FIELD TESTING OF FUMIGANT RETENTION PROPERTIES OF BAYFILM WITH PIC CLOR 60 (Tampa, Florida January 2012)

D.A. Sullivan[1]*, H.A. Ajwa[2], R. Dujardin[3], R.D. Sullivan[1], and M. Holdsworth[1]

[1]Sullivan Environmental Consulting Inc., 1900 Elkin Street, Suite 200, Alexandria, VA 22308

[2]University of California at Davis, 1636 East Alisal St., Salinas, CA 93905

[3]Bayer Innovation, Bayer Innovation GmbH, Kaiser Wilhelm Allee 20, 51738 Leverkusen, Germany

Introduction

In the current and future regulatory environment, the effective management of airborne flux from pre-plant fumigation is critical to the long-term availability of the fumigants. Ongoing efforts over the past decade have substantially reduced flux while maintaining efficacy. This achievement can be attributed to improvement in application and sealing technology, improved tarp materials, as well as improve field preparation.

One of the most notable improvements is the introduction of virtually impermeable films (VIF) and totally impermeable films (TIF). Such films are very effective in retaining the volatile fumigants within the treatment zone. At the time of tarp cutting, however, it has been noted that relatively high flux rates occur from those fields that were well controlled prior to that time. In some cases, the peaks at that time are higher than preceding periods, effectively delaying the peak flux but not eliminating it. As a consequence it is inevitably for growers to delay transplanting to reduce workers' exposure and to prevent crop injury.

This paper shows the initial testing of a new approach to flux management, which is a new tarp material called BayFilm (ADVASEAL®, registered trademark of Bayer AG). This tarp initially has the permeability characteristics of a TIF as expressed by its low mass transfer coefficients $\leq 10^{-4}$ cm/h for various fumigants[1]

[1] Y. Qian, A. Kamel, C. Stafford, T. Nguyen, W. J. Chism, J. Dawson, and C. W. Smith; Evaluation of the Permeability of Agricultural Films to Various Fumigants, Environ. Sci. Technol. 2011, 45 (22), pp 9711-9718.

according the static permeability testing method established by EPA. The design allows, however, for a gradual fumigant release over time to release fumigants earlier for safe transplanting, and also minimizing the peak flux values that can occur at the time of tarp cutting or punching with a VIF or TIF material.

Objectives

The objectives of the study are summarized as follows:

(a) Obtain comparative flux data following application to the soil of the product, PIC Chlor 60 (1,3-Dichloropropene and Chloropicrin) using three alternative versions of BayFilm tarp material to evaluate fumigant retention properties of BayFilm relative to a reference total impermeable film of similar thickness (VaporSafe^{TM} Raven Industries, Inc).

(b) Show that the addition of active ingredients to the BayFilm tarp, i.e. the herbicide Halosulfuron-Methyl (HSM) for nutsedge control used in this study as an example, does not adversely affect the retentive properties of BayFilm.

Methods

Four separate treatment plots (one-half acre plots, separated by 500 m or more) were applied by shank injection with PIC Chlor 60 and monitored as specified below:

- Air sampling for 1,3-Dichloropropene and chloropicrin with subsequent laboratory analysis.
- Four profiles (one per field) established with four-level coverage (~ 0.3, 0.9, 1.8, and 3.0 meters).
- Off-field air monitoring conducted at eight locations around each field during the applications

Materials

Test Field (Field #)	Gross Acres (Acreage of Treated Beds)	Time of Application (Start Time)	Injection Depth (cm)	Tarp Type	Amount of PIC Chlor 60 Applied (lbs)
1	0.4725 (0.2083)	1/17/2012 9:17	20.32	BayFilm HSM Textured Black Swiss-made	66.20
2	0.4712 (0.2083)	1/17/2012 11:38	20.32	BayFilm Blank Textured Black Swiss-made	64.60
3	0.4672 (0.2083)	1/17/2012 14:36	20.32	BayFilm HSM Textured Black US-made	63.30

4	0.4673 (0.2083)	1/17/2012 16:33	20.32	VaporSafe® 1.8 mil TIF	63.05

Results

Refer to Figures 1 and 2.on the following pages.

Conclusions

- All four fields showed excellent mitigation of peak flux rates. In terms of buffer zone management, all four tarps show excellent performance for both fumigants.

- At the time of tarp cutting, Field 4 showed a three-fold increase in flux for 1, 3-Dichloropropene relative to the highest flux prior to that time. The other three fields did not show discernible peaks beyond the general trends (including diurnal variation) prior to that time. For chloropicrin, all four fields showed low emissions at and beyond tarp cutting.

