peppers in Georgia, Telone C-17 at 20 gpa and Telone C-30 at 20 gpa were compared to methyl bromide at 9 lbs/300 linear feet on tobacco beds (Csinos et. al., 1993). Nematode and soil-borne disease pressure was low. There was no significant difference between these treatments for control of root knot nematode larvae, ring nematode, or spiral nematode or for the final root gall index. Additionally, there was no significant difference between these treatments for control of numerous soil-borne diseases including Pythium spp., Fusarium spp., and Rhizoctonia solani. Percent control of purple cudweed, cutleaf evening primrose and old field tonelflax were not significantly different between these treatments and ranged from 84.5-95.0%. Tobacco and pepper stand counts and height measurements were not significantly different between treatments.

FUTURE RESEARCH

Present and future DowElanco self-initiated and sponsored research will focus on a number of areas. Field trials presently are in place to determine the optimal 1,3-D/chloropicrin ratio for soil injection to control nematodes and soil-borne diseases. Field trials also presently are in place to determine the optimal 1,3-D/chloropicrin ratio for drip irrigation application to control nematodes and soil-borne diseases. Additionally, herbicide active ingredients are being screened as a possible weed control component.

REFERENCES CITED

Coffey, M. D. et. al. 1994. Evaluation of Alternative Soil Fumigation Methods for Use in Strawberery Production in Southern California. Proceedings: Annual International Research Conference on Methyl Bromide Alternatives and Emissions Reductions.

Crop Protection Coalition. 1995. Status of Methyl Bromide Alternatives Research Activities.

Csinos, A. S. et. al. 1993. Evaluating Alternatives for Methyl Bromide Fumigation. 1993 Georgia Tobacco Research - Extension Report. pp 95-105.

Duniway, J. M. et. al. 1994. Evaluation of Strawberry Growth, Fruit Yield, and Soil Microorganisms in Nontreated Soil and in Soil Fumigated with Methyl Bromide/Chloropicrin, Telone II/Chloropicrin, Chloropicrin, or Vapam in a California Strawberry Production System. Proceedings: Annual International Research Conference on Methyl Bromide Alternatives and Emissions Reductions.

Eger, J. E. 1995. Efficacy of Telone Soil Fumigants as Alternatives to Methyl Bromide in Florida Mulched Vegetable Culture. DowElanco Internal Report.

Gilreath, J. P. et. al. 1994. Nutsedge and Soil-Borne Pathogen Control with Alternatives to Methyl Bromide. 1994 Proceedings of the Florida Tomato Institute. pp 7-16.

Noling, J. W. et. al. 1994. Alternatives to Methyl Bromide for Nematode Control. 1994 Proceedings of the Florida Tomato Institute. pp 1-6.