ECONOMIC IMPACTS OF SWITCHING FROM PRE-PLANT FUMIGATION WITH METHYL BROMIDE

Lori Lynch and Janet Carpenter

Since phase out schedules for methyl bromide were announced under the Montreal Protocol and the Clean Air Act, researchers have been investigating alternatives to methyl bromide fumigation for both pre-plant and post-harvest uses. They have also been exploring methods of decreasing emissions of methyl bromide through closed chambers and impermeable tarps. As the year 2001 approaches, growers are exploring these alternatives as options after the ban on methyl bromide production and importation comes into place. We examine the most likely alternatives that growers will use and how these methods will alter yields and costs. Given the next best alternatives, we examine impacts on crop production, prices and society's welfare.

Methyl bromide is primarily used as an agricultural fumigant in the high-valued horticultural crops in California and Florida as well as Georgia, South Carolina, and North Carolina to a lesser degree. In the markets for these crops, the primary competitors are the Mexican states of Baja California, Sinaloa, and Sonora. These states will be able to replace some of the production losses incurred in the United States after growers stop using methyl bromide. California uses 15.325 million lbs. for pre-plant fumigation ranging from high valued use on strawberries to spot treatments in orchards. Florida uses 13.35 million lbs. with the highest valued uses in double cropping systems. Georgia uses 1.541 million lbs. in tomatoes, tobacco beds, and onions. South Carolina uses 1.453 million lbs. in tomatoes. Similarly, North Carolina uses 1.819 million lbs. in tomatoes, peppers, strawberries and tobacco beds.

We examined research documents, sought expert opinion, and conducted two workshops to elicit information and feedback on the possible alternatives that growers could employ. These alternatives included: 1,3-Dichloropropene (1,3-D), Chloropicrin, Metam Sodium, Dazomet, Methyl Iodide, Enzone, Ethoprop, Aldicarb, Carbofuran, Oxamyl, Fenamiphos, Benomyl, Metalaxyl, Biological Control, Botanical Extracts, Cover crops, Crop Rotation, Fallow, Flooding, Greenhouse Production, Hot Water treatment, Hot Water Dips, Plastic Barriers, Resistance and Grafting, Solarization, Steam, Soil Amendments, Organic Production, and other chemical and nonchemical combinations. After this data collection, we determined that the highest profit alternative in Florida vegetable production will be 1,3-D/Chloropicrin with Pebulate as an herbicide for nutsedge. Growers with drip irrigation systems who decide to double crop will use Metam Sodium before planting the second crop. Florida turf will shift to limited fumigation with 1,3-D or use a mix of other inputs to compensate for absence of

methyl bromide. Cut flowers grown in the field are also assumed to shift to 1,3-D in both California and Florida. California tomatoes, peppers, strawberries, tree and vine crops, and nurseries will shift to 1,3-D/Chloropicrin. Strawberry growers are assumed to use more Chloropicrin than other crops for control of soil borne pathogens. Greenhouse crops such as roses and carnations will shift to steam sterilization.

Our assumptions are based on the best available information at this time. We are aware however that there are regulatory problems with some growers shifting to these alternatives. For example, California regulations only permit the use of 1,3-Dichloropropene under restrictive conditions. 1,3-Dichloropropene can not be applied in a buffer zone of 300 feet around any school, hospital, business or residence. The maximum amount of 1,3-Dichloropropene that can be applied without tarpaulin is 35 gallons per acre. The maximum amount under a tarpaulin is 24 gallons per acre. Within a 36 square mile area, no more than 5,000 gallons can be used if any application is made at depths less than 18 inches. If all applications are made at depths of 18 inches or more, 9,000 gallons can be applied in the area. These quantities are not sufficient for the conversion of all the acres that would desire to change. In addition, recent actions by certain Agricultural Commissioners indicate that Chloropicrin rates may be limited in the future to avoid potential conflict with residents in areas in proximity to fumigated fields. Recent research using multiple year trials suggests that the strawberry yield losses using 1,3-D and Chloropicrin will be higher than those reported previously (over 15% rather than 3-8%). In addition, the lack of methyl bromide in the nursery stage results in less vigorous and lower yielding plants than under a methyl bromide regime. Concern remains that without methyl bromide tree and vine nurseries will not be able to guarantee nematode-free products as required by law. The use of Pebulate, the preferred herbicide for southeastern grown tomatoes, is not allowed on hand transplanted tomatoes, which is the current practice. Even with the fast track for methyl bromide alternatives, it is not clear that Pebulate will be available for use in the tomato industry by the year 2001. 1,3-D bed fumigation in Florida would require worker safety equipment that will be very uncomfortable due to heat. Fortunately fumigation for the majority of Florida's crops happens during cooler seasons. In addition, growers could shift to full-field fumigation where the number of workers in the field at the time of application could be minimized.

