DMDS AND ACROLEIN STUDIES IN STRAWBERRY AND TOMATO PRODUCTION SYSTEMS

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Introduction: Soilborne problems that limit **s**trawberry yields in NC include Back Root Rot (BRR), primarily caused by Pythium sp. and Rhizoctonia sp., and weed pressure. Fumigation of tomato land in western NC targets Verticillium wilt (race 2, VW) and weeds. Host resistance is currently not available to manage neither BRR nor VW race 2. Therefore, most growers rely on chemical-based fumigation strategies. Products with high chloropicrin content offer superior management of soilborne pathogens but may not offer sufficient weed management or have other issues that limit their adoption as fumigant alternatives. Therefore, two experiments were designed to test the efficacy of Acrolein and dimethyl disulfide (DMDS) in strawberry and tomato production systems. Both Acrolein and DMDS plus chloropicrin (21%) were evaluated as alternatives to methyl bromide. Weed control, disease incidence/severity, plant growth (strawberry) and crop yield were evaluated for each of the chemical treatments.

Materials and Methods: The strawberry experiment was conducted at the Horticultural Crops Research Station, Castle Hayne, NC on land with a history of BRR and weed pressure. Fumigant treatments (Table 1) were applied 2-4 Oct 2006 and strawberry (cv. Chandler) plug plants were field set 26 Oct 2006. The experiment was designed as a randomized complete block design with 4 replications with 40 plants per plot on raised beds 30 in wide. Whole plants were harvested the day of planting, 14 Dec 2006, 15 Mar 2007 (full bloom) and 23 May 2007 (near termination date). Fruit were harvested weekly from 19 Apr – 29 May 2007. The tomato study was conducted at the Mountain Horticultural Crops Research Station in Fletcher, NC. The experiment was initiated on 10 May 2007 when most plots were fumigated (Table 2). Pre-plant Acrolein was drip applied 16 May 2007 and post-plant treatments were applied 2 Jul, 1 Aug, and 31 Aug, 2007 according to protocol (Table 2). The experiment was designed as a randomized complete block design with 4 replications with 12 plants per plot on raised beds 30 in wide. Acrolein was injected preplant at a high concentration over a short time interval (high) or a low concentration over a longer interval (low) through two drip tapes on each preformed bed. The experiment also included grafted plants using 'Maxifort' rootstock or self-grafted plants (Table 2). Plants ('Mountain Fresh') were field set May 30. Verticillium wilt incidence, and fruit yield were collected weekly as disease and fruit ripening, respectively, occurred.

Results: All fumigants and fumigant combinations had similar numbers of holes with weeds (open areas in the mulch where the strawberry plant was planted) with a range of 2.0 to 6.0 % (Table 1). In contrast, plots not fumigated had a high weed incidence of 25.3 to 38.0 % (Table 1). Black root rot pressure was high (data not

shown). Total yield was impacted by fumigant treatments (Table 1) but percent marketable fruit was not dramatically affected. DMDS at the low rate of 38 gal/A under VIF had the highest yield and this was similar to the MB 67:33 low rate under VIF, Telone-C35, Midas 50:50 and SEP-100. The chloropicrin plus Vapam HL treatment compromised yield. In part, this was attributed to the roto-tilling process to incorporate Vapam and the resultant poor bed formation, negatively impacting plant growth.

Fumigant treatments also dramatically impacted tomato yield. At the time of publication (Oct 1) the experiment was still underway and final harvests were not collected. To date, the post planting treatments with Acrolein at 25 or 50 lb/A caused plant stunting and the lowest yields. The Maxifort rootstock, in the absence of fumigation, generated the highest (numerically) yield and greatest number of Jumbo fruit. The yield values for the grafted plants on Maxifort rootstock were statistically similar to the self-grafted rootstock and these two had much higher yields than the appropriate non-grafted control. The mechanism of yield benefit in the self-grafted plants is not well understood.

The grafted, self-grafted, DMDS 50gal/A under VIF, DMDS 62gal/A under LDPE and VIF, Acrolein 200 high and low and Acrolein 400 low generated statistically similar yields comparable to one-another and to the MB treatments (high under LPDE and low under VIF). Final data will be posted in the website publication.

Table 1: Treatments and treatment effects on weed incidence and yield in strawberry experiment, Castle Hayne, NC 2006-2007.

Treatment	Rate/ 43560 sq ft	App. method	Plastic	Holes with weeds (%) 15 Mar	Total yield lb/A	Marketable (%)
Control	----------	----------	LDPE	38.0 a	6397 a	86.5 ab
Control	----------	----------	VIF	25.3 a	8575 ab	89.6 ab
Pic (99%) + Vapam HL	150 lb + 70 gal	shank/ tilled	LDPE	2.0 b	10459 abc	89.7 ab
MB 67:33	400 lb	shank	LDPE	3.3 b	12082 a-d	87.4 ab
DMDS	63 gal	shank	VIF	6.0 b	12405 b-e	85.9 a
SEP-100	150 lb a.i.	drip	LDPE	3.3 b	15004 c-f	88.9 ab
Midas 50:50	300 lb	shank	LDPE	3.3 b	17006 def	86.7 ab
Telone-C35	34 gal	shank	LDPE	2.8 b	18188 ef	88.4 ab
MB 67:33	200 lb	shank	VIF	2.0 b	19620 f	88.2 ab
DMDS	38 gal	shank	VIF	3.3 b	20967 f	90.1 b
LSD P=0.05				18.8	5968	4.1

DMDS formulation had 21% chloropicrin

Table 2: Treatments included in the tomato experiment, Fletcher, NC 2007.

TRT #	Description	Rate/ 43560 sq ft	Plastic
1	Untreated	----------	LDPE
2	Untreated	----------	VIF
3	Untreated Maxifort Graft	----------	LDPE
4	Untreated Self Graft	----------	LDPE
5	Methyl bromide (50:50)	350 lb	LDPE
6	Methyl bromide (50:50)	175 lb	VIF
7	Acrolein	400 lb low	LDPE
8	Acrolein	400 lb high	LDPE
9	Acrolein	200 lb low	LDPE
10	Acrolein	200 lb high	LDPE
11	Acrolein	200 lb low + 25 lb post	LDPE
12	Acrolein	200 lb low + 50 lb post	LDPE
13	DMDS + Pic (21%)	75 gal	LDPE
14	DMDS + Pic (21%)	62 gal	LDPE
15	DMDS + Pic (21%)	62 gal	VIF
16	DMDS + Pic (21%)	50 gal	VIF