Using TIF Tarp and Reduced Soil Fumigation Rates for Almond Replanting

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Introduction

Soil fumigation is critical for successful orchard replanting and nursery stock certification in the control of soil borne pests, especially nematodes and replanting diseases. However, soil fumigants are highly regulated to minimize exposure risks and reduce VOC air emissions. This project is to develop strategies for increasing fumigation efficiency with reduced rates and lower emissions by using low permeability tarp, such as totally impermeable film (TIF). The purpose of this research is to maintain fumigant use for agriculture while minimizing environmental impacts.

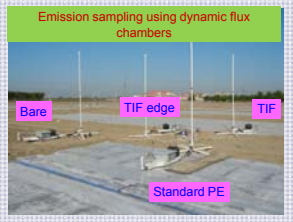
Objectives

- Demonstrate the ability of TIF to reduce emissions and improve fumigant distribution in soil from the broadcast shank application of alternative fumigants to methyl bromide (MeBr).
- Determine the potential of using reduced fumigant application rates to achieve good efficacy under TIF and carbonation.
- Evaluate fumigant distribution and persistency under TIF tarp and treatment effects on nematodes, pathogens and weeds.

2011 Field Trial

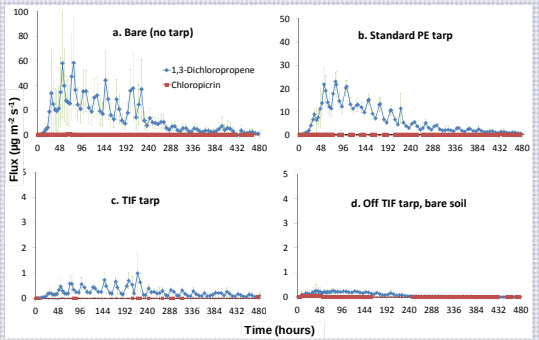
A 10-year old vineyard was removed and a fumigation trial was conducted in fall 2011, at Parlier, CA. The soil had high population of citrus, root-knot and pin nematodes. Soil type: Hanford sandy loam. Treatments are shown below. Telone C35 (61% 1,3-D, 35% chloropicrin, 4% inert ingredient); PE, (polyethylene); TIF, (totally impermeable film); N_2 (fumigant pressurized with nitrogen); CO_2 (fumigant saturated with carbon dioxide).

		Bare	PE (N_2)	TIF(N_2)	TIF(CO_2)
Telone C35 rate:					
	0	x			
	1/3 (180 lb/ac)		x	x	x
	2/3 (360 lb/ac)	x	x	x	x
	full (540 lb/ac)	x	x		
MeBr (MeBr:CP 67:33=400 lb/ac);			x		



Results

- **Emission.** TIF significantly reduced 1,3-D emission flux to ~ 1 μg m^{-2} s^{-1} or below compared to bare or standard PE tarped soils. Flux near TIF tarped edges was also low.



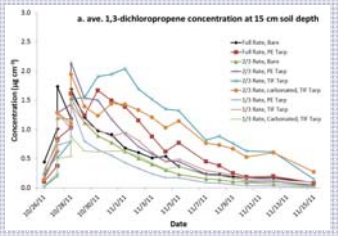
- **Cumulative loss.** Nearly half of applied fumigant to bare soil was lost through emission. Standard PE tarp barely reduced emissions compared to the >95% emission reduction by TIF.

Total emission loss as % of applied.

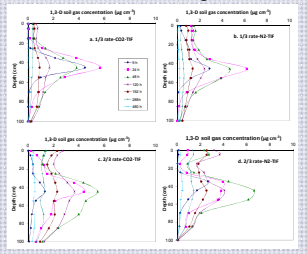
Surface	1,3-D	Chloropicrin
Bare	53.5 (22.2)	0.5 (0.7)
PE	38.3 (17.3)	0 (0)
TIF	1.9 (0.5)	0 (0)
Off TIF tarp in bare soil*	0.6% (0.1)	0 (0)

* Based on fumigant applied to the adjacent TIF tarped plot.

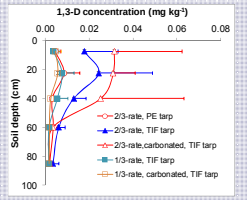
- **Air under tarp.** TIF retained higher 1,3-D concentrations than standard PE. The 2/3 rate under the TIF was comparable to or higher than the full rate under the PE.



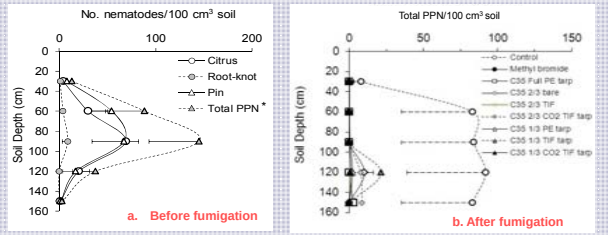
- **1,3-D distribution profile in soil-gas phase from 2011 trial.** Higher application rate resulted in higher fumigant concentrations in soil. Carbonation of fumigant at 30 psi showed no difference from non-carbonated fumigant.



- **Residual fumigant in soil.** TIF retained higher fumigant concentrations in soil than standard PE tarp and bare soil at the same application rate.



- **Efficacy on nematodes.** High population of resident nematodes were detected prior to fumigation (left figure below). All fumigated treatments provided effective control at soil depths less than 90 cm (3 ft), but survival of significant numbers of nematodes were observed in soil deeper than 90 cm (3 ft). The results indicate the challenge to deliver fumigant to deeper depths in perennial field.



* Total PPN - total population of nematodes

- **Efficacy on pathogens** varied significantly among species.
- **Efficacy on weeds.** Regardless of plastic type, tarping resulted in significantly lower weed density and biomass than bare soils. Weed density decreased as fumigant application rate increased.
- **A new trial** was initiated in a 5-acre almond orchard to be replanted at Braden Farm, ~13 miles north of Merced. Fumigant was applied on Nov. 28, 2012 and treatments included 4 application rates of Telone C35 (full, 2/3, 1/3, and 0) and 3 surface sealing (bare, standard PE tarp, and TIF tarp). Fumigant movement in soil and efficacy (nematodes and pathogens) as well as emissions are being determined. Tree response to the treatments will be monitored.

2012 Almond Replanting Fumigation Trial

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