Using these assumptions, we computed the increase in revenue generated from using one pound of methyl bromide rather the next best alternative assuming market prices do not change for the crop. For example, California South Coast strawberries gain an extra $41.43 from the availability of a pound of methyl bromide rather than using 1,3-D/Chloropicrin. If they use an average of 115 lbs. of methyl bromide per acre as indicated in the California Pesticide Use database, this is equivalent to a loss of $4764 an acre. Estimates for other crops are included in the Table 1.

REFERENCES

McWilliams, Bruce, David Sunding, Brent Hueth, Lori Lynch, David Zilberman and Jerry Siebert, 1997, "Economic Impacts of Banning Methyl Bromide Use in California Agriculture-DRAFT," University of California.

Yarkin, Cherisa, David Sunding, David Zilberman and Jerry Siebert, 1994, "All crops should not be treated equally," *California Agriculture*, vol. 48, no. 3, pp. 10-15.

Table 1. Increased revenue: Methyl bromide compared to best alternative

Region and Crop	Methyl bromide use (lbs)	Value ($/lb)
CA S. Coast Strawberry	1,394,720	$41.43
CA Carnations	12,000	$36.25
Cent. FL Strawberry	914,610	$33.48
CA C. Coast Strawberry	2,462,202	$28.24
CA Perennial Nursery	170,302	$20.30
SW FL Tomato-Cucumber	335,160	$18.67
Cent. FL Pepper-Watermelon	849,268	$13.93
CA Rose Nursery	290,474	$12.40
SW FL Tomato-Watermelon	1,934,324	$11.67
Cent. FL Eggplant	50,568	$11.37
SW FL Eggplant	50,568	$11.37
SE FL Eggplant	303,800	$11.27
CA S. Coast Tomato	198,512	$11.23
Dade Eggplant	39,200	$10.99
CA Strawberry Nursery	239,772	$10.20
SW FL Tomato-Squash	619,360	$10.09
CA S. Desert Tomato	76,304	$9.43
SE FL Pepper	1,409,632	$9.10
SW FL Pepper	1,695,400	$8.29
SW FL Watermelon	46,648	$7.17
NC Strawberry	155,040	$6.72
Cent. FL Watermelon	46,648	$6.64
FL Cut Flowers	718,530	$6.44
W. FL Watermelon	110,740	$6.14
CA Field Flowers	640,787	$5.40
CA Sac. Walnut	126,678	$5.00
CA SJ Walnut	98,604	$5.00
CA Sac. Almonds	81,840	$4.99
CA SJ Almonds	773,956	$4.99
CA N. Coast Wine Grapes	814,042	$4.96
CA C. Coast Wine Grapes	273,294	$4.96
CA Sac. Peach and Nectarine	266,034	$4.90
CA Sac. Plum and Prune	125,953	$4.90
CA SJ Peach and Nectarine	181,818	$4.90
SW FL Tomato	939,624	$4.69
SE FL Tomato	1,110,732	$4.64
W. FL Tomato	408,660	$4.54
Cent. FL Tomato	3,263,008	$4.27
Dade Tomato	868,868	$4.25
SC Tomato	590,548	$4.15
CA S. Coast Pepper	194,194	$4.08
CA S. Desert Pepper	329,602	$3.85
CA Roses	116,000	$2.05
FL Turf	3,049,515	$1.78
FL Caladium	392,236	$1.38
NC Tomato	244,200	$1.04
GA Tomato	689,500	$0.97
NC Peppers	204,000	$0.94
CA SJ Table Grapes	489,600	$0.50
CA SJ Wine Grapes	69,344	$0.50