TOTALLY IMPERMEABLE FILMS FOR FUMIGANT RATE REDUCTION IN NORTH CAROLINA

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INTRODUCTION: The emergence of totally impermeable film (TIF) offers growers the potential advantage to use reduced rates of fumigants or improve soilborne pest control. Reduced rates could save input costs and potentially enable growers to comply with new risk mitigation measures. The objective of this study was to compare standard methyl bromide (MB) treatments under virtually impermeable film and reduced rates of Pic-Clor 60 under TIF in tomato production systems.

Materials and Methods: The first experiment was conducted on a growerôs farm in Western North Carolina (WNC) on land with a history of tomato production and Verticillium wilt pressure. Pic-Clor 60 was used at broadcast rates of 260 lbs/A (100%), 195 lbs/A (75%), 130 lbs/A (50%) and 65 lbs/A (25%) in the spring of 2010. A positive control using methyl bromide:chloropicrin (MB:Pic 50:50) 275 lbs/A under VIF and a negative control with no fumigant under the TIF were included in the study. The experiment was repeated in 2011 but at the Mills River Horticulture Research Station, on land with a history of Verticillium wilt pressure. The same fumigant rates and practices were followed except an additional treatment of Pi-Clor 60 applied at 260 lbs/A was included using LPDE mulch. In both years, all fumigant treatments were made using a single pass with the growerôs or stationôs single row bedder. The fumigants were injected through 2 knives spaced 12 inches apart to a depth of 8 to 10 inches. Fumigants were dispensed from 200 lb cylinders mounted on the fumigation rig, metered by a flow meter and divided into the two knives using appropriately sized orifices at the manifold. Pressure was preset at 80 psi. Speed was checked with a hand held gps unit and set at 3 mph. The single row bedder also applied the plastic mulch and the drip tape in the bed. Treatments were arranged as a randomized complete block design with 4 replications.

RESULTS: In 2010 there was high disease pressure, and plots not fumigated had low marketable yields compared to areas fumigated with MB:Pic and Pic-Clor 60 rates higher than 130 lbs/A (Figure 1). The 25% rate (65 lb/A) of Pic-Clor 60 under VIF reduced total marketable fruit and control of disease (Figure 1). There was a high correlation between rate of Pic-Clor 60 and marketable tomato yields (Figure 2). Although the exact number is a function of ñscaling upò and needs to be interpreted with some caution, the yield of tomatoes increased 92.4 lbs/A for each additional lb of Pic-Clor 60 ($R^2 = 0.988$). Using the regression equation generated and calculating use rates based on equivalent yields, MB:Pic 50:50 used at 275 lb/A under VIF generated yields comparable to Pic-Clor 60 if used at a rate

of 138 lbs/A under TIF (broadcast rates) or equivalent to 53% of the ñfullò rate used in this study. The upper end of Pic-Clor 60 use to generate a yield advantage was not discovered in this study and no phytotoxicity was observed.

In 2011, results were similar. Non-fumigated plots had 78% the yield of the best treatment (Pic-Clor 60 75% rate) and all fumigation treatments offered a yield advantage except the Pic-Clor 60 25% rate (Figure 3). There was a strong relationship between the marketable yield of tomatoes and Pic-Clor 60 rates from 0 to 195 lbs/A ($R^2 = 0.963$). The highest rate of Pic-Clor 60 compromised yield (arrow in Figure 2) and was not included in the regression analysis. As above, exact values are impacted by ñscale calculationsò but each lb of Pic-Clor 60 used under TIF increased yield by 77.3 lbs/A. Using the regression equation generated, MB:Pic 50:50 used at 275 lb/A under VIF generated yields comparable to Pic-Clor 60 if used at a rate of 129 lbs/A under TIF (broadcast rates) or equivalent to 50% of the ñfullò rate used in this study. The Pic-Clor 60 used at 260 lbs/A under LPDE generated yields equivalent to a 128 lb/A rate of Pic-Clor 60, or around 50%. Fumigant use and rates had the most dramatic effect on the yield of X-large fruit (Figure 4) and the anatomy of the curves show the reduced weight of X-large fruit for the high rate of Pic-Clor 60 and the non-fumigated treatment.