- The trend for 1,3-Dichloropropene suggests that punching holes after 14 instead of 11 days in BayFilm would further reduce worker exposure.

- Incorporation of the HSM herbicide did not increase the flux with BayFilm.

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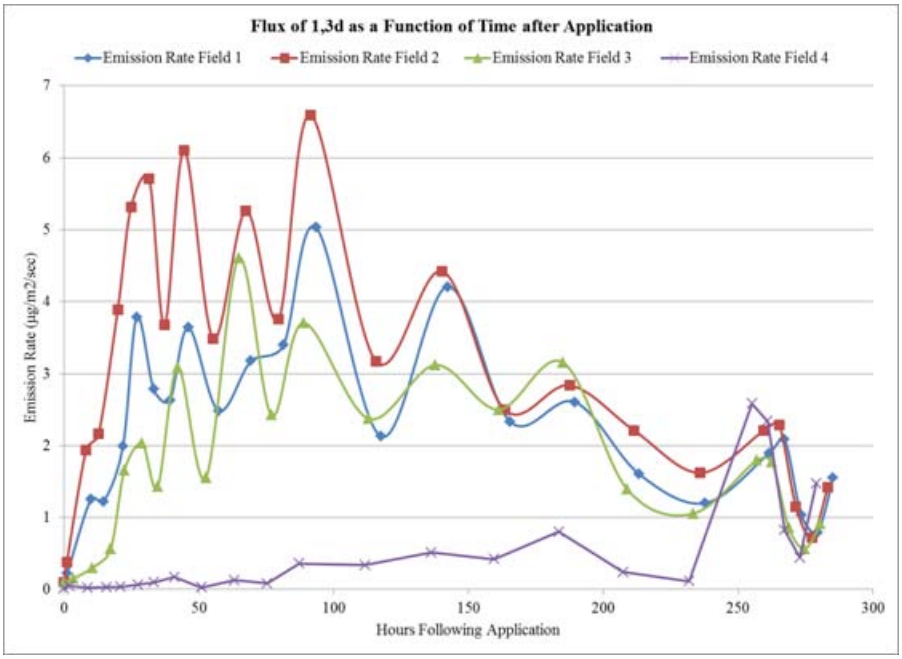
References:
(1) Y. Qian, A. Kamel, C. Stafford, T. Nguyen, W. J. Chism, J. Dawson, and C. W. Smith; Evaluation of the Permeability of Agricultural Films to Various Fumigants, Environ. Sci. Technol. 2011, 45 (22), pp 9711-9718

Figure 1: Airborne Flux and Measured Soil Concentrations (0-15 cm depth) for 1,3-Dichloropropene



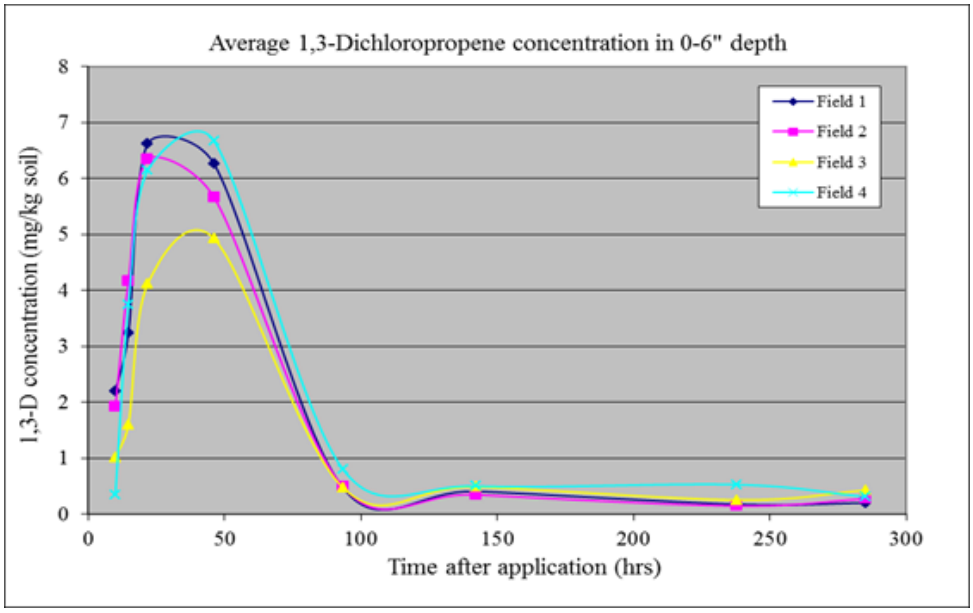


Figure 2: Airborne Flux and Measured Soil Concentrations (0-15 cm depth) for Chloropicrin