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Presentation summary

METHYL BROMIDE FUMIGATION ALTERNATIVES FOR SWEETPOTATO HOTBEDS IN CALIFORNIA, YEAR 2

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While sweetpotatoes are commonly considered to be a southern crop, California has a history of sweetpotato production dating back more than 100 years. Production has increased markedly in the last 10 years, and now the state ranks number two in production, with 2008 estimated at 4.366 million Cwt from about 14,500 acres and a value exceeding $130 million, according to USDA-NASS estimates.

Similar to many other vegetable crops, sweetpotatoes are entirely propagated from transplants. Unlike most other crops, however, transplants are reared by growers for their own production, using roots saved from the previous year's crop. The nursery area where this occurs is called a hotbed, and it is a distinct and separate operation for any grower. Because of the importance and expense related to growing sweetpotato transplants, the hotbed area is typically fumigated to ensure the area will be free of nematodes, disease, and weeds. Hotbeds are most commonly fumigated in the late fall with a MeBr + Pic combination, tarped with standard plastic. Currently, MeBr is allowed under a Critical Use Exemption (CUE) with the U.S. EPA. This is likely to end soon, and effective alternatives are needed. The purpose of the project is to evaluate alternatives to MeBr for sweetpotato hotbeds that are agronomically acceptable and meet regulatory approval.

Alternative fumigants were evaluated in a commercial hotbed operation near Atwater, CA, using a randomized block split-plot design with three replications. Main plots consisted of six fumigation treatments: 1) untreated control; 2) MeBr + Pic 53/47% at 350 lbs/A; 3) Pic-Chlor 60 (1,3-D + Pic) at 45 gallons/A; 4) metam sodium 40 gallons/A + 1,3-D 12 gallons/A shanked, incorporated, and rolled; 5) Pic only at 150 lbs/A; 6) flat solarization. Split-plot treatments include two different fungicides and herbicides: Devrinol (napropamide) 4 lbs/A; Valor (flumioxizin) 1.5 oz/A; Botran (dichloro nitroaniline) 3.5 lbs per 14 gallons per 1000 sq ft; Mertect (thiabendizole) 30 fl oz per 14 gallons per 1000 sq ft; fungicide + herbicide combination; untreated control. Split plots were 8 ft x 12.5 ft.

Fumigation and solarization treatments were installed in the summer and fall of 2008; herbicide and fungicide applications were made after bedding in March 2009. Plots were evaluated for weed pressure, nematodes, root rotting caused by *Pythium* fungi, and plant production.

Results.

Soil temperature data were collected at 1, 3, 6, and 12 inches under bare ground (UTC) and the solarization treatment from July 15 to September 15, 2008. Daily maximum temperatures at each depth are shown in Figure 1. The clear plastic tarp used in this trial significantly ($p < 0.001$) increased average and maximum soil temperature at all depths. At one inch, temps exceeded 125° F with plastic, 109° F without.

Nematodes were sampled by taking a 500 cc soil sample from each of the main plots in February before the beds were installed and again at plant harvest in May. No root knot nematodes (*Meloidogyne incognita)* or other plant parasitic nematodes were found at either sampling event (Table 1). Similar to nematodes, the soil analysis for potential root rotting pathogens showed no significant differences among treatments. Pythium populations were extremely low in all plots (in general, Pythium populations in most soils in the San Joaquin Valley average between 20 and 50 cfu/g).

Weed pressure was not that high in this area, probably because it had been previously fumigated with MeBr. However, there were significant differences between the main plot treatments, with greatest number of weeds in the untreated (UTC) and solarization treatments (Table 1). These treatments also required the most hand weeding time, averaging 25 and 20 seconds per man per 100 ft^2. Significant differences were also noted between the split plot treatments for weed control. Application of either herbicide significantly reduced weed pressure as compared to not treating, with Valor having the greatest efficacy on the weeds present at this location (puncture vine, malva, pigweed, mustard, and barnyard grass dominated). However, Valor caused some noticeable crop phytotoxicity, with a corresponding reduction in plant production. Even with this, plant production was excellent in 2009, with 240 – 280 plants per 4 ft^2 (much better than 2008 production). No crop phytotoxicity was seen as a result of the main plot fumigation treatments.

Research thus far has shown weeds to be the main pest issue sweetpotato growers must contend with in the hotbed area. As a result, the Telone + Vapam treatment has been the most effective and economical alternative to MeBr. Unfortunately, solarization has not been that effective in suppressing weed populations, probably a result of the length of time between treatment in the summer and bedding the following spring. The use of pre-plant herbicides Devrinol or Valor significantly improved weed control, especially in the Pic only, solarization, and untreated alternatives.