CONCLUSIONS and DISCUSSION: Pic-Clor 60 used at about 130 lbs/A or 50% the ñfull rateò used in this study and combined with TIF generated yields comparable to the 275 lb/A rate of MB:Pic 50:50 used at 275 lbs/A under VIF. Likewise, the TIF appeared to generate yields comparable to a 2x rate of Pic-Clor 60 under LPDE. An interesting outcome of these rate studies showed that the MB:Pic rate used at the on-farm-test in 2010 compromised potential yield compared to the Pic-Clor 60 treatments, and the upper end of yield response to increasing rates of fumigant was not discovered. In contrast, the ñfull rateò used at Mills River in 2011 compromised yield and all fumigant treatments were statistically similar to MB:Pic 50:50. Additional rate studies under TIF are warranted at more regional sites to help growers determine the most economical rates that generate the highest return for investment. Growers capable of doing on-farm-trials may fine-tune their rates for field specific optimization.

Figure 1: Yield in 2010 plots fumigated with Pic-Clor 60 under TIF, fumigated with methyl bromide under VIF or not fumigated.

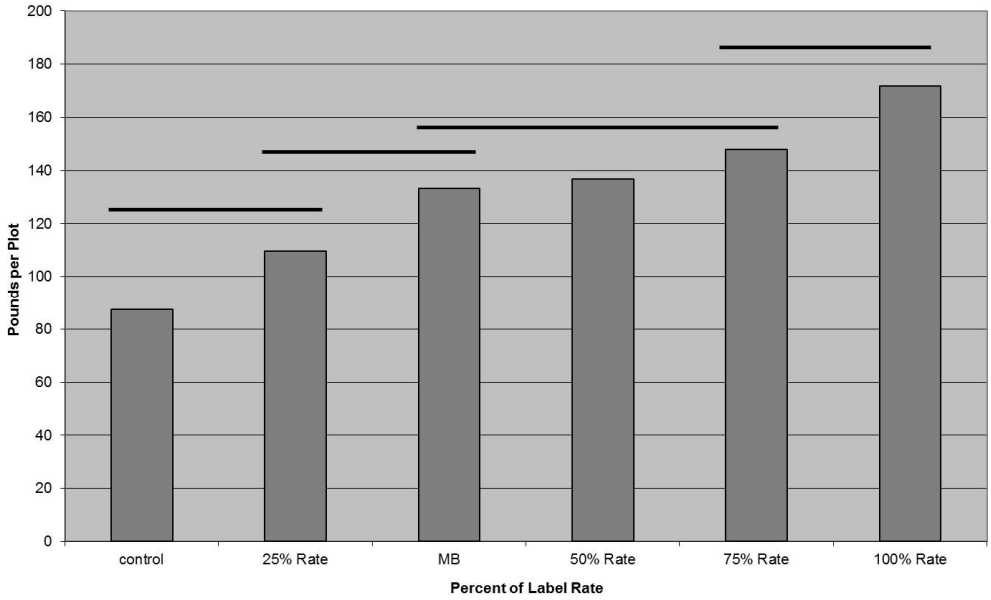

Figure 2: Relationship of Pic-Clor 60 rate of application and marketable tomato yields in 2010 and 2011.

