

USDA ARS AREAWIDE PROJECT: LARGE SCALE FIELD DEMONSTRATIONS IN FLORIDA STRAWBERRY 2009-10

J.W. Noling

University of Florida, IFAS, Citrus Research & Education Center,
Lake Alfred, FL 33850

This USDA ARS South Atlantic Areawide project was funded for 2009-10 to demonstrate and improve the performance and consistency of next-best chemical alternatives to methyl bromide in large scale, grower field demonstration trials in Florida strawberry. Alternative chemicals evaluated within these trials include individual and or combined uses of chloropicrin, and 1, 3-dichloropropene with use of appropriate herbicide(s). A diversity of drip fumigants were also evaluated for pest control efficacy, strawberry yield enhancement, and as a potential risk mitigation tactic to reduce buffer zone distances and overall personal protective equipment requirements which were being proposed by EPA. Secondary objectives were to evaluate the feasibility of using two drip tapes per bed rather than one to enhance efficacy and yield of methyl bromide chloropicrin and of other different drip applied fumigants; and use of a high barrier, semi-impermeable mulch film (Pliant Blockade) to reduce emissions and soil fumigant field application rates and to compare crop yield and pest control efficacy of methyl bromide alternatives. A final objective was to evaluate the performance of drip applied fumigants into beds being cropped for the second time to strawberry (double cropping) with as many as 20,000 /acre open planting holes in the plastic mulch from the previous years strawberry plants.

Methods: Two grower field studies focused on a co-application approach of different fumigants, herbicides, and other alternative tactics to achieve pest control efficacy and crop growth response similar to that of methyl bromide. Among the sites, chisel applied soil treatments included broadcast equivalent methyl bromide (50%) chloropicrin (50%) (288 – 320 lb/ta), in addition to five drip applied fumigants including, metam sodium (as Vapam, 75 gpta), and Telone Inline (35- 48 gpta) were evaluated with either one or two drip tapes per bed at the Florida Strawberry Growers Association (FSGA) Research and Education farm in Dover, FL ; and at Ferris Farms, Floral City, FL. At all field locations, the highly gas retentive Pliant Blockade was installed immediately after methyl bromide chloropicrin application. All fumigants were applied with commercial grower equipment. Calibration procedures were followed at each experiment location. Certified applicators and pesticide label requirements for buffers, posting, rates of use, personal protective equipment requirements, etc., were closely followed.

At all farm locations, beds measured 30 inches wide, 10 inches in height, with rows spaced on 4 foot centers. Actual per acre fumigant use rates represent 62.5% of the broadcast or reported per treated acre (ta) rates expressed above. At FSGA and Ferris, bare root 'Festival' transplants from Canadian nurseries were planted between 4 to 5 weeks following fumigant treatment. Water and nutrients were supplied to each plant row with Netafim or TTape (0.22 gpm/100 ft or 0.45 gpm/ 100 ft row; or 0.40 gpm/100 ft row) on at least a daily/ twice daily basis (unless sufficient rainfall occurs) for much of the season. Fertigation rates were seasonally defined based on crop growth stage. Fertilization rates were generally based on a near field equivalent of 225 lbs NPK per acre per season. Other pest and disease control measures were maintained primarily on both a prophylactic and as needed basis.

Assessments of plant growth were made as appropriate during the course of the season to characterize differences in plant size, health, and vigor. Strawberry fruit were harvested (lb/plot or lb/row) and numbers of individual flats (8 lb/flat and 10,890 ft/a) were determined on a 2 to 3 day basis from early December 2009 through April 2010. Following chemical treatment, weed densities were monitored and recorded on a periodic basis to determine any differences in weed control between fumigant treatments. An untreated control was not included as a replicated treatment for comparison at Ferris Farms, Floral City. All treatments were arranged within their respective experimental areas as a completely randomized block design with 4 replications per treatment. Plot sizes varied from 2 to 12 rows or 0.06 to 0.4 acres among the different grower farm locations.

Results and Discussion:

At FSGA, weed densities were low and no meaningful differences among drip fumigants. In general, highest populations were generally observed in the untreated control. Similarly, a higher number of dead plants per 40 linear feet of plant row was observed with the untreated control compared to most other drip fumigants. Strawberry plant growth assessments made on December 8, 2010, demonstrated significantly improved ($P=0.05$) strawberry plant growth between adjacent rows within the bed when Telone Inline was applied, particularly when the fumigant was delivered with twin drip tapes per bed. This is the second year in which a significant drip tape effect (1 vs 2) was observed in strawberry plant growth improvement (horticultural effect) . With twin tapes, the convergence of strawberry plant growth between rows increased presumably as a horticultural effect (improved water and nutrition) and also as a fumigation effect (improved bed distribution of the fumigant and correspondingly nematode control) with Telone InLine. With regard to end of season nematode population densities, improved fumigant efficiency was not observed with two tapes per plant bed. The extraordinarily cold

winter in Dover, FL during 2009 -2010 resulted in a significant reduction of approximately 45% from average strawberry crop yields from the previous year. For the majority of an 8 week period (January + February), soil temperatures at 5 inches persisted at levels below 60 F . The combination of unseasonably cool air and soil temperatures slowed growth significantly. The protracted cold weather and needs for repeated overhead irrigation for cold protection, resulted in reduced plant growth and fruit production, and of fruit produced, resulted in significant amount of cull fruit during January. Fruit production did not begin in earnest until early February 2010, at which time a glut of fruit was observed in the market. Even with the record number of freeze events, significant difference in strawberry yield was observed between drip fumigant treatments. Strawberry yields were greatest ($P=0.05$) when treated with two drip tapes per plant bed in the spring and or fall with Telone Inline. Similar results were observed with estimated of relative yield derived from analysis of the numbers of small, medium, large, and dead plants per 40 linear feet of row. All other drip treatments, either Telone Inline or Vapam treated with a single drip tape per bed, were not significantly ($P=0.05$) different from the untreated control. The horticultural benefits of a second drip tape per bed was again demonstrated for the second year in a row. Given no differences in final soil population densities of nematodes, it is not clear whether strawberry yields increased as a result of a fumigation effect (improved bed distribution of the fumigant and correspondingly nematode control) with Telone InLine delivered via 2 rather than 1 drip tape per bed-.

