Research and Extension Efforts To Enable Successful Transition Away From Methyl Bromide Fumigation

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Over the past three years research has been conducted through the Southeast US as part of a USDA AREAWIDE project with the purpose of enabling growers to transition away from methyl bromide fumigation. During this time period, trials in commercial fields have been conducted utilizing large percentages of growers overall production acreage to evaluate commercially available alternatives to fumigation. Crops investigated have included strawberry, tomato and pepper and have included alternative fumigants such as MIDAS, Telone C-35, PicClor 60, Inline and Paladin. Reduced rates of fumigants have also been trialed using different types of virtually impenetrable films (VIF), including products produced by Pliant and Cadillac corporations, and metalized films also used for vector control to reduce certain diseases in peppers. In addition to fumigant alternatives, we have investigated grafted tomatoes as a method of disease suppression including several on-farm trials in standard production systems.

Fumigation for strawberries in the Southeast is conducted in late Summer to early Fall and plantings are done by the end of October in the region. Fumigation during this time of year provides growers with somewhat of an advantage over most of the vegetable growers in this region as the soil temperatures are usually high and in most years there is opportunity to get optimal soil moisture between rain storms. Challenges are encountered with the constraints of a twenty-one day plant back for some of the alternatives if an extended period of rain occurs, compressing the time between fumigation and optimal planting times. Strawberry yields can decline more due to late planting than not fumigating.

For each AREAWIDE strawberry trial, we work closely with the grower and the area Cooperative Extension Personnel to custom select the optimum fumigation plan given available knowledge about the primary pests at the on-farm site. Growers also are given the option evaluating shank applied fumigants, drip applied fumigants, or a combination of the two types. Growers have been given assistance with equipment setup prior to every application including changing orifices for optimal application rates and in some cases completely re-building fumigation equipment to include flow meters and additional fumigant knives. Depending on the growers' needs, treatments were placed into the field as a side-by-side demonstration or as a randomized trial within the field. In some cases, growers allowed non-fumigated treatments as a negative control. After the trials were set-up, the plants were managed by the grower in the same manner as standard crop procedures, and any differences (i.e. additional weeding) in the treatment rows were noted.

In the spring of the following year just prior to harvest, a field day was held at the trial location for area growers, Cooperative Extension Personnel, NRCS personnel, industry personnel and other interested people to see first-hand the alternative effectiveness. At each field day participants were given extensive information about the available

alternatives, equipment calibration/set-up and given the opportunity to discuss the positive and negative aspects of using each of the alternatives. To date, ten of these field days have been held, and most draw a group of at least 20 local growers and Cooperative Extension agents as shown in Figure 1.

Figure 1. A Spring Field day in a strawberry production field in Eastern North Carolina.

Vegetable growers in our region typically fumigate in the spring, and therefore can encounter cooler and wetter soils. On-farm trials with vegetable growers were conducted in the same manner as the strawberry on-farm trials with the exception of the on-farm field days. During the growing season, it is not possible to draw growers to a field other than their own to look at a trial. Growers are too busy during the field season, so we employed an alternative extension outlet for information dissemination to them. Many of the growers in this region attend one of several off-season meetings: The Southeast Vegetable and Fruit EXPO, the NC Strawberry EXPO, the North Carolina Vegetable and Tomato Growers' Association and a field day during the summer at the Mills River Research and Extension Center in Mills River, NC. Talks and information are provided every year at these venues for the growers, and results are presented along with general information about alternatives to methyl bromide fumigation.

Figure 2. Sub-plots within a growers' commercial field covered by netting for yield assessment.

For every trial, harvest data was usually collected by the grower and has ranged from collecting weights of harvested fruit from pre-selected sub-plots, to collecting total numbers of buckets harvested from entire rows. In some cases sub-plots have also been covered with nets in commercial fields (Figure 2) and harvested by NC State personnel. All of this data has allowed us to compare the most important measure of the alternatives in the minds of the growers: yield. For every trial we have had great success with the alternatives and yield data has shown comparable yields to methyl bromide fumigation from at least one alternative. Figure 3 shows a typical data set from an Eastern North Carolina Strawberry Grower and Figure 4 is a typical result for a tomato grower in Western North Carolina.

