UCONN EXTENSION AND DEPARTMENT OF PLANT SCIENCE AND LANDSCAPE ARCHITECTURE

CT IPM CROP TALK

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EXTENSION & PLANT SCIENCE AND LANDSCAPE ARCHITECTURE

How long does soil-biodegradable plastic mulch take to degrade in soil?

Shuresh Ghimire, Assistant Extension Educator

Soil-biodegradable plastic mulch films are a promising alternative to polyethylene mulches, but their adoption has been slow because growers perceive them to have a high cost and premature or inconsistent degradation during the cropping season. Yet the cost to use soil-biodegradable plastic mulches can be lower than polyethylene mulch when removal and disposal costs are taken into account. Further, deterioration of soil-biodegradable plastic mulch that occurs toward the end of the cropping season does not negatively impact crop yield, nor is there significant weed growth within the mulched area. Thus, the potential of soil-biodegradable plastic mulches to minimize environmental burden and pollution with plastics is promising.

The first and only international standard for soil-biodegradable agricultural plastic mulch films in soil, EN-17033, prescribes that >90% of the carbon in a mulch's plastic polymers must have converted to carbon dioxide within 2 years when incubated in a topsoil under aerobic conditions in a standard laboratory test at a constant temperature between 68 to 82 ºF. However, in-laboratory biodegradability does not guarantee in-field degradation will follow the same timeframe.

Our team conducted a study to (1) monitor in-field degradation of soil-biodegradable plastic mulches following successive applications and incorporations and (2) compare in-field degradation with the laboratory standard in terms of calendar and thermal times. (Full research article is available here or send me an email for a copy.)

A field experiment was established in spring 2015 in Mount Vernon, WA testing five biodegradable mulches laid each spring and incorporated each fall until 2018. Pie pumpkin was grown in summers of 2015 and 2016, and sweet corn was grown in summers of 2017 and 2018. Winter wheat was seeded as the cover crop in winters 2015 to 2018 and was allowed to self-seed with mowing in 2019 and 2020. After harvest of vegetable crops each fall, mulches were rototilled to a depth of 6 inches. Plots were again rototilled in spring in preparation for planting. Following harvest of the last crop in 2018, the plots were left undisturbed with occasional mowing of volunteer wheat and weeds in 2019 and 2020.

One soil sample from each plot was collected starting in fall 2016 and then in 6-month increments until fall 2020, such that the final sample was collected 60 months after the first mulch incorporation. Each sampled area was marked and excluded from subsequent sampling. For each sample, soil was collected from a 1 m × 1 m area centered in the bed width to a depth of 6 inches using a shovel. Mulch fragments were recovered by wet sieving each soil sample using a 2.36 mm sieve, then mulch fragments were air-dried in the laboratory until they reached a constant weight. Percent mulch recovery was based on the weight of mulch applied to and recovered from a 1-m2 area in each replicate plot.

