WEED SPECIES AND THEIR EMERGENCE PATTERNS UNDER METHYL BROMIDE AND ALTERNATIVE FUMIGANTS IN FRUIT NURSERIES

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Introduction:

Methyl bromide (MB) has provided broad-spectrum control of several weed species in perennial fruit and nut nurseries. With the phase-out of MB and the limited herbicide options in these nurseries in California; weed management can be expensive because of high labor and energy costs involved in mechanical or hand weeding. Further, elimination of MB in these nurseries can cause weed species shifts. Therefore, weed species and their emergence patterns need to be determined to assess the effect of the various alternative fumigants in almond and walnut nurseries.

Materials and Methods:

Studies were conducted at two locations in California, Le Grand (2005) and Hickman (2005/2006), CA. Le Grand was a one-year study whereas Hickman was a two-year study. The treatments were as follows:

1. Control (no tarp)
2. Methyl bromide (98:2), 400 lb/ac, standard high density polyethylene mulch (HDPE)
3. Iodomethane:chloropicrin (IM:PIC, 50:50), 400 lb/ac, HDPE
4. Telone II, 340 lb/ac, HDPE
5. Telone C35, 544 lb/ac, HDPE
6. Inline 544 lb/ac, HDPE
7. Telone C35, 544 lb/ac, virtually impermeable film mulch (VIF)

All fumigants were shanked at 12 to 18 inch depth in the soil except Inline, which was injected through drip tape at 4 inches depth. The experimental design was a randomized complete block with four replications. Plot sizes varied across locations and ranged from 80-90 feet long and 22-33 feet wide.

Herbicide treatments varied between the two locations. At Le Grand, paraquat was applied before the emergence of the nursery crop (January 6, 2005) whereas, in Hickman, glyphosate was applied before crop emergence (November 16, 2004). Both herbicides were applied at recommended labeled rates. No other herbicides were applied during the entire study. The inter-row space was mechanically cultivated several times during the growing season/s.

Weed emergence counts by species in one entire crop row per treatment were made approximately every 3 months. After the counts were made, the rows were hand-weeded. Data were subjected to ANOVA and means were separated by Fisher's LSD at a 0.05 level using the PROC GLM procedures of SAS.

Results:

Le Grand:
The alternative fumigants, in general, provided similar or better weed control than MB (Fig. 1). The dominant weed species at this location were mallow (*Malva* sp.), horseweed and fleabane (*Conyza* sp.), burclover (*Medicago polymorpha*), common purslane (*Portulaca oleracea*), and shepherdspurse (*Capsella bursa-pastoris*). All the fumigants reduced the emergence of mallow compared to the control plots. However, the fumigants did not provide complete control of this species. A similar trend was observed with burclover. This indicated that mallow and burclover would be a difficult weed to control with MB or any of the other fumigants. Control of common purslane was relatively lower in the MB plots compared to the other fumigants. All the fumigants provided effective control of shepherdspurse, common chickweed (*Stellaria media*), nutsedge (*Cyperus* sp.), and some grasses (e.g. *Echinochloa* sp.). Horseweed and fleabanes are wind-disseminated weeds and they were present in similar numbers in all the treatments including the control plots. It is likely that seeds of these species blew into the plots after pre-plant fumigation over the course of the season.

Hickman:
Similar to the Le Grand site, the alternative fumigants in general provided similar or better weed control than MB (Fig. 2). Both the Telone C35 treatments (HDPE and VIF) provided effective weed control and their effectiveness lasted for the entire duration of the study similar to MB. At this site, common chickweed, burclover, pigweed (*Amaranthus* sp.), nutsedge, *Conyza* sp., common groundsel (*Senecio vulgaris*), sowthistle (*Sonchus* sp.), and shepherdspurse. All the fumigants effectively controlled most of these species. Relatively fewer burclover and mallow plants were present at this site compared to Le Grand but none of the fumigants provided effective control of these two species. Similar to Le Grand, *Conyza* plants were present in all the treatments.

Conclusion:
The alternate fumigants were effective or better than MB in providing season-long weed control at these study sites. Telone C35 treatments provided persistent weed control over the entire two-year duration of the study at one site. Efficacy of the fumigants was influenced by the dominant weed species present at each location. Species such as burclover and mallow will require additional control techniques. It has been reported that VIF may reduce fumigant emissions and increase fumigant efficacy by retaining lethal fumigant concentrations for a longer time than HDPE. Several studies have reported better weed control with VIF than HDPE (Fennimore et al., 2004; Hochmuth et al., 2004). In these studies, no

further major cultivation was done after the removal of the plastic. In our study, we did not generally observe fewer weeds with VIF compared to the HDPE. This could be because we cultivated and bedded up the plots after fumigation. The cultivation and bedding up process could have brought weed seeds up to the soil surface from deeper in the profile where the seeds were probably not affected enough by the fumigant or the solarization by the VIF. The wind disseminated weed *Conyza* sp. will also be difficult to control with the fumigants as they can blow into the nurseries after the plots have been fumigated. The presence of this species in surrounding areas can serve as a seed reservoir; therefore, it may be necessary to keep field margins and adjacent areas clean of *Conyza*.

