

Soil-Biodegradable Plastic Mulch Professional Training

Soil-Biodegradable Mulches and Fumigation



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Introduction



Image: Gao 2013

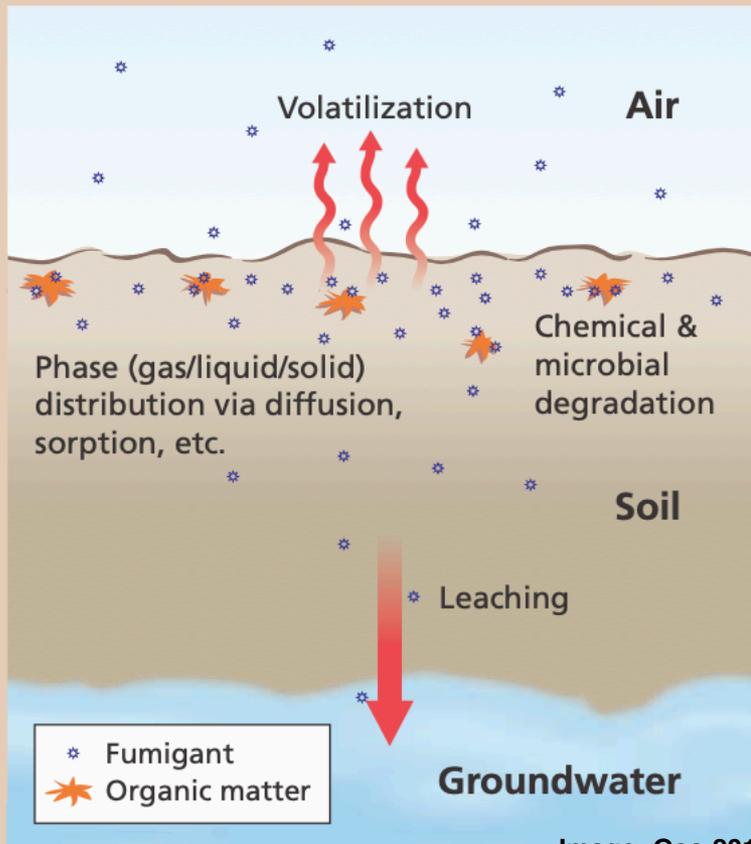


Image: Gao 2013

- ❖ Fumigation is a **pre-plant chemical treatment** of soil used independently or in conjunction with cultural and physical control methods to **reduce populations** of disease-causing organisms
- ❖ Mainly suppresses **soil-borne pathogens** including **parasitic nematodes and pathogenic fungi**

Mai & Abawi, 1981

Soil Fumigants



- ❖ Soil fumigants are **volatile chemical compounds**
- ❖ Requires an **effective concentration or exposure duration and uniform distribution** of fumigants in soil
- ❖ Fumigant emissions to the air will **pollute the air and translates into wasted resources** intended for soil borne disease control

Processes affecting the fate of fumigants in soil

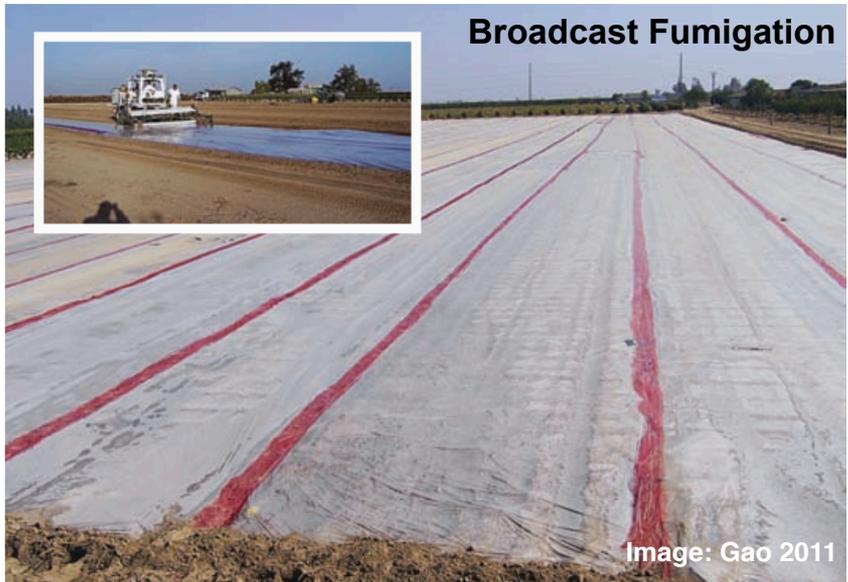
Buffer Zone

- ❖ A buffer zone is an area that **surrounds within all directions in an application block**, which allows airborne chemical residues to disperse before reaching bystanders
- ❖ Buffer zone size is based on:
 - Application rate
 - Field size
 - Application equipment and methods
 - Multiple emission and buffer zone size reduction measures (e.g. tarps)
- ❖ Read the product label!
- ❖ Buffer zone size calculator; see: <https://iaspub.epa.gov/apex/pesticides/f?p=106:2:.....>