In-field degradation and mulch recovery

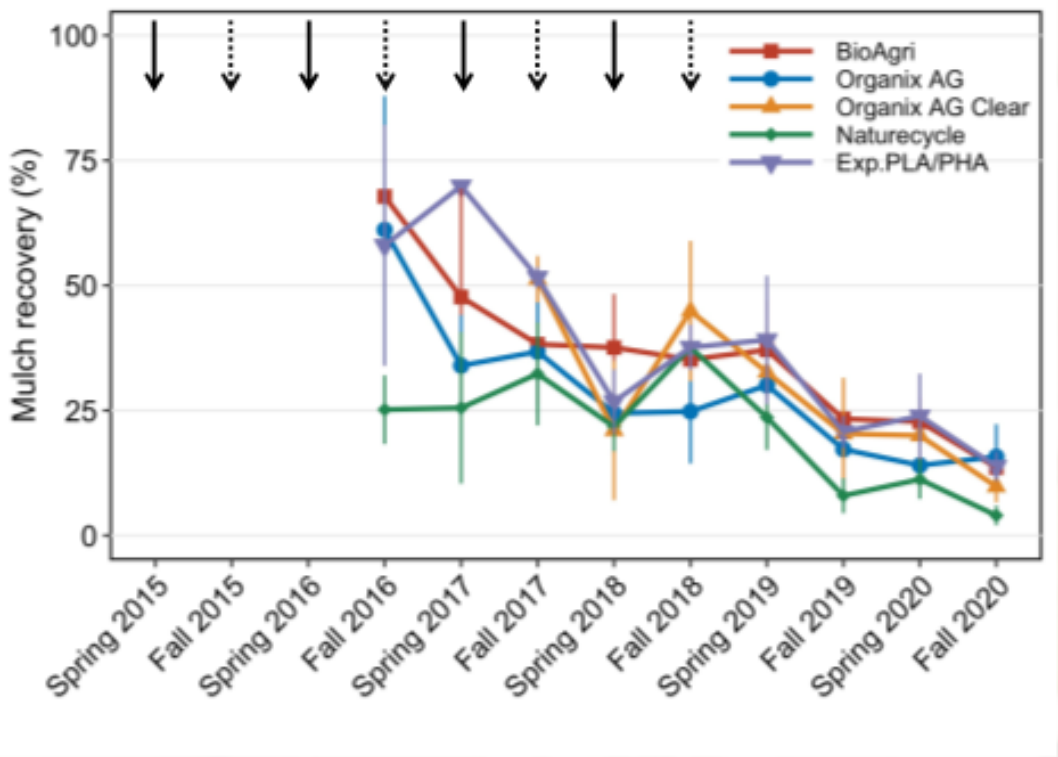

Figure 1. Percent recovery of mulch fragments collected from the field from 2016 to 2020. Points are the mean of four replicates and errors bars are standard deviations. New mulch films were laid every spring from 2015 to 2018, indicated by solid black arrows. The plots were rototilled twice a year from 2016 to 2018, once in fall before collecting samples, indicated by dotted arrows, and a second time in spring after collecting samples, then plots were left undisturbed until 2020.

From 2015 to 2018, soil-biodegradable plastic mulches were applied every year in spring and incorporated into soil the following fall. If no mulch degradation was occurring, the yearly application of plastic mulch would lead to an accumulation of mulch in soil. However, the recovery of macroscopic mulch fragments from fall 2016 to fall 2018 for the commercial soil-biodegradable plastic mulches used in the experiment shows no increase in mulch recovery, but rather a constant or decreasing recovery (Figure 1). A constant mulch recovery would be expected if input of new mulch each year is offset by the continuous degradation of previously applied mulch. BioAgri, Organix AG, and Naturecycle showed no significant differences in mulch recovery over time during this period. Mulch application ceased after 2018, and the mulch recovery data after that point show a decreasing trend for all treatments. At the last sampling date (fall 2020), five years after the initial application, mulch recovery ranged from 4 to 16% by weight of the total mulch mass incorporated.

