Using TIF Tarp and Reduced Soil Fumigation Rates for Almond Replanting

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Introduction

Most almond replanting still relies on pre-plant soil fumigation to control soil-borne pests and diseases in order to establish productive and healthy trees. With the environmental constraints on fumigant use, fumigation methods for high pest control efficiency and low emissions are needed greatly. This project is to develop strategies for increasing fumigation efficiency with reduced rates and lower emissions by a low permeability tarp, such as the totally impermeable film (TIF).

Objectives

- Demonstrate that the use of TIF can improve fumigant distribution in soil and increase fumigant concentration-time exposure index values for better pest control than standard PE tarp in field fumigation.
- Evaluate pest control efficacy (nematodes, pathogens, or weeds) under TIF and reduced fumigation rates.
- Monitor almond tree vigor and growth from different fumigation treatments in fumigated growers' fields.
- Determine the effective field fumigation rates under TIF with regards to soil-borne pest control and almond tree performance.

2012 Field Trial

In late November 2012, a fumigation field trial was conducted in an almond orchard that was scheduled to be replanted at Braden's Farm in Merced County. The field had a high nematode population, chiefly pin and some ring nematodes. Fumigation treatments included non-fumigated control, three rates (full or maximum allowed label rate, 2/3, and 1/3 of Telone® C-35), and three surface sealing methods (bare, standard polyethylene (PE) tarp, and TIF) with six replicates in a randomized complete block design.

Emissions, gaseous fumigant concentration under the tarp, and fumigant concentrations in soil profile were determined for five weeks. Both soil existing indigenous nematodes and bioassay bags containing soils infested with citrus nematodes were investigated. Tree growth after replanting in 2013 is being monitored.

Table 1. Treatments (fumigant application rate and surface sealing) in 2012 almond replanting trial, Merced, CA

Telone® C-35 rate:	Bare	PE	TIF
0	x	x	x
33% (16 gallons/ac)	x	x	x
66% (32 gallons/ac)	x	x	x
100% [48 gallons (540 lb)/ac or 610 kg/ha]	x	x	x

Field layout of 2012 Almond Replanting Fumigation Trial in Merced, CA


Soil preparation after injection


Sampling soil gas using a sampler


Soil sampling for nematodes & pathogens


Tarp installation after fumigant injection


Air under tarp sampling tubing


Burying pest bags

Results

- **Emissions (Fig. 1)** from TIF tarp were lower compared to the standard PE tarp for 1,3-D. In late fall cool temperature, chloropicrin emissions were much lower than 1,3-D under all fumigated conditions. Flux near TIF tarped edges was extremely low.

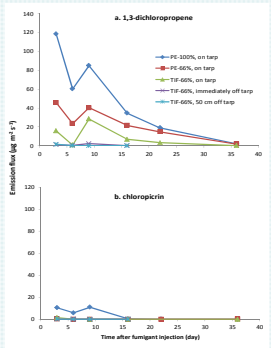

Fig. 1. Emission flux of 1,3-D and chloropicrin.

- **Air under tarp (Fig. 2).** TIF retained higher 1,3-D concentrations and the higher concentrations lasted for longer period of time compared to standard PE tarp.

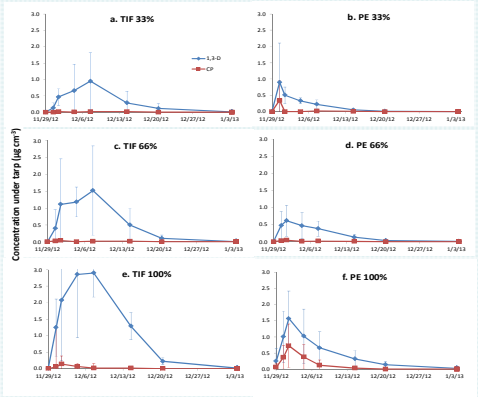

Fig. 2. 1,3-D and chloropicrin (CP) concentration under tarp.

- **1,3-D distribution profile in soil-gas phase (Fig. 3).** Higher application rate resulted in higher fumigant concentrations in soil and the difference in 1,3-D concentration between TIF and standard PE tarp is small.

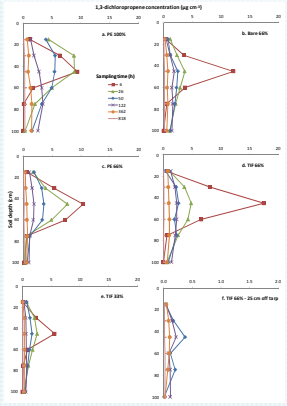

Fig. 3. Gas 1,3-D concentration in soil profile

- **Residual fumigant in soil (Fig. 4).** TIF retained higher fumigant concentrations in soil than standard PE tarp and bare soil at the same application rate.

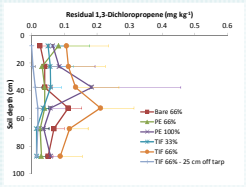

Fig. 4. Residual1,3-D in soil six weeks after application

- **Efficacy on nematodes (Fig. 5).** High population of resident nematodes were detected prior to fumigation. All fumigated treatments provided effective control at soil depths above 1 m (3 ft), but significant survival of nematodes were found in soil below (**Figs. 6 and 7**). The results indicate the challenge to deliver fumigant to deeper depths in perennial field.

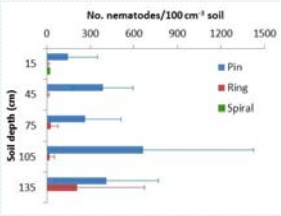

Fig. 5. Nematodes in soil before fumigation

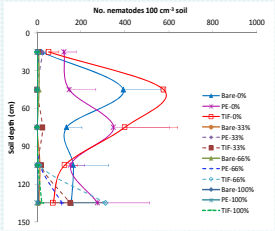

Fig. 6. Survival of residential nematodes in soil after fumigation

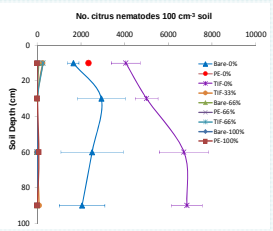

Fig. 7. Survival of pin nematodes in buried bags after fumigation

- **Efficacy on pathogens** varied greatly among species (data not shown).
- **On-going work.** Almond trees were planted in early 2013 and tree response to the fumigation treatments is being monitored and will be continuously monitored for a couple of years. Nematode recovery in the field will be monitored by sampling soil samples for nematode counting.

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