References:

1. Fennimore, S., Z. Kabir, H. Ajwa, O. Daugovesh, K. Roth, and J. Valdez. 2004. Chloropicrin and Inline dose-response under VIF and HDPE Film: Weed Control Results in California. Available online at: http://www.ars.usda.gov/is/np/mba/jun05/film.htm
2. Hochmuth, R. C., W. L. Laughlin, S. S. Kerr, and L. L. Davis. 2004. Soil fumigant, mulch type, and herbicide treatments affect pepper yield and vigor, and control of nutsedge and root-knot nematode. Prc. Fla. State Hort. Soc. 117:11-15.

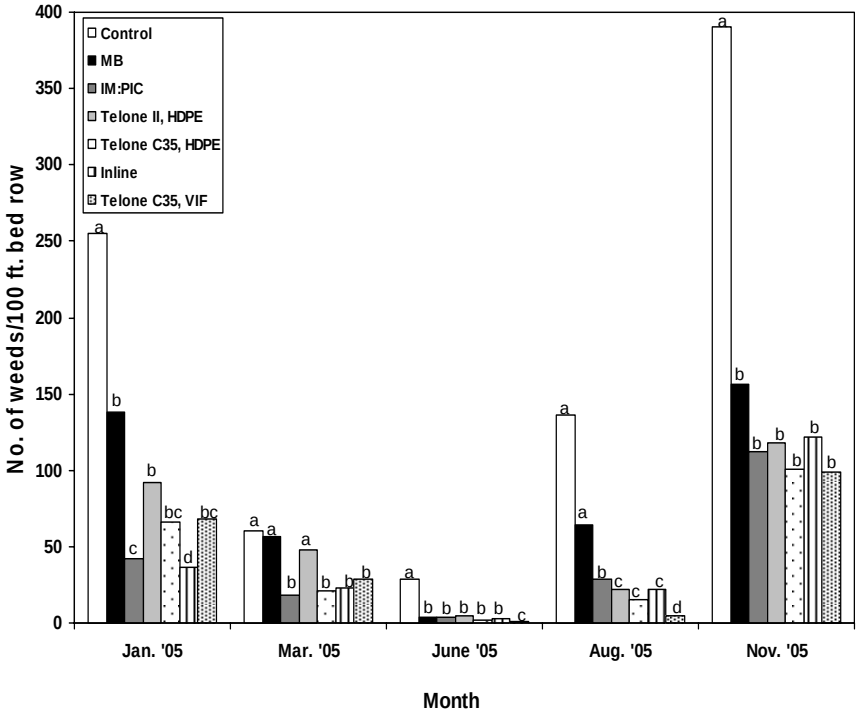

Figure 1. Total weed emergence over the growing season in the treatment plots at Le Grand, CA. Means followed by the same letter are not different at a 0.05 level of significance.

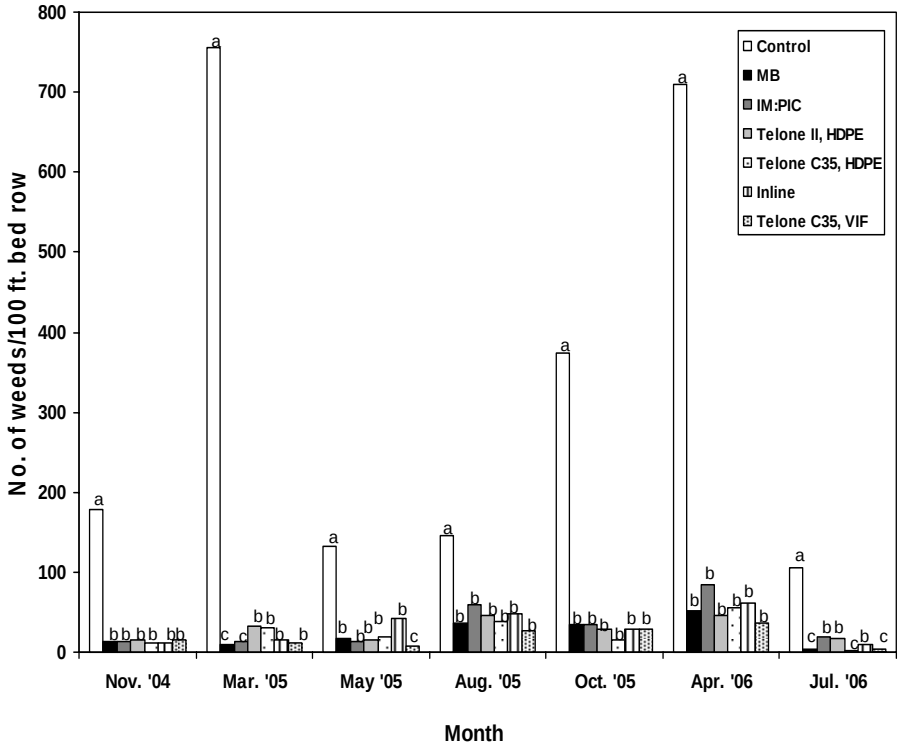

Figure 2. Total weed emergence over the growing season in the treatment plots at Hickman, CA. Means followed by the same letter are not different at a 0.05 level of significance.

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