Prediction of in-field degradation timing

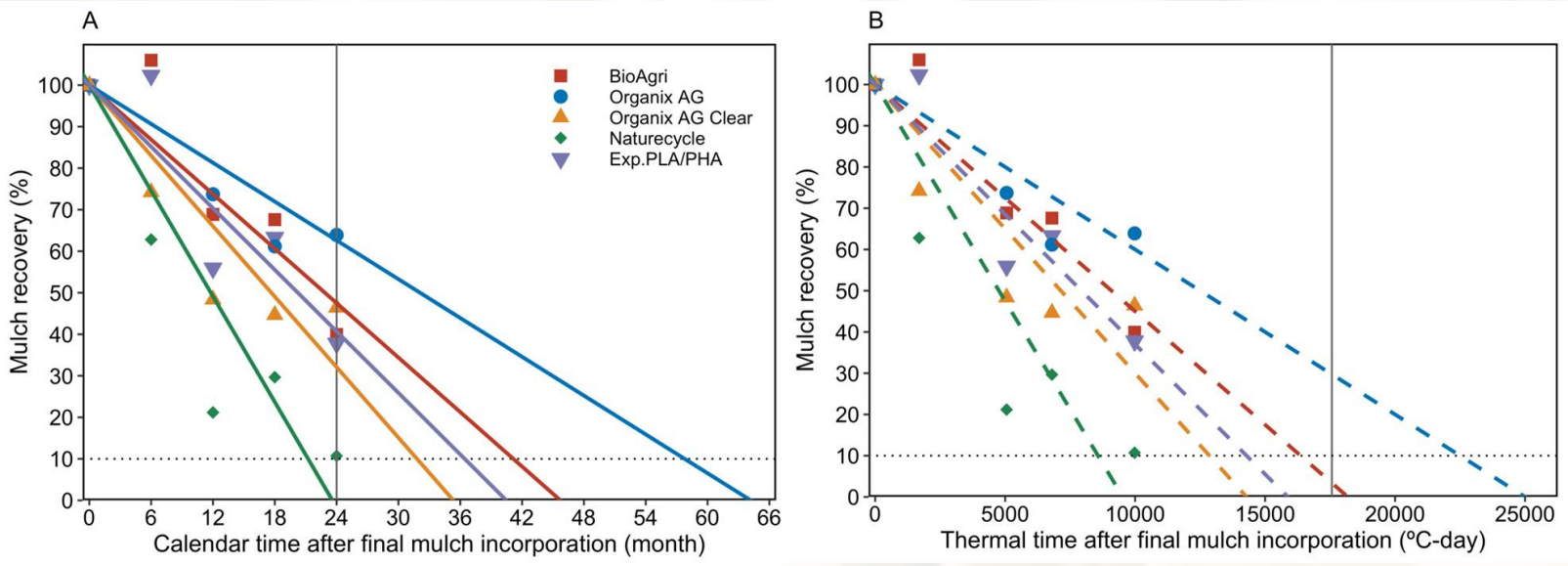

Figure 2. Mulch recovery (%) of five mulch treatments as a function of calendar time (A) and thermal time (B) in two years following the last mulch application. The mulch recovery in fall 2018 was set to 100%. A zeroth-order model (solid and dashed lines) was fitted to the experimental data and extrapolated to obtain the 10% mulch recovery benchmark, indicated by a horizontal dotted black line. The vertical line indicates the point at which 90% degradation would be expected in the laboratory standard in calendar time (A; 24 months) and thermal time (B; 17568 cumulative °C-days in a 24 °C incubation).

The predicted time for mulch treatments to reach 10% recovery (90% mulch degradation) ranges from 21 months for Naturecycle to 58 months for Organix AG. These predicted degradation times are approximately 0.9 to 2.4 times longer than the 24-month laboratory incubation standard test. While standard laboratory tests for soil biodegradation of plastics are done at temperatures prescribed to be between 68 and 82 °F (ASTM-D5988; EN-17033), temperatures in many field soils rarely exceed 68 °F and are also not constant; therefore, biodegradation of plastics under real environmental soil conditions, such as those in our field study, is expected to proceed more slowly than in a standardized laboratory test. However, when the analysis is done with thermal time, better agreement between in-field and laboratory degradation rates is observed. While other factors, including soil type, soil moisture, and mulch fragment size are also at play, thermal time, rather than calendar time, will be more applicable for assessing site-specific, in-field mulch degradation.

