EVALUATION OF TECHNOLOGY AND APPLICATION METHODS FOR CHEMICAL ALTERNATIVES TO METHYL BROMIDE

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The objectives of these studies were to develop and test technologies and methods to optimize the performance of alternative soil fumigants. Combinations of 1,3-dichloropropene (1,3-D) and chloropicrin were evaluated along with the herbicides napropamide, pebulate, and trifluralin for the control of soilborne pests and their effects on marketable yield of tomato and pepper. Three application methods were evaluated; 1-broadcast application 1,3-D:chloropicrin formulations several days in advance of bed preparation/plastic laying operations using a deep placement coulter system; 2-shank injection of chloropicrin during bed preparation/plastic laying; and 3-shank injection of 1,3-D:chloropicrin under existing raised, plastic-mulched beds. To achieve the desired combination of placement depth and fumigant retention in the broadcast applications, a deep placement coulter system (Yetter 30" Avenger, Yetter Manufacturing Co.) was modified to permit injection of the fumigant without disturbing the soil profile. The injection of fumigants under pre-existing raised, plastic mulched beds was achieved by designing and constructing an implement to allow a winged chisel to enter the ground in the row middles and reach under the beds without disturbing the plastic. Trials were conducted in research plots and in large-scale plots located on commercial production farms ranging in size from 0.8 to 5.4 hectares. In two commercial trials a second (double) crop of cucumber was planted directly into the beds after completion of the first crop.

For broadcast applications using the deep placement coulter system, retention of 1,3-D in the soil was increased when the crust layer at the soil surface was left undisturbed. Thus, no additional disking procedures are recommended before fumigant application using this technology. When injected under existing, raised, plastic-mulched beds, retention and distribution of 1,3-D in soil was increased dramatically through the use of virtually impermeable films (Hytibar, Klerks Plastic Co.). Fumigant rates could be reduced by 50% under the virtually impermeable films without compromising retention and distribution in the soil.

In tomato fields with a high incidence of Fusarium wilt and Fusarium crown rot, disease incidence in the alternative fumigant treatments ranged from 16% to 56% while disease incidence in methyl bromide treated areas averaged 18%. Following the broadcast application of 1,3-dichloropropene:chloropicrin, an additional application of chloropicrin shank injected during the bedding operations provided the best disease control of the fumigant alternatives. In tomato fields with high populations of the weed Solanum nigrum (black nightshade), none of the chemical alternatives provided acceptable weed control when compared to methyl bromide. In tomato fields where pest

pressure was low to moderate, the fumigant/herbicide alternatives evaluated in the broadcast treatments provided levels of pest control similar to methyl bromide.

In pepper production fields where the incidence of Phytophthora blight and Pythium root rot and damping off were low to moderate, the fumigant alternatives provided levels of disease control similar to methyl bromide. In one location with a high incidence of damping off, an additional application of chloropicrin in the bed reduced disease incidence from 15% to 6% while disease incidence in the corresponding methyl bromide treated area was 4%. Disease and weed control in the alternative fumigant treatments were extended to a second double crop of pepper in two locations.

The results indicate that in fields with low to moderate pest pressure, broadcast applications of 1,3-dichloropropene:chloropicrin mixtures using a modified deep placement coulter system can provide levels of pest control similar to methyl bromide when coupled with an effective herbicide program. In locations where disease pressure is severe, it is recommended that an additional application of chloropicrin be made during bedding. Some factors found to impact pest control included selection, calibration, and timing of herbicide applications, and proper soil moisture, and tillage operations. In fields with a history of severe pest pressure, a systems approach to pest management is advised where crop management practices are coupled with pest management practice to address the outbreaks of specific plant pests.

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Table 1. Demonstration/validation trials of the alternatives fumigants 1,3-dichloropropene and chloropicrin conducted during the 2000/2001season.

Site	County	Crop	Hectares Treated	Application Date	Double Crop
1	Palm Beach	tomato	4.1	September	No
2	Palm Beach	tomato	5.4	September	No
3	Palm Beach	tomato	3.2	November	No
4	Palm Beach	pepper	4.7	November	No
5	Palm Beach	pepper	4.8	September	No
6	Palm Beach	pepper	1.6	July	Yes
7	Palm Beach	pepper	1.1	August	Yes
8	St. Lucie	tomato	0.8	February	No
9	St. Lucie	tomato	4.0	August	No
10	St. Lucie	pepper	4.0	February	No
		total	33.7		