EPA factsheet 735-F-12-003; 735-F-12-006



Tarping



- ❖ **Concept:** covering the soil with a film during and immediately after fumigation
- ❖ **Pros:** improves efficiency, reduces buffer zone credits (10% to 60%) and reduces fumigant emissions into the atmosphere
- ❖ **Cons:** generates plastic waste and adds additional costs (\geq \$500 per acre for broadcast fumigation)

Tarp Perforation

❖ Phytotoxicity

All of the fumigants, including the gas and water phases of these fumigants, are toxic to plants

Fumigation and Tarping Application Start

Minimum 5 days

Tarp Perforation

Minimum 2 hours

Tarp Removal



- Read product labels!
- After perforation, some growers use tarps as mulch

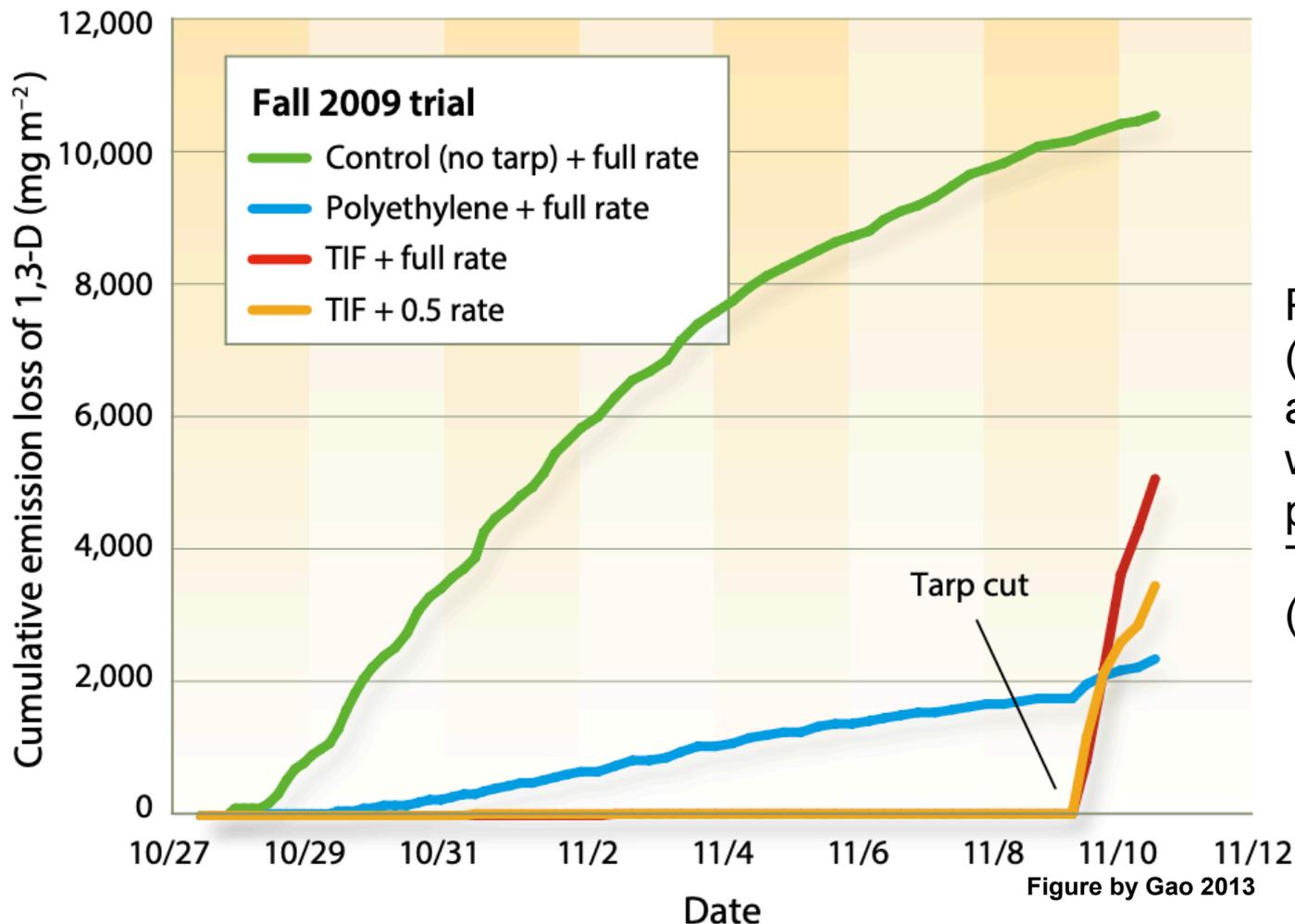
Source: EPA factsheet 735-F-12-008; Blecker & Thomas, 2012

EPA Approved Tarps

- ❖ Tarps are approved by the EPA; see: <https://www.epa.gov/soil-fumigants/tarps>
- ❖ Major categories: PE (LDPE & HDPE), metalized films, multilayered films (low permeability films)
- ❖ Low permeability films
 - **VIF (virtually impermeable film)**
 - A multilayered film composed of barrier polymers, such as nylon or ethyl vinyl alcohol (EVOH), sandwiched between polyethylene polymer layers [Villahoz et al. 2008]
 - **TIF (totally impermeable film)**
 - A five-layer film incorporated with a middle layer of EVOH into a standard polyethylene-based film [Chow 2008]
 - Even **lower** permeability than some VIFs [Ajwa 2008]



Is Standard PE Effective?