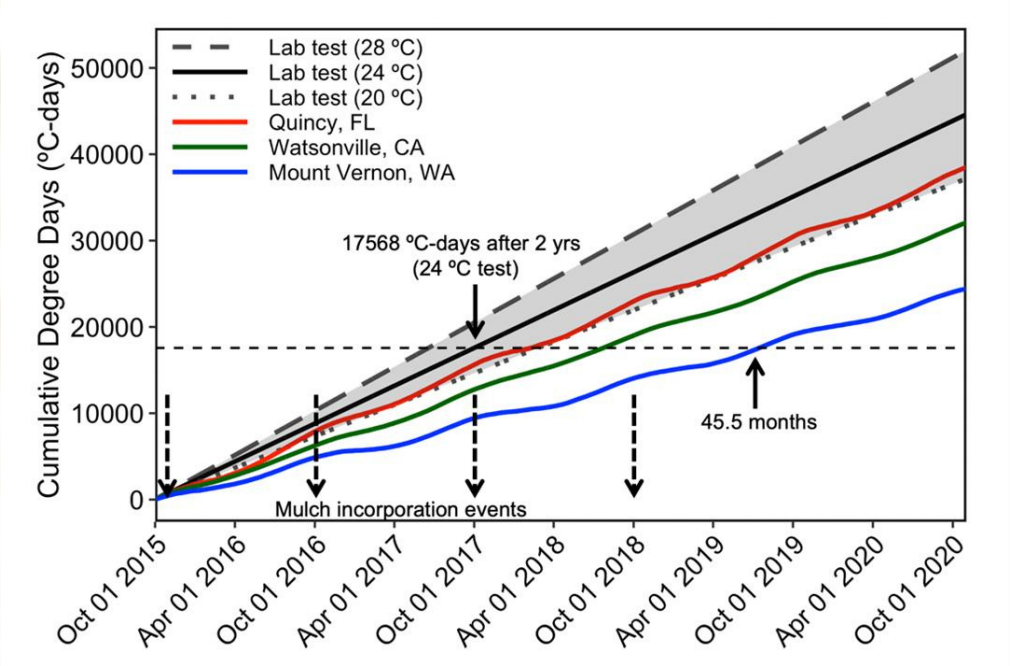

Figure 3. Thermal time (cumulative degree days) based on soil temperature data from a standard laboratory test and three field locations (2-6 inches depth): Mount Vernon, WA (blue); Watsonville, CA (green); Quincy, FL (red). The shaded region indicates the range of laboratory incubation test temperatures (68 °F/20°C - 82 °F/28 °C), with the solid black line representing 75 °F/24 °C. Dashed arrows represent mulch incorporation events at the trial in Mount Vernon. The dashed horizontal line indicates the cumulative degree days after 2 years in a laboratory incubation test at 24 °C, and the 2-year time period is shown by the solid downward arrow. The date at which Mount Vernon reaches the same cumulative degree days is shown by the solid upward arrow.

Average annual soil temperatures (between 2 and 6-inch depth) vary from 50 °F (Mount Vernon), 56 °F (Watsonville), to 67 °F (Quincy). The thermal time for the standard laboratory test at constant temperatures are shown as straight lines, whereas the field sites reveal the sinusoidal seasonal temperature variation. The figure shows that the thermal time of the standard EN-17033 test (17,568 °C-days) would be reached in Quincy, Watsonville, and Mount Vernon after 28.3, 33.8, and 45.5 months, respectively. Biodegradation will take much longer in cooler than in warmer climates, and the laboratory incubation test underestimates the length of time for biodegradation even in warm climates. Only the Quincy, FL site overlaps at all with the rate of degree day accumulation seen in the laboratory test, and then only with the lowest point of the temperature range (68 °F).

Reference to the full article

Griffin, D., S. Ghimire, Y. Yu, E.J. Scheenstra, C.A. Miles, and M. Flury. 2022. In-field degradation of soil-biodegradable plastic mulch films in a Mediterranean climate. Science of The Total Environment 806, 150238. https://doi.org/10.1016/j.scitotenv.2021.150238.

