ECONOMICS OF METHYL BROMIDE ALTERNATIVES FOR ORCHARD REPLANT IN CALIFORNIA

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When peach and several other types of fruit and nut trees are replanted after a previous orchard is removed, the trees often grow slowly and non-uniformly. Growers have learned that fumigation with methyl bromide (MeBr) reduces this “replant disease” and the new trees are more vigorous and uniform. The causes of replant disease have not been identified but are believed to include a complex of major and minor soil-borne plant pests whose populations grew with the previous orchard.

We are pursuing chemical and non-chemical strategies that reduce the replant problem in peach and plum. Several of the field trials and results are described in Trout, et al. 2003. Another paper in these proceedings (Schneider, et al. 2004) describes similar work in grapes, and Browne et al. (2003) discusses diagnosis of the replant disease.

Although most of these trials show tree growth and yield benefits of fallow periods and alternative fumigants, it is important to assess the economic costs and benefits of the various treatments. In this report, we present a preliminary economic analysis of several methyl bromide alternatives for peach and plum orchard replant in California. The yield data summaries are for peach, plum and pluot orchard trials carried out in the San Joaquin Valley on replanted orchard soil with no identified plant parasitic nematodes. Trial methods, treatments, and measurements are given in last year’s proceedings (Trout et al., 2003).

Economic Analysis

The economic analysis is based on costs of production and yields provided by UC Cooperative Extension personnel that specialize in tree fruit crops and compiled by the Dept. of Agricultural and Resource Economics, University of California as part of the Cost and Return Studies series: http://www.agecon.ucdavis.edu/outreach/crop/cost.htm. The cost data for peaches and plums for fresh market were updated in summer 2004 for this analysis. A spreadsheet was developed using the basic structure of the Cost and Return Studies that allowed comparative analyses of fumigant and fallowing alternatives, including fallow period (0 – 3 years), cultural practice costs during the fallow period, fumigation costs, cultural practice costs of the new orchard (weed control, etc.), and annual yields. Base cost and yield data as well as economic assumptions are given at the above Web site. Results are sensitive to fruit price. For the cost and yield assumptions used, $8.35 per box (11.3 kg) is required to break even (Net Present Value (NPV) of net returns = 0).

Results

At a fruit price of $8.35/box, a 2% yield increase would be required to pay for a $850 Telone fumigation, and a 4% yield increase would be required to pay for a $1700 methyl bromide tarped fumigation. As fruit price increases, the yield increase needed to pay for preplant treatments declines. Our yield data (see tables 1 – 8) show that fumigants have provided 10 – 30% yield increases in the early production years in most cases (full production is assumed by year 7 (5^{th} production year), but the yield benefits decrease with time. The NPV of a 10% yield increase over the life of an orchard is about $4,000/ac. The NPV of a declining yield increase over the first 5 production years (from 50% in year 3 to 0% year 7) is $1300, sufficient to pay for Telone fumigation.

Fallow periods increase production costs by delaying income while fixed costs (land, structures, etc.) continue. We have also assumed a cultural practice cost of $50/ac/year during fallow years to sow and mow a winter rye cover crop to control weeds and reduce erosion. Fallowing (with no yield increase, a $8.35 fruit price, and $213/yr land capital recovery cost) decreases the NPV of net returns at the time of fallowing (when the orchard would otherwise be replanted) by $400, $800, and $1200 for 1, 2, and 3 years of fallow, respectively. Each year of fallowing would be paid for by about a 1% yield increase (ie. 3 years of fallow would require a 3% yield increase to break even). Yield tables show that yield increases with fallowing exceed this level, and thus are worthwhile. For our economic assumptions, 3 years of fallow costs less than methyl bromide fumigation, and for our soil/pest conditions our limited data indicate yields are about equivalent.

Conclusions

The net present value of an orchard at the time of planting is very sensitive to fruit price and yields over the life of the orchard. Preplant practices such as fumigation and fallowing (delayed planting), that result in even a relative small yield increase will often increase value. Our trials show that for replanted orchards in the San Joaquin Valley without acute disease or nematode problems, yield increases following fumigation with alternative fumigants or fallowing 1 – 3 years can increase the NPV of the orchard.

References

Browne, G.T., J.H. Connell, L.R. Bulluck, T.J. Trout, and S.M. Schneider. 2002. Management and etiology of replant disorder on almond and peach. Proc. Ann. Intern'l Research Conf on MeBr Alt and Emissions Reductions. p 44A.

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Table 1. Study 1a: Peach; Fall 1997 Fumigation with Spring 1998 Replant

Treatment	*MeBr Shank*[1]	*Telone EC + Vapam*[2]	*1-Yr. Fallow Non-Fum*	*Non-Fumigated*
Market Yield *(kg/tree and % of MeBr value)*				
Year 3	9.9 a	92% a	73% b	68% b
Year 4	18.8 a	109% a	98% a	91% a
Year 5	38.2 a	100% a	93% a	86% a

[1] 350 lb/ac deep shanked and covered with HDPE plastic

[2] 35 gal/ac Telone II EC *(310 lb/ac 1,3-D)* drip-applied in 4" of water with 26 gal/ac Vapam microsprayed on the surface.

[3] like letters within a row indicate no significant differences at $P<0.05$.

