REDUCED RATES OF DIMETHYL DISULFIDE IN COMBINATION WITH TOTALLY IMPERMEABLE FILM MULCH

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Dimethyl disulfide (DMDS) (Paladin®) is a new soil fumigant chemistry that has recently received a federal and many state labels. DMDS efficacy on soilborne pests has been generally similar to methyl bromide in a large number of field experiments. Totally Impermeable Film (TIF) is a new mulch technology that utilizes a high barrier ethylene vinyl alcohol (EVAL) copolymer which is less permeable than nylon barrier layers common in Virtually Impermeable Film (VIF) mulches. Benefits of mulches with increased fumigant retention are a reduction in the amount of fumigant needed for effective pest control, lower emissions, and a lowered buffer zone requirement. DMDS has a garlic-like odor that can be detected by humans at very low concentrations in the air. This odor may present problems for DMDS use in certain areas. TIF may also be beneficial from an odor management strategy when used with DMDS. Vaporsafe® TIF mulch has been shown to increase retention of dimethyl disulfide compared with VIF mulch. Soilborne pest control equivalent to standard rates under VIF has been demonstrated with reduced rates of these DMDS under TIF (Freeman and McAvoy, 2010). A research program has been developed to evaluate reduced use rates of DMDS under Vaporsafe ® TIF mulch.

Materials and Methods

DMDS fumigant trials were conducted at the Virginia Tech Eastern Shore Agricultural Research and Extension Center in Painter, VA during the fall of 2010 and spring of 2011. A 79:21 w/w formulation of DMDS:chloropicrin fumigant was shank applied using a single row bed press 30 inches wide with three shanks. The treatments applied were an untreated control under TIF and VIF, a standard rate (50 GPA) under Blockade® VIF and TIF, a high rate (60 GPA) under VIF, and several reduced rates (20, 30, and 40 GPA) under TIF.

Data Collection

Fumigant persistence, soil temperature, weed and disease incidence, and tomato yield data were collected. Fumigant persistence was measured using a MiniRAE3000 volatile organic compound (VOC) meter. Soil temperature under the plastic was recorded using a HOBO data logger. Weed and disease incidence (dead/wilted plants) data were recorded from each plot at the end of the growing season. Tomatoes were harvested and graded at maturity.

Results and Discussion

During the fall of 2010 and spring of 2011, the retention of DMDS under TIF showed a classical rate response (Figs. 1 & 2). The standard application rate (50 GPA) under TIF was retained at the highest level for the longest period of time, while the reduced application rates (40, 30, 20 GPA) showed a stepwise decrease in retention levels and periods. The retention of DMDS under VIF at both rates (50 and 60 GPA) was generally similar to the 30 and 40 GPA rate under TIF in the fall of 2010 and similar to the 30 GPA rate under TIF in the spring of 2011. Therefore, it may be possible to decrease application rates by approximately 50% under TIF compared to VIF, while maintaining similar fumigant retention levels. The plant back period was longer in the spring compared to the fall due to lower soil temperatures. Extended plant back periods may be an issue when DMDS is used in combination with TIF during cool seasons. DMDS was still detected at < 100 ppm isobutylene equivalent 37 days after application in the spring of 2011 when 50 GPA was applied under TIF. During the fall of 2010, a similar concentration was measured in same treatment 28 days after applications. If DMDS is to be used under TIF, labeled plant back periods will likely have to be adjusted.

During the fall of 2010 all the fumigant treatments significantly reduced yellow nutsedge emergence compared to the untreated VIF and TIF treatments (Table 1). Incidence of grass and broadleaf weeds and soilborne diseases was low. There were no significant differences in nutsedge emergence between fumigant treatments. TIF mulch itself provides some measure of nutsedge control without fumigant. Untreated TIF had significantly fewer nutsedge plants emerge compared to untreated VIF. All fumigant treatments resulted in significantly greater total marketable yield compared to the untreated VIF plots. In several instances the untreated TIF plots produced yields similar to fumigant treatments. Yields are most likely a response to competition from yellow nutsedge. Data generated in the fall of 2010 indicates that it may be possible to reduce fumigant use rates by 40% or more while maintaining efficacy, however, soilborne disease pressure was low in this trial. Complete data from the spring 2011 trial will be presented in November. Fumigant reduction capacity under TIF will remain unclear until more trial data is accumulated when pressure from other yield limiting factors is high.