Solid Ground

Solid Ground is wrapping up the winter season with a couple more opportunities for learning before summer whisks us away into its frenzy of activity. We have spent the last couple months exploring topics ranging from running irrigation systems, to the entrepreneurial spirit behind some niche livestock operations, to how to use Every Door Direct Mailing to market your farm business. Many of these were able to be recorded and can be found on our Solid Ground page here: https://newfarms.uconn.edu/solid-ground-videos/

One special series we have been working on is our Farmer's Stress and Solutions webinar series. A new initiative for Solid Ground, we explored with fellow farmers, from out of state and within the state, some of the commons stresses that we as farmers are facing and how to deal with that stress which seems to be relentless. A three webinar series, covering issues such as raising a family and farming, being able to identify success for your farm, and farming in an urban environment (to name a few), the final session will be taking place March 8th from 7-8:30: What to Expect if you want to see a Therapist. Want to join us? You can sign up here: s.uconn.edu/farmerstressandsolutions

For the event, join therapist, and other half of Truelove Farm, Alana DiPesa, LCSW, and farmer Becca Toms (who also works at UConn Extension) as they talk about what you can expect if you'd like to see a therapist. Becca will talk about what it was like for her the first time she went to a therapy, some difficulties she faced along the way, and how she eventually found a therapist that helped her through some challenges.
Alana will discuss the process from a therapists point of view: what can you expect when you are reaching out to a therapist, how to deal with insurance, different approaches to therapy, and her perspective on what therapists want to provide for clients.

This series was put out with support from CT Dept. of Agriculture and recordings of the series will be on the Solid Ground website after the fact. This webinar series is open to all, but all participants will be completely anonymous to other attendees.

Please see the following two pages for infomation on upcoming and previously recorded classes, and don't forget to check out the rest of this season's trainings at https://newfarms.uconn.edu/solidground/

Solid Ground Ag Mechanics

Agroecology

SOLID GROUND
A Program Of UConn Extension

AGROECOLOGY SERIES

ON-FARM COMPOSTING

TUESDAY JANUARY 25TH, 2022
FIND THE RECORDING ON OUR WEBSITE!
PRESENTERS; YOKO TAKEMURA + ALEX CARPENTER
ASSAWAGA FARM

Building biologically active compost on small farms Yoko and Alex will share their composting system, which uses very basic tools with a low starting cost. This method produces high quality compost that is used in small amounts for ongoing inoculation of the soil rather than to boost OM% or add significant amounts of nutrients. It is also excellent material to make compost extracts, teas and/or feeding worm bins.

NO-TILL FIELD DAY

SATURDAY MARCH 26TH, 2022
WAITLIST ONLY! 1:00-4:00PM
TOBACCO ROAD FARM - LEBANON, CT
PRESENTER; BRYAN O'HARA
AUTHOR; NO-TILL INTENSIVE VEGETABLE CULTURE

Bryan will provide mountains of details on agricultural techniques and will also demonstrate specific equipment adapted for No-Till operations. These specialized tools will be absolutely game changing for saving on labor and maximizing efficiencies on your farm.

ECOLOGICAL GROWING

SATURDAY APRIL 2ND, 2022
1:00-3:00PM REGISTER ON SOLID GROUND
HIGH HILL ORCHARD - MERIDEN, CT
PRESENTER; WAYNE YOUNG

Explore how ecological growing can be implemented to support reduced or no pesticides use operations. Learn how building soil health leverages other natural systems in order to manage pests and environmental challenges.

These trainings are supported by the National Institute of Food and Agriculture, U.S. Department of Agriculture, under award number 2020-70017-32733.

USDA

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EXTENSION

Variety Selection for the Vegetable Grower

Jacqueline Kowalski, Associate Extension Educator, Urban Agriculture, Fairfield County

Variety selection is critical to all growers regardless of scale or market. Seed catalogs and growers' expos highlight new varieties each season as seed breeders continue to develop new varieties that meet current needs and market expectations. Ultimately, variety selection is based on the needs of the grower to fulfill the requirements of their market and consideration of all who interact with the crop from the farmer to the end-user. Selection consideration criteria should include:

Yield
Is the yield potential of the variety you are considering more or at least as much as your current selections? It is important to remember that yield potential can vary from actual yield based on weather and local conditions.

