

# Minimize Emission and Improve Efficacy of Soil Fumigation with Tarping of TIF



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## Introduction

Soil fumigation is critical to successful orchard replanting for control of soil borne pests and replanting diseases as well as nursery stock certification. However, the use of soil fumigants is increasingly limited by environmental regulations on control of exposure risks and VOC air emissions. The San Joaquin Valley, where most of the almonds are grown, is one of the ozone nonattainment areas that require emission reductions. This project is to develop strategies using low permeability film, such as totally impermeable film (TIF), to minimize emissions and improve pest control.

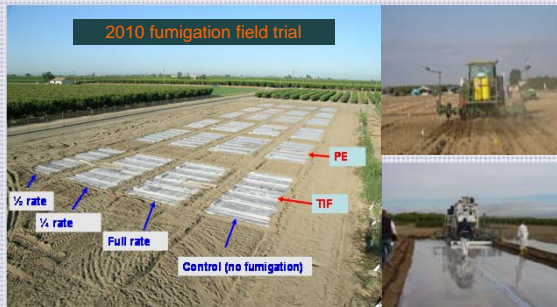
## Objectives

- Demonstrate the potential of totally impermeable film (TIF) to improve soil fumigant distribution in soils.
- Determine the potential of using reduced fumigant application rates to achieve good efficacy under TIF tarp.
- Determine fumigant persistence under TIF tarp over time from different fumigant application rates and evaluate the effects on the waiting period for tarp-cutting.

## Field Trials

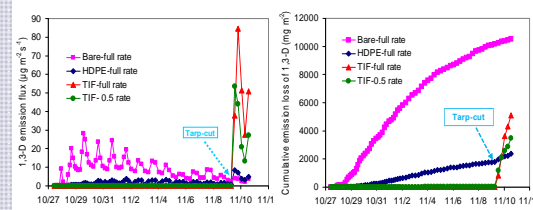
Summary of three field trials conducted from Fall 2009 to Fall 2010 in Parlier, CA. (Soil: Hanford sandy loam; PE: polyethylene; TIF: totally impermeable film)

Field Trial	Treatment (shank injection of Telone C35)	Field Measurement	Efficacy Study
Fall 2009 (Oct. 27–Nov. 9)	Rate: Full rate (48 gallon/acre), and 0.5 rate Tarp: Standard PE, TIF	Emission Air under tarp Residual fumigants	Nematodes weeds
Summer 2010 (June 9 - July 1)	Rate: Full rate, 0.5 rate Tarp: Standard PE, TIF	Air under tarp Gaseous fumigant distribution in soil	None
Fall 2010 (Sept. 8 – Oct. 13)	Rate: Full rate, 0.5 and 0.25 rates Tarp: Standard PE, TIF	Air under tarp Gaseous fumigant distribution in soil	Nematodes pathogens weeds

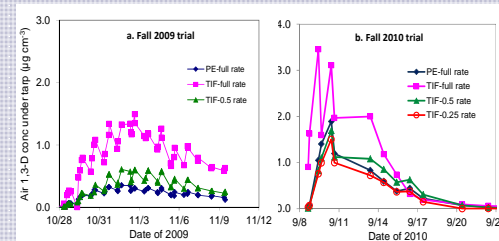


## Results

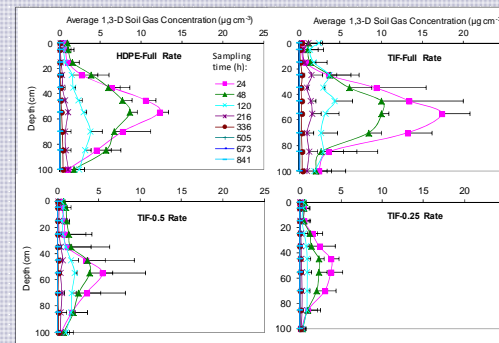
- **Emission reduction by TIF and surge of emission after tarp-cutting.** Emission flux was highest from bare soil and lowest from TIF tarp during tarp-covering. However, a surge of emissions after tarp-cutting (after 14 days) was the highest from the TIF tarp. This resulted in a sharp increase of total emission loss, although the surge of emission flux was only one third of that observed when TIF tarp was cut after 6 days in an earlier trial (data not shown).



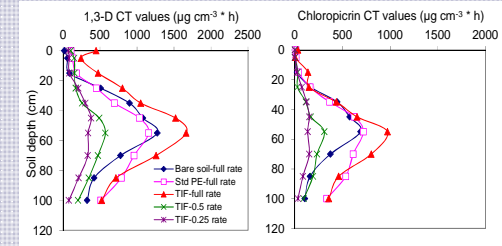
- **Air concentrations under tarp.** All three field trials including summer 2010 (data not shown) show that the TIF retained much higher 1,3-D concentrations than standard PE. The 1/2 rate under the TIF was comparable to or higher than the full rate under the PE.



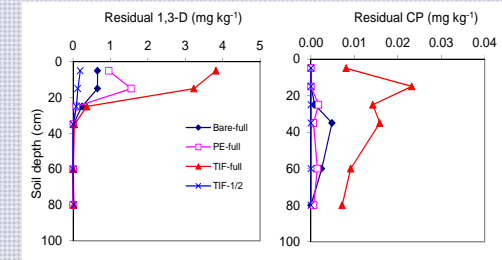
- **1,3-D distribution profile in soil-gas phase from Fall 2010 field trial.**



- **Average concentration-time (CT) indices in soil profile from fall 2010 field trial.**



- **Residual fumigant in soil from fall 2009 field trial.** Chloropicrin (CP) has a much shorter half-life than 1,3-D, thus showed lower concentrations. If the residence time of fumigants increased significantly under TIF tarp, this suggests that reduced rates with TIF may be desirable and/or necessary.



- **Efficacy on nematode, pathogen and weed:** Data of two field trials show that reduced Telone C35 rates were as effective as full rate against nematodes as all fumigated treatments provided 100% control and there was also no significant differences between tarps. Large variations in control of pathogen species from rate treatments were observed. No significant interactions on rates by tarp types for weed count and biomass data were detected for both years. (Details are in Cabrera et al., MBAO Conference, 2011. <http://www.mbao.org/2011/Proceedings/75CabreraA.pdf>).

Number of citrus nematodes/100 cm<sup>3</sup> of soil in bags in fall 2010 trial

Treatments	Soil depth (cm)			
	15	30	60	90
Control bare soil	1346	1364	2168	1983
Control under HDPE	881	1368	1452	1637
Control under VIF	592	2680	2165	1688
HDPE 1/2 rate	71*	0	0	0
HDPE 1/2 rate	0	0	0	0
HDPE Full rate	0	0	0	0
TIF 1/2 rate	0*	0	0	0
TIF 1/2 rate	0	0	0	0
TIF Full rate	0	0	0	0

Research continues to determine effective reduced rates under TIF

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