SUPPLEMENTAL APPLICATION OF CHLOROPICRIN TO IMPROVE FUSARIUM WILT CONTROL IN TOMATO

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Compared to MeBr, the alternative fumigants have vapor pressure and boiling point properties that are drastically lower. Therefore, the volatility of these materials are greatly reduced. Previous studies have shown the movement of MeBr extending throughout the whole bed and even escaping through the row middles. The alternatives are less volatile than MeBr, thus the effective zone of fumigation is reduced promoting early bed re-colonization. Colonization from non-fumigated row middles and under-fumigated regions within the bed are likely sources of inoculum for the infestation of raised beds.

Supplemental chloropicrin application field trials at Gulf Coast REC: A series of trials were initiated in February 2013 to define the effective zone of fumigation in a standard PicClor60 (1,3-dichloropropene + chloropicrin) fumigated, raised bed system, and the effect of supplemental chloropicrin (Pic) applications along the bed edges on the recovery of total *Fusarium oxysporum.*

The treatments consisted of:

1) Non-fumigated control
2) Non-fumigated bed + supplemental Pic (100 lbs/treated A)
3) PicClor60 (250 lbs/treated A) treated bed + no supplemental fumigant
4) PicClor60 (250 lbs/treated A) treated bed + supplemental Pic (100 lbs/treated A)

Bed treatments were applied 8 inches from the top of the bed using a tractor-driven three shank injection rig. Supplementary fumigation treatments were applied using the Yetter Avenger coulter applicator at 8 inches below the soil surface to 75ft sub-plots along the outer edges of the raised bed. Directly after the supplemental fumigant application, two drip tapes (0.45 gal/100ft/min) and black VIF mulch was applied over all treatments using a speedroller. Beds were 28 in wide on top and 32 in at base. Methyl bromide was added as a fifth treatment in Fall 2013 and Spring 2014. Lab prepared inoculum of *Fusarium oxysporum* f.sp. *lycopersici* (FOL; prepared at 10^5 cfu/g) was mixed with sand in a fertilizer hopper and spread across the entire trial area just before the planting beds were formed. This trial was arranged as a randomized complete block with a split-plot design and four replications per treatment. The trial was established along groups of three 300 ft raised beds on 5 ft center-center spacing placed between ditches on 25 ft center-center spacing. Four sets of soil cores were collected in each plot over the course of the season from 16 different locations throughout the bed and row middles ranging from 2 to 10 inches deep to assess the distribution and quantity of total *Fusarium oxysporum* using a standard dilution plating techniques on a semi-selective medium. Buried mesh bags of FOL inoculum mixed with sand weighing between 2.5 and 3 grams were also strategically placed throughout the

bed within one hour after fumigation to further examine the effective fumigation zone.

Supplemental chloropicrin application trials on farm: Additional large scale field trials were performed at a site with a known history of high Fusarium wilt incidence. This on-farm trial served to better assess the efficacy of the supplemental chloropicrin application. This trial was initiated on December 23, 2013 and consisted of standard raised beds treated with PicClor60 (300 lbs/treated A) with or without the supplemental Pic treatment. Supplemental applications of Pic100 (200 lbs/treated A) were placed 8 inches below the soil surface immediately along the raised bed edges using a Yetter avenger coulter system. Plots were three rows by 700 ft long on 6 ft center to center spacing. This trial was arranged as a randomized complete block design with six replications per treatment. Root density samples were taken to quantify location of roots from the edge of the bed to the row middle using a turf "cup cutter."

Results:

Based on results from the first season at Gulf Coast REC, the supplemental Pic application reduced total Fusarium levels in the tuck and row middle at all four evaluations compared to the non-treated control. Also, there was a positive effect on Fusarium levels from the edge of the bed at 10 inch depth. There were no yield differences because of very low disease incidence.

Due to the high level of incidence at the commercial farm, we were able to gather the greatest treatment differences at this location. Results showed that with the supplemental chloropicrin application to the row middle, there was a statistically significant decrease in Fusarium wilt incidence which led to a 23% increase in tomato yield (Figure 1). Data was only taken from two harvests but the grower was able to pick this crop three times due to the low Fusarium wilt incidence and healthy tomato plants which can be attributed to the additional chloropicrin application (Figure 3). Also, root density samples showed an increase in total root mass on the edges of the bed and under the tuck extending into the row middle (Figure 3).