Days to harvest and seasonality
When do you need the product to meet a contract or go to the market? If a growing late season planted crop, are you likely to be able to harvest before the end of the season? Are you able to utilize different varieties to extend the growing season? Days to harvest listed on seed labels use traditional planting dates for the crops. Actual dates to harvest may vary from expected days to harvest depending on environmental conditions.

Disease and pest resistance
One facet of integrated pest management (IPM) in produce production is the selection of pest and disease resistant/tolerant varieties. If all other factors are equal, varieties with resistance/tolerance may produce more marketable products and save labor/money due to fewer management concerns.

Market acceptability
Each variety planted requires acceptability to all of those on the market continuum, which could include the farmer, farmworker, shipper, processor, and end-user. Each market has different standards and requirements that need to be met. Does the variety meet the requirements needed? A tomato variety destined for processing will need different qualities than those sold for fresh market.

Plant traits
Does the variety perform better when trellised or pruned? Where on the plant does most of the fruit form? Do the harvesting requirements fit with your staffing or current machinery? Ease of harvest is important when selecting varieties whether mechanically or hand-harvesting.

Horticultural traits
Does the variety taste good? Is the color, shape, or size appropriate for your market? What is the post-harvest quality? Again, the market channel of the produce dictates the required traits.

Climate adaptability
Of increasing importance is climate adaptability. Can the variety withstand temperature or weather extremes? It is resistant to cracking in the event of excessive rain. Continued variability in weather may lead you to make different choices in variety selection.
The results of university research variety trials provide non-bias research results. Regional guides, such as the New England Vegetable Management Guide provides detailed growing information and lists of commonly grown varieties best suited for the region. Some seed companies also engage in variety trials and may publish their data and results. Some may also have field days that are open to the public. If there is a variety that you are interested in, trialing on your farm for a couple of years will provide an indication of performance on your site.
Growers may experience continued delays with seed orders this season so if you have not gotten your seed orders in, do so as soon as possible.

Success with Laser Scarecrows in 2022

Tuesday, March 22, 2022|9:00 am until 10:30 am|Online via Zoom
Free!

Frustrated with bird control on your farm? Curious about what laser scarecrows are or how to optimize their set up? The University of Rhode Island and Cornell Cooperative Extension have teamed up to share their research and on-farm experiences using the University of Rhode Island laser scarecrow which utilizes a constantly moving green laser beam to scare birds away from fields. Join us for this online event!

Newly improved laser scarecrow kits will again be available for 2022 for those who wish to partner with our research. This workshop will feature a presentation by Rebecca Nelson Brown and David Brown of the University of Rhode Island about the laser scarecrow and what improvements have been made for 2022. Cornell Cooperative Extension Educators Chuck Bornt and Julie Kikkert will share their experiences testing the devices on New York farms. We will also open the floor to cooperating growers to share their tips for success on the farm.

COST AND REGISTRATION:

This online event is FREE! Registration is required to receive the Zoom link. The link will be in your confirmation email. Register at https://cvp.cce.cornell.edu/event.php?id=1632

MORE INFORMATION:

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University of Rhode Island
brownreb@uri.edu or 401-874-2755

Julie Kikkert
CCE Cornell Vegetable Program
jrk2@cornell.edu or 585-394-3977 ext. 404

Chuck Bornt
CCE Eastern NY Commercial Horticulture Program
cdb13@cornell.edu or 585-859-6213

Important WPS information for growers from CT DEEP

Christina Berger, Environmental Analyst II, Pesticides Management Program
Bureau of Materials Management and Compliance Assurance
Department of Energy and Environmental Protection
79 Elm Street Hartford CT 06106-5127
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The Pesticides Management Program at DEEP is gearing up for pesticide inspections for this year and have been visiting vineyards early this season. One thing that we have found is that some farms still are not in compliance with the Worker Protection Standard, and seem to have very little knowledge of the requirements for that. Even if the farm is not using Restricted Use pesticides it works out that they probably do need to have someone on the farm certified as a Private Applicator to be able to do training of handlers and workers and for following other provisions of WPS.