At Ferris Farms, no significant differences in strawberry yield were observed between fumigant treatments season long . A significant tape effect ($P=0.05$) was not observed with either methyl bromide chloropicrin 50/50 (either 1 or 2 drip tapes per bed) or with Telone Inline (either 1 or 2 drip tapes per bed) season long. Regardless of tape number, higher weed densities per 48 feet of row were observed on December 7, 2009 and April 6, 2010 with Telone Inline compared to methyl bromide. Increased nutsedge survivorship with distance from the bed center to bed shoulder was observed with drip application of Telone Inline, particularly when applied through a single tape (data not shown). No differences in early season growth and the degree of closure in growth between adjacent strawberry rows within the same bed were observed between fumigant and drip tape treatments. In general no significant ($P=0.05$) differences in numbers of dead or decline strawberry plants were observed among treatments season long. In general, strawberry plant beds fumigated and grown with 2 drip tapes per bed had significantly ($P=0.05$) higher plant density of large plants per 48 linear feet of plant row . With larger plants, relative yields computed from analysis of the 4 plant categories, suggest strawberry yields were higher when grown or fumigated with 2 drip tapes rather than 1 per plant bed.

GENERAL SUMMARY:

The focus of Area-Wide strawberry studies for 2009-2010 was to characterized performance differences between methyl bromide chloropicrin fumigant treatment with that of drip fumigants metam sodium and Telone Inline applied as combinations of crop termination treatments in the spring after the initial crop of strawberry, followed by a stale bed treatment during the summer, and concluding in fall with another preplant drip fumigant treatments. These studies were initiated, out of necessity, because of 2008-09 strawberry market conditions and needs of strawberry growers to reduce production costs. Due to low yields obtained following the atypical and unseasonably cold temperatures which persisted during January 2010 at both demonstration site locations, we were not able to fully characterize the impacts (positive or negative) of double cropping. Early season stunting from sting nematode was not observed at either double cropping demonstration location. Temperature probes installed stale-beds into east and west bed shoulders and bed center locations demonstrated that soil temperature at 30 cm depth could attain temperatures of 100 to 110 F on a daily basis. These results suggested that crop termination treatments with either metam sodium or Telone Inline did not necessarily have to be 100% effective to provide nematode control within strawberry plant beds. The results from FSGA again demonstrated strawberry yield enhancement with the addition of a second drip per bed. Additional research is required to validate the fumigant, horticultural, and economic benefits of the drip fumigants and additional drip tape.

Fig. 1. Combinations of spring and fall drip fumigant treatments on double cropped strawberry yields at the Florida Strawberry Growers Association Farm, Dover, FL. Spring treatments were applied as end of season crop termination treatments spring 2009 and as preplant drip treatments fall 2009. Drip fumigants consisted of Vapam HL (46 gpa), Telone EC (12 gpa) and InLine (22 gpa) into strawberry beds with 1 (0.45 g/min/100 ft) or 2 (0.225 g/min/100 ft) drip tapes per bed.

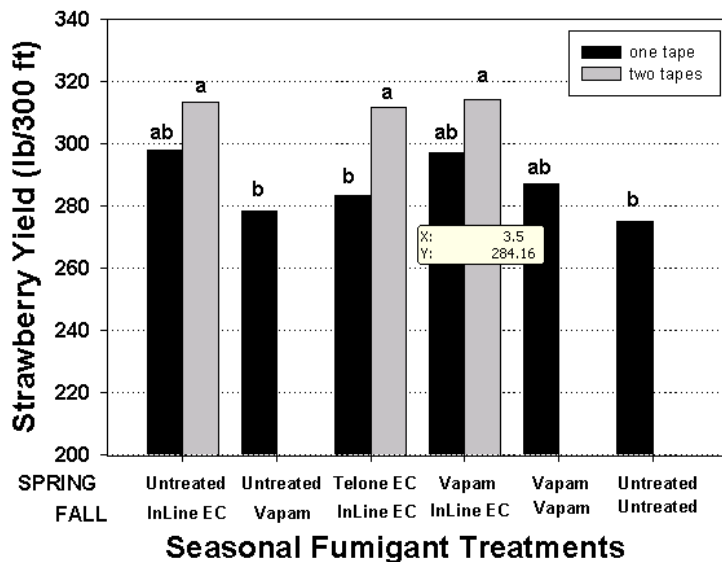


Figure 2. Comparison of shank and drip applied fumigant treatments on strawberry yields at the Ferris Farms, Floral City, FL 2009-10. Fumigant treatments are shank methyl bromide chloropicrin 50/50 (288 lb/ta) and Telone InLine (35 gpta) drip applied into double cropped strawberry beds with one (0.45 g/min/100 ft) or two (each 0.225 g/min/100 ft) drip tapes per bed. Methyl bromide chloropicrin was also similarly irrigated with one or two drip tapes per bed to characterize horticultural benefit.