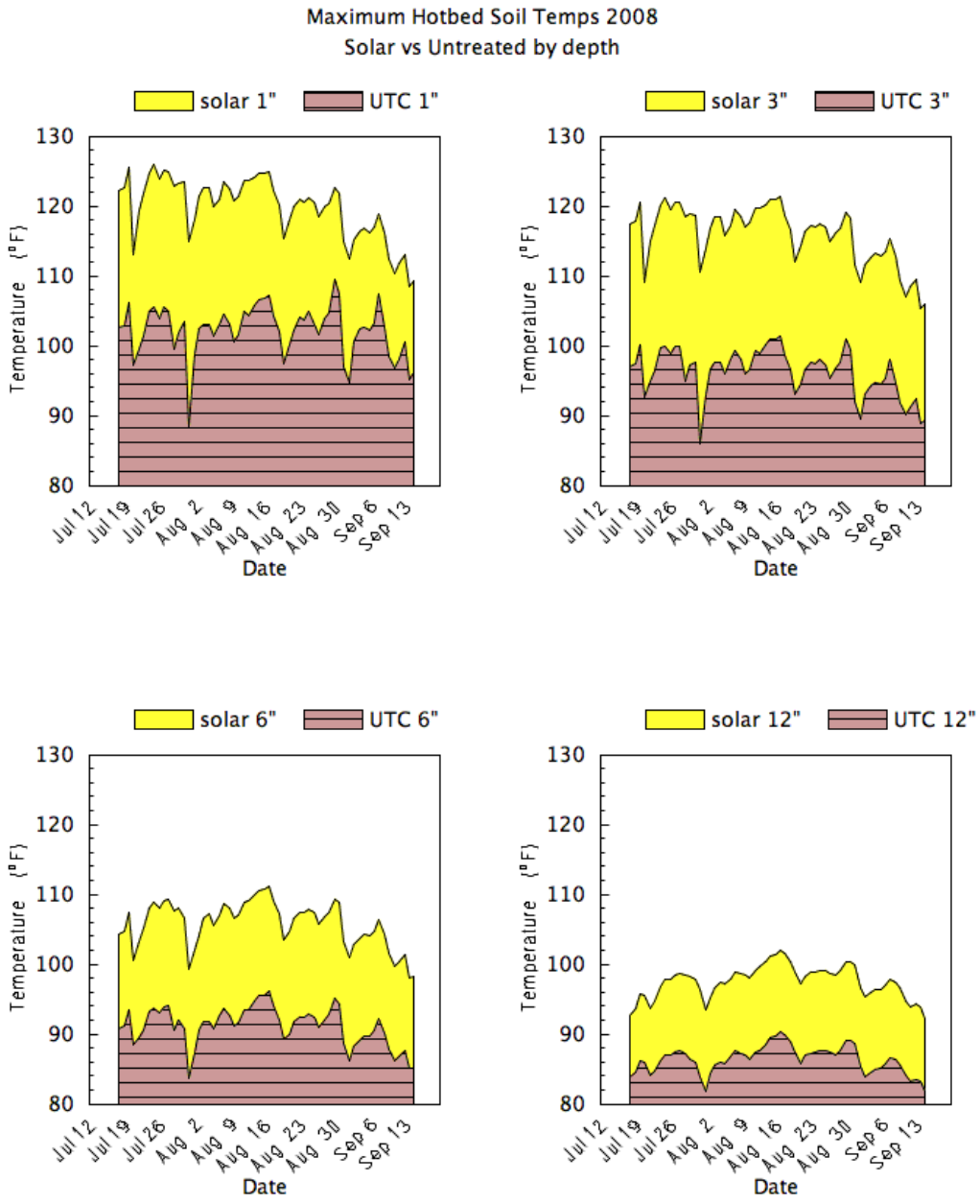

Figure 1. Hotbed soil temperatures at 1, 3, 6, and 12 inches for the untreated and solarized treatments between July 17 – Sept 15, 2008. Use of clear plastic tarp significantly increased soil temperatures at all sampling depths.

Table 1. Nematode, Pythium, weed counts, and plant production from the 2nd year of the trial (2009).

Main plot treatments:	Nematodes (RKN/100 g) 11-Feb	7-May	non parasitic 7-May	Pythium cfu/g soil	Weeds #/plot 9-Apr	Crop Phyto 9-Apr	Weed time secs/man/plot	plant counts #/4 sq ft
1 UTC	0	0	200	3.2	47.4	1.2	25	235
2 MeBr + Pic, 350 lbs/A	0	0	94	2.1	4.4	1.2	8	268
3 PicChlor 60, 45 gpa	0	0	111	2.5	13.4	0.6	16	254
4 Vapam 40 gpa + Telone 12 gpa	0	0	134	0.5	5.6	1.6	9	306
5 Pic only, 150 lbs/A	0	0	135	3	16.4	1.6	14	258
6 flat solarization	0	0	190	1.8	22.4	2.0	20	264
p value				0.75 NS	0.001	0.25 NS	0.07	0.79 NS
LSD 0.05				---	15.1	---	12	---
CV				147.3	68.4	102	65.6	16.3
Split plot treatments:								
1 UTC					32.3	0	not weeded	278
2 Devrinol 4 lbs/A					11.9	0.6	15	281
3 Valor (Chateau) 1.5 oz/A					0.7	4.3	6	242
4 Botran 3.5 lbs/1000 sq ft/10 gals					27.3	0.4	20	268
5 Mertect 30 fl oz/1000 sq ft/10 gals					33.4	0.6	25	274
6 Devrinol + Valor tank mix					4.0	2.2	9	244
p value					0.001	0.001	0.001	0.02
LSD 0.05					8.3	0.9	6.6	28.7
CV					68.4	102	65.6	16.3
p value, Main plot x split plot interaction	ND	ND	ND	ND	0.001	0.91 NS	0.65 NS	0.47 NS

Nematodes and Pythium were determined within main plot treatments only.
Weed counts are a combination of broadleaf, grass, and yellow nutsedge. Broadleaf weeds spp include puncture vine, malva, pigweed, mustard.