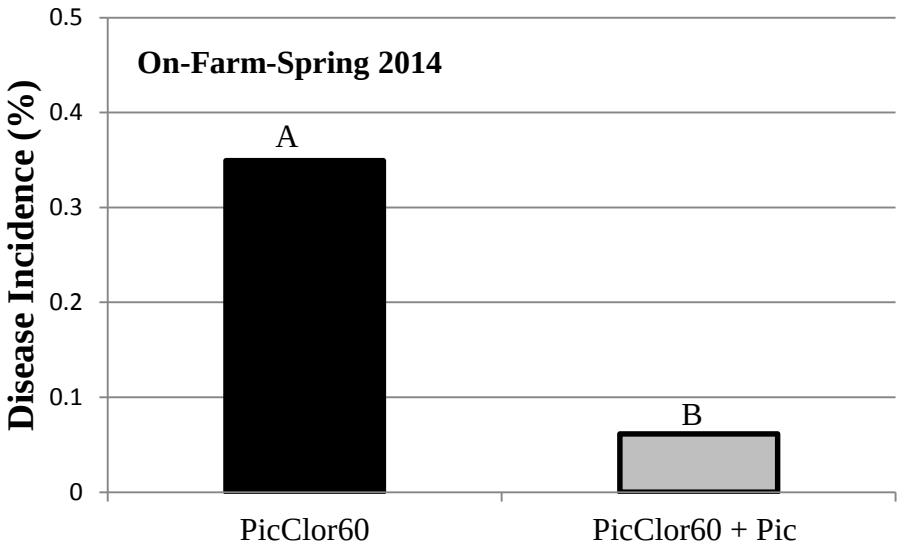

Figure 1. Effect of supplemental chloropicrin row middle application on the end of season incidence of Fusarium wilt. Letters above bars indicate statistical significance ($\alpha = 0.05$).

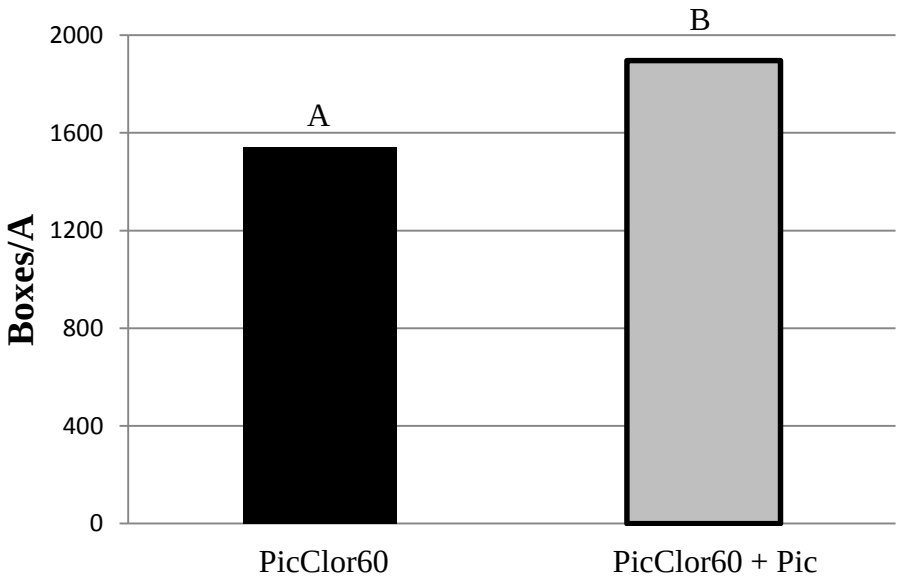

Figure 2. Effect of supplemental chloropicrin row middle application on total tomato yield. Letters above bars indicate statistical significance ($\alpha = 0.05$).

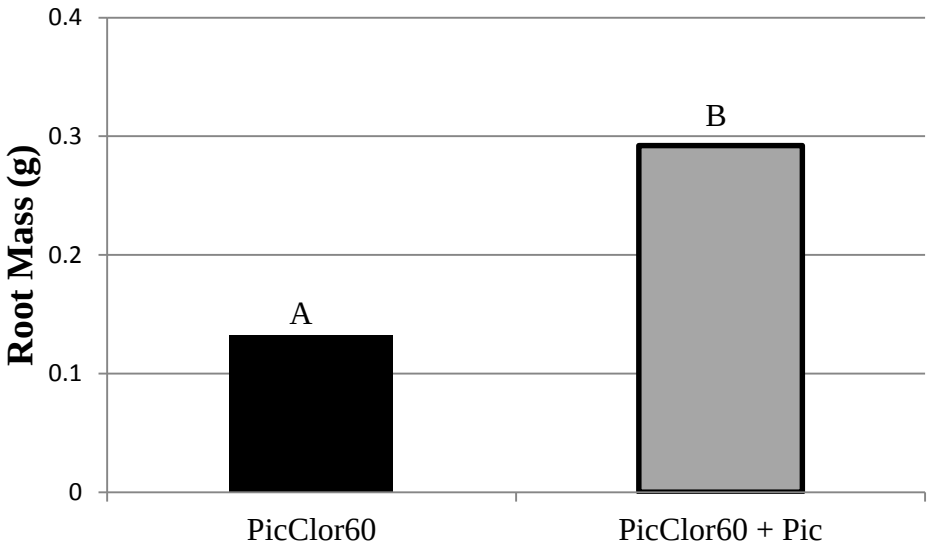

Figure 3. Effect of supplemental chloropicrin row middle application on root mass from the edge of the fumigated bed and row middle. Letters above bars indicate statistical significance ($\alpha = 0.05$). (Volume of soil = $85in^3$)