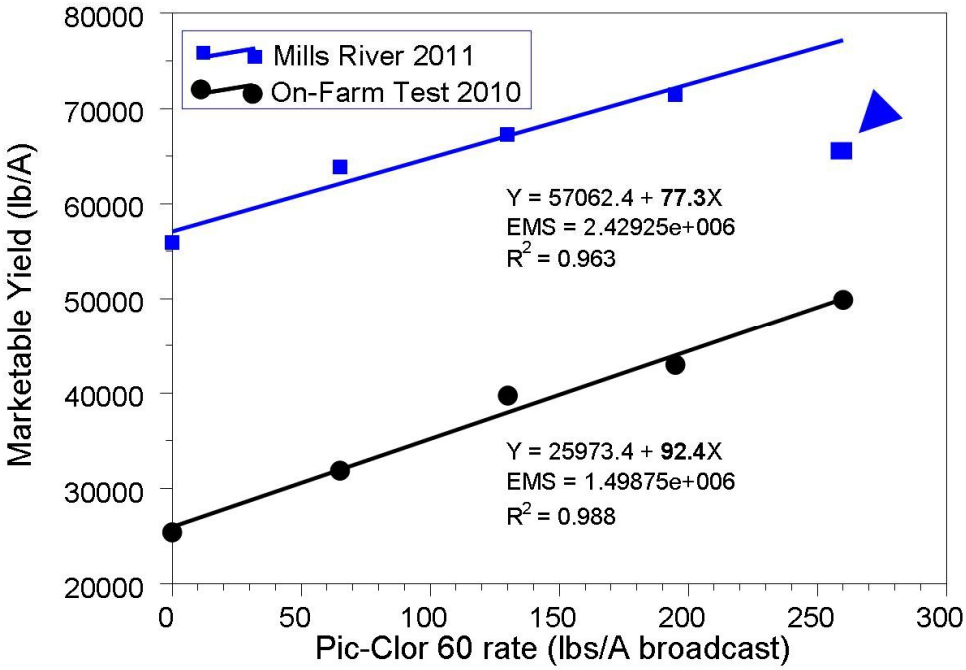

Figure 3: Yield and yield parameters in 2011 plots fumigated with Pic-Clor 60 under TIF or LPDE, fumigated with methyl bromide under VIF or not fumigated.

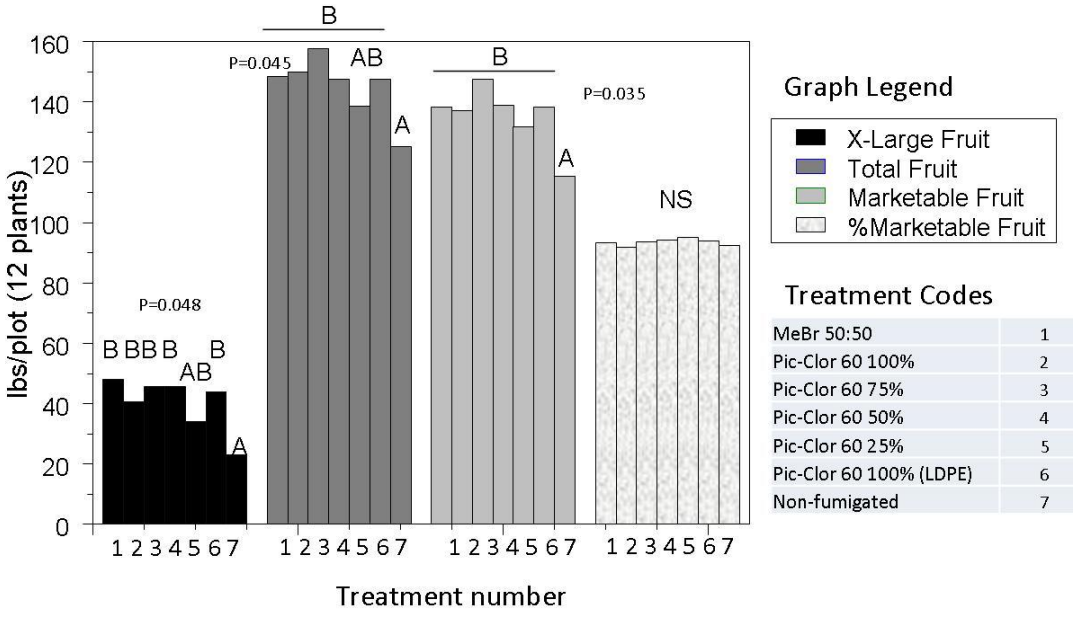

Figure 4: Cumulative yield of X-large fruit in 2011 plots fumigated with Pic-Clor 60 under TIF or LPDE, fumigated with methyl bromide under VIF or not fumigated.