Polyethylene film (1-mil thickness and 13-foot width) was provided by Trical, Inc. (Hollister, CA)

Cumulative emission loss of 1,3-D in a field trial

Are Soil-Biodegradable Mulches (BDMs) Tarps?



- ❖ BDMs are designed to degrade in soil after incorporation
- ❖ BDMs are **not EPA-approved** tarps for soil fumigation
- ❖ BDMs can only be applied **after the fumigant's REI** has expired **or** may be applied during fumigation but do not qualify for buffer zone reduction credits (i.e., similar to an untarped fumigation)
- ❖ Unknown chemical effects on BDMs from fumigants DeVetter & Stanghellini, 2020

Future Tarp Testing Guidance

- ❖ For manufactures/researchers: Test your tarp, Go to EPA tarp testing guidance website, see: <https://www.epa.gov/soil-fumigants/tarp-testing-guidance#inter-guide>



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Tarp Testing Guidance

On this page you will find:

- [Interim guidance](#) for testing soil fumigant tarps and information on how to submit test results to EPA
- [Background information](#) on EPA standards for tarp testing

Interim Guidance on How to Test Tarps and Submit Data to EPA

We are working to develop an American Society for Testing and Materials (ASTM) standard for tarp testing. Until the ASTM standard is approved, EPA provides this interim guidance for those interested in testing soil fumigant tarps so the tarps may be added, as appropriate, to either the agency's tarp credit Web page and/or the dimethyl disulfide (DMDS) tarp Web page. We highly recommend that the testing procedures be followed as closely as possible. Since the reactivity, stability, and other chemical properties are different for each fumigant, the permeability of each fumigant through a film will be different. To assess comparability with existing permeability data, we also recommend conducting individual tarp permeability tests for more than one fumigant.



Resources

- ❖ Ajwa.H. 2008. Testing Film Permeability to Fumigants under Laboratory and Field Conditions. In: Proc Ann Int Res Conf on MeBr Alternatives and Emission Reductions, Nov. 11–14, 2008. Orlando, FL. p 35(1-2).
- ❖ Blecker.L.A., and J.M. Thomas. 2012. Soil Fumigation Manual. National Association of State Departments of Agriculture Research Foundation.
- ❖ Chow. E. 2008. Properties of EVOH and TIF films For the Reduction of Fumigant Dosage and VOC Emission. In: Proc Ann Int Res Conf on MeBr Alternatives and Emission Reductions, Orlando, FL, Nov. 11–14, 2008. p 38 (1).
- ❖ DeVetter.L., & Stanghellini.M. 2020. Soil Fumigation and Biodegradable Plastic Mulch Application. WSU Extension Service.
- ❖ EPA Soil Fumigation Mitigation Factsheet: Worker Protection Measures. 2012. EPA-735-F-12-008.
- ❖ EPA Soil Fumigation Mitigation Factsheet: Posting Requirements for Buffer Zones. 2012. EPA-735-F-12-006.
- ❖ EPA Soil Fumigation Mitigation Factsheet: Buffer Zones. 2012. EPA-735-F-12-003.
- ❖ Gao.S., Hanson.B.D., Qin.R., Cabrera.J., Gerik.J.S., Wang.D., & Browne.G.T. 2013. Totally Impermeable Film (TIF) Reduces Emissions in Perennial Crop Fumigation. California Agriculture, Vol 67, No.4.
- ❖ Gao.S., Hanson. B.D., Wang. D., Browne. G.T., Qin. R., Ajwa. H.A., & Yates. S.R. 2011. Methods Evaluated to Minimize Emissions from Preplant Soil Fumigation. California Agriculture, Vol.65, No.1.
- ❖ Mai. W.F., and G. S. Abawi. 1981. Controlling Replant Diseases of Pome and Stone Fruits in Northeastern United States by Preplant Fumigation. Plant Disease.
- ❖ Villahoz.M.D., Garza. F., Barrows. P., Sanjurjo. M. 2008. TIF (totally impermeable film): An Innovative Film for Mulch, Broadcast Fumigation, and Greenhouses in Agriculture. In: Proc Ann Int Res Conf on MeBr Alternatives and Emission Reductions, Nov 11–14, 2008. Orlando, FL. p 37(1-2).