Literature Cited

Freeman, J and T. McAvoy. 2010. Retention and efficacy of dimethyl disulfide under virtually and totally impermeable film. Proc. 2010 Annual International Research Conference on Methyl Bromide Alternatives and Emissions Reductions. http://mbao.org/2010/Proceedings/006FreemanJDMDS.pdf

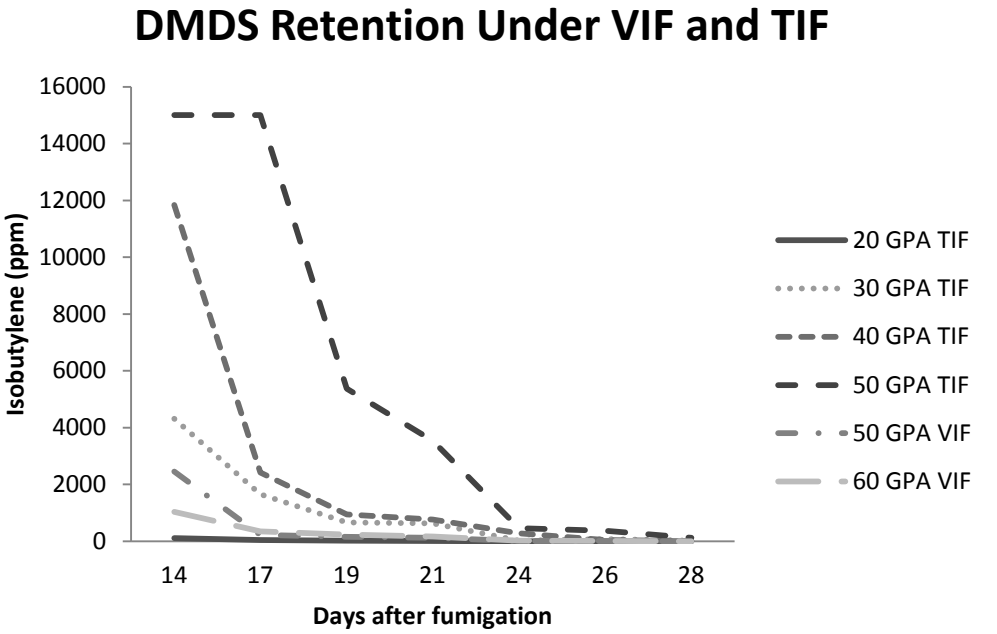

Fig 1. Dimethyl disulfide retention under VIF and TIF. Experiments were performed during the fall of 2010 at the Eastern Shore Agricultural Research and Extension Center in Painter, VA

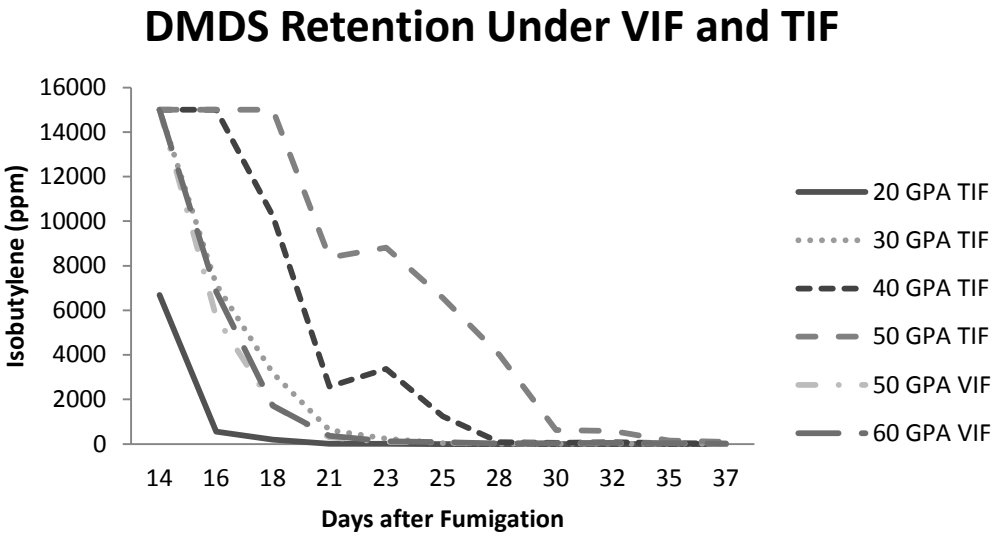

Fig 2. Dimethyl disulfide retention under VIF and TIF. Experiments were performed during the spring of 2011 at the Eastern Shore Agricultural Research and Extension Center in Painter, VA

Table 1. Tomato yield and nutsedge incidence data from dimethyl disulfide fumigant trials conducted at the Eastern Shore Agricultural Research and Extension Center in Painter, VA during the fall of 2010.

		Yields (lbs/A)			
Treatment	Emerged nutsedge/ft^2	Medium	Large	Ex-large	Total marketable
Untreated TIF	23.8 a [z]	5789 ns	5518 c	8428 c	19735 c
Untreated VIF	8.933 b	5723	8428 bc	18350 bc	32501 b
20 GPA DMDS TIF	0.387 c	6794	10811 ab	26166 ab	43772 ab
30 GPA DMDS TIF	0.127 c	6340	8615 abc	19771 ab	34727 b
40 GPA DMDS TIF	0 c	7949	10267 ab	24400 ab	42616 ab
50 GPA DMDS TIF	0 c	8433	11816 a	26082 ab	46331 ab
50 GPA DMDS VIF	0.29 c	7066	11477 ab	30383 a	48926 a
60 GPA DMDS VIF	0.023 c	8954	6715.5	9692 ab	29022 ab

[z] Means not followed by the same letter are not significantly different at $P \leq 0.05$ by Duncan's multiple range test. ns = not significant