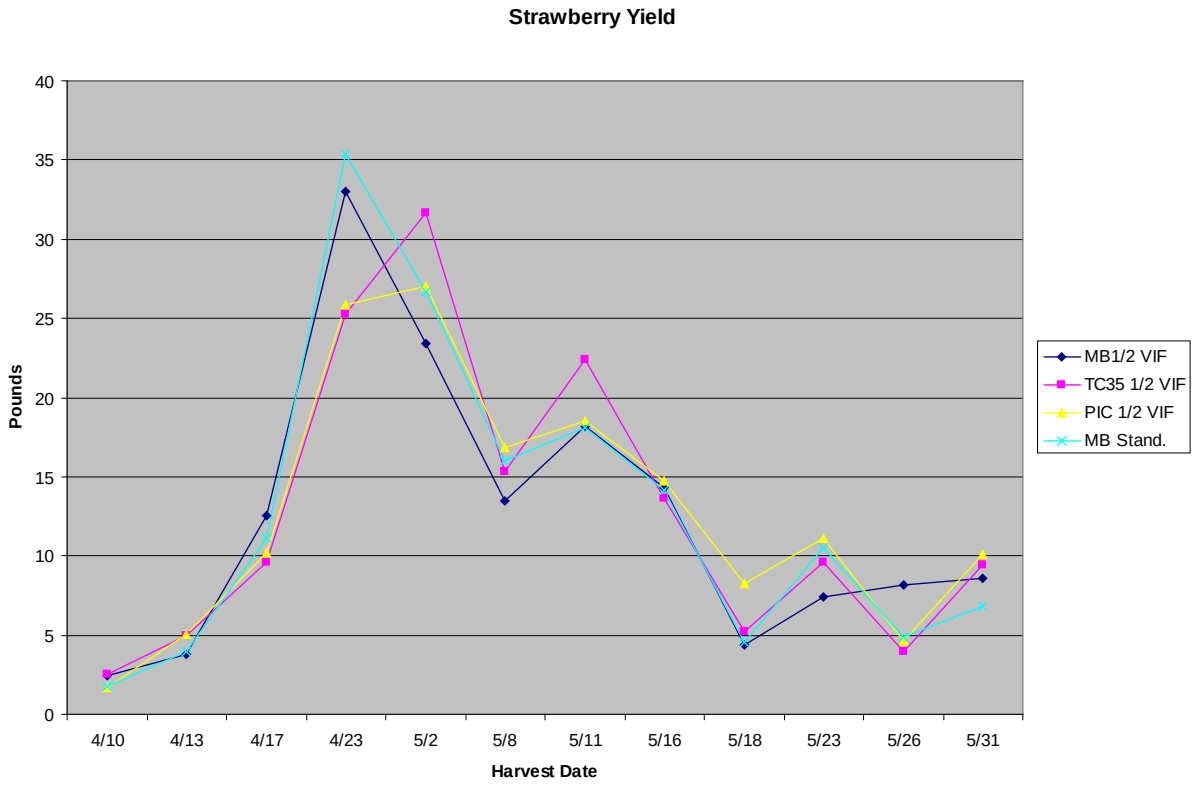

Figure 3 shows a typical data set from an Eastern North Carolina Strawberry Grower trial using very reduced rates (1/2 typical use rates) of fumigants under VIF mulch.

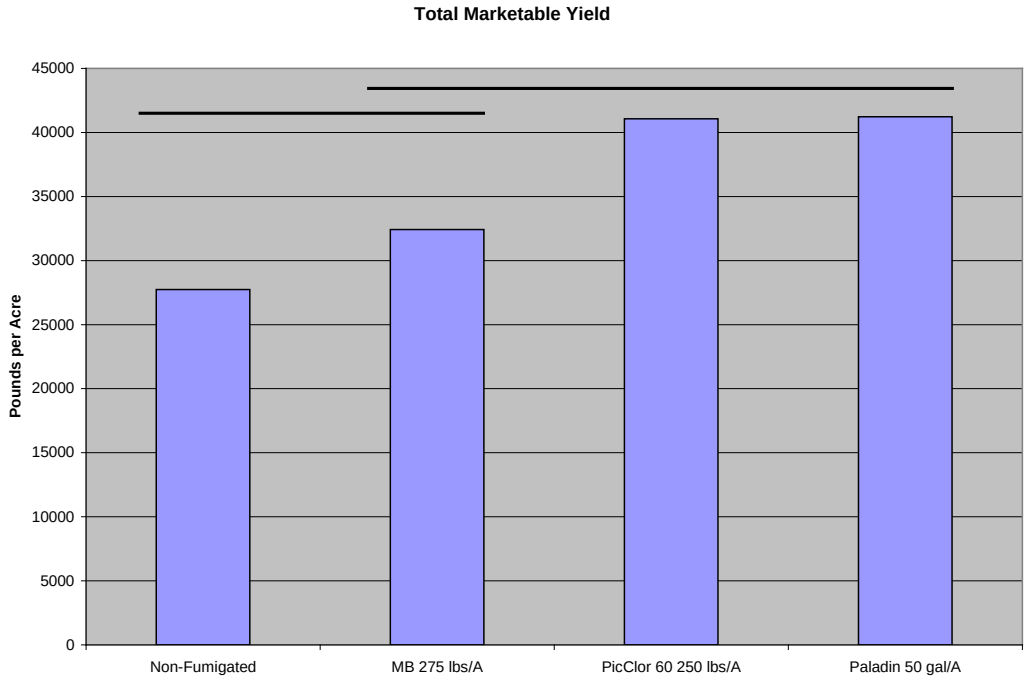

Figure 4 is a typical result for a tomato grower in Western North Carolina. Lines above treatments show statistically similar results.

Through all this work we have learned a lot and, more importantly, so have the growers and Cooperative Extension Agents. One thing that we have learned is that these alternatives are not nearly as forgiving as methyl bromide under less than ideal environmental conditions. Cool and moist conditions have proven to be extremely difficult for growers to deal with, especially when planting deadlines are involved. We have also seen cases where efficacy has been affected by environmental conditions. In an on-farm trial with PicClor 60, nutsedge was adequately controlled in a field when the application was made in late spring to warm, moist soil. A different grower using the same chemical, rates and methods had complete failure of nutsedge control in his field that was fumigated in late May. Although many causes may impact this result, we hypothesize that the soil temperature was cooler, and the grower was trying to get his plastic in place between rain storms resulting in high moisture content. As we continue to learn more about how the alternative fumigants perform in large on-farm applications, we can continue to refine our suggestions and help growers complete the transition away from methyl bromide fumigation.