Table 2. Study 1b: Peach; Fall 1998 Fumigation with Spring 1999 Replant

Treatment	*MeBr Shank*	*InLine + Vapam*[1]	*1-Yr Fallow Non-Fum*	*Non-Fumigated*
Market Yield *(kg/tree and % of MeBr value)*				
Year 4	30.1 ab	109% a	87% bc	75% c
Year 5	35.9 a	102% a	99% a	91% a
Year 6	53.4 a	100% a	97% a	100% a

[1] 35 gal/ac Inline® (Telone C-35 EC) *(230 lb/ac 1,3-D + 130 lb/ac chloropicrin)* drip-applied in 3" of water with 13 gal/ac Vapam microsprayed on the surface.

Table 3. Study 2a: Plum; Long Term Fallow; Oct 1999 Fumigation, Feb 2000 replant

Fallow Period (yr)	*0*	*0*	*1*	*1*	*2*	*3*
Additional Treatment	*MeBr*			*Herbic*[1]		
Market Yield *(kg/tree and % of MeBr value)*						
Year 3	11.8 a	40% b	50% ab	54% ab	70% ab	108% a
Year 4	48.6 a	57% c	90% ab	81% b	90% ab	105% a
Year 5	22.0	100%	81%	84%	90%	108%

[1] herbicide trtmnt to stumps *(50 mL Roundup + 100 mL MorAct)* 9/1/98, to accelerate root kill

Table 4. Study 2b: Peach; Long Term Fallow; Oct 1999 Fumigation, Feb 2000 replant

Fallow Period (yr)	*0*	*0*	*1*	*2*	*3*
Additional Treatment	*MeBr*				
Market Yield *(kg/tree and % of MeBr value)*					
Year 3	18.2 a	44% d	57% cd	77% bc	88% b
Year 4	19.4 a	69% b	71% b	90% a	92% a
Year 5	38.6	85%	85%	88%	98%

Table 5. Study 2a: Plum; Alternative Chemicals; Oct 1999 Fumigation, Feb 2000 replant

Chemical Treatment	*MeBr shank*	*None*	*None*	*None*	*Lime-Urea*[1]	*Chloro-picrin*[2]	*Inline*[3]
Fallow Period (yr)	*0*	*0*	*1*	*1*	*1*	*1*	*0*
Additional Trtmnt			---*Herbicide root kill* [4]---				
Market Yield *(kg/tree and % of MeBr value)*							
Year 3	11.8 a	40% b	50% b	54% b	51% b	108% a	103% a
Year 4	48.6 b	57% d	90% bc	81% c	75% cd	116% a	103% ab
Year 5	22.03	100%	81%	84%	84%	86%	96%

1 500 lb/ac Urea + 20 lb/ac lime urea *(240 lb N/ac)* microsprayed onto the soil surface
2 300 lb/ac Chloropicrin EC subsurface drip-applied with 6" of water with 20 gal/ac Vapam microsprayed on the surface.
3 60 gal/ac Inline *(390 lb/ac 1,3-D + 225 lb/ac Pic)* subsurface drip-applied in 6" of water with 20 gal/ac Vapam microsprayed on the surface
4 herbicide trtmnt to stumps *(50 mL Roundup + 100 mL MorAct)* 9/1/98, to accelerate root kill

Table 6. Study 3: Peach; Fall 1996 Tree Removal and Fumigation with Spring 1997 Replant

Treatment	*MeBr Shank*[1]	*Midas*[2]	*Non-Fumigated*
Market Yield *(kg/tree and % of MeBr value)*			
Year 8	99	95%	81%

1 400 lb/ac deep shanked and covered with HDPE plastic
2 400 lb/ac Iodomethane (100%) deep shanked and covered with HDPE plastic.

Table 7. Grower Trial 1: Pluot; Fall 1998 Tree Removal, Fall 1999 Fumigation with Spring 2000 Replant (all treatments had 1 yr fallow)

Treatment	*MeBr Shank*[1]	*InLine + Vapam*[2]	*Herbicide*[3] *+ Urea Drench*[4]	*Herbicide*[3]
Market Yield *(kg/tree and % of MeBr value)*				
Year 3	4.3	95%	74%	72%
Year 4	37.1 a	91% ab	83% bc	79% c
Year 5	7.0 a	101% a	101% a	90% a

1 325 lb/ac deep shanked and covered with HDPE plastic
2 45 gal/ac InLine *(290 lb/ac 1,3-D)* drip-applied in 6" of water applied in 10' wide strips (55% of field surface) with 26 gal/ac Vapam microsprayed on the surface.
3 herbicide trtmnt to stumps (see Table 5)
4 500 lb/ac Urea + 25 lb/ac lime urea *(240 lb N/ac)* dripped onto the soil surface in 10' strips (eq. To 135 lbs N per gross ac).

Table 8. Grower Trial 2: Pluot; Fall 2000 Tree Removal and Fumigation with Spring 2001 Replant (no non-fumigated control)

Treatment	*MeBr Shank*[1]	*InLine + Vapam*[2]	*Metam Sodium*
Market Yield *(kg/tree and % of MeBr value)*			
Year 4	9.4	97%	57%

1 350 lb/ac deep shanked and covered with HDPE plastic
2 60 gal/ac InLine *(400 lb/ac 1,3-D)* drip-applied in 5" of water with 40 gal/ac Vapam microsprayed on the surface.
3 75 gal/ac drenched with 8" of water