Connecticut is one state that does not allow train-the-trainer, to implement this training, instead the person must have a Private Applicator or Supervisory (any) pesticide certification to be able to train workers and handlers under the WPS.
Farms need to follow the WPS if the farm is using pesticides (organic or non-organic) to grow crops. They can determine this requirement directly from the pesticide label if it has the "Agricultural Use Requirements" statement.

Connecticut Farm Risk Management Updates

UConn Extension offers a variety of informational webinars and pre-recorded videos regarding farm risk management, focusing on crop insurance, farm success, benchmarking, soil health, and much more!

Publications are also available for download, including the Connecticut Agricultural Business Management Guide, Financial Assurance for Connecticut Farmers, and a list of UConn Extension specialists.

Visit https://ctfarmrisk.extension.uconn.edu/

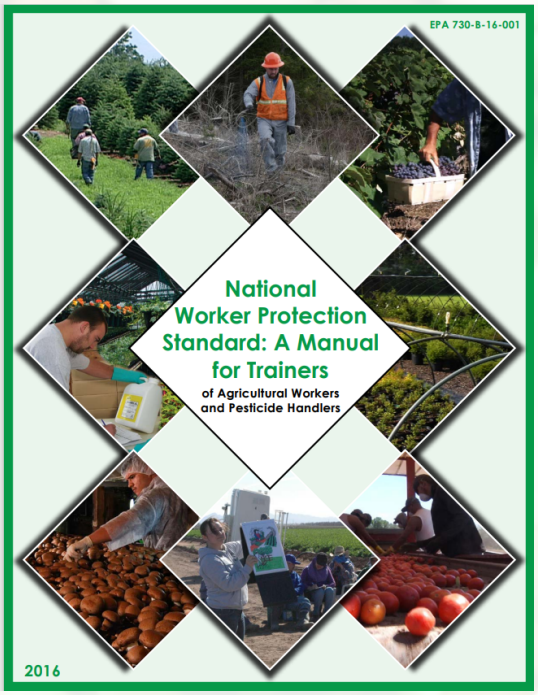
-or-

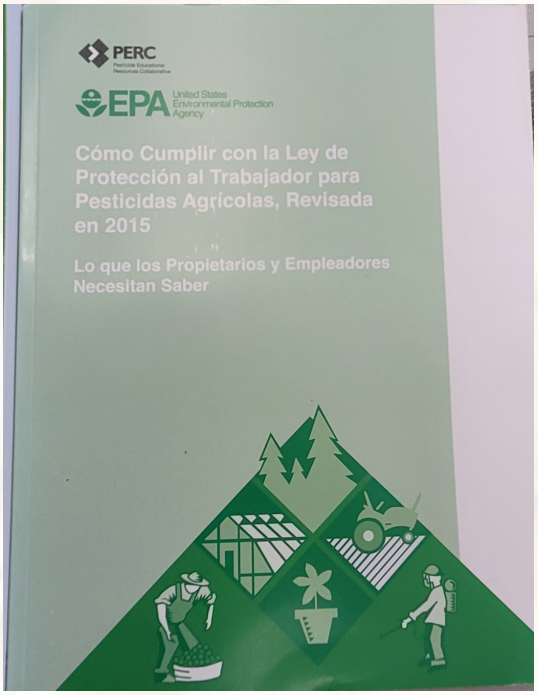
contact Joseph.Bonelli@uconn.edu for more information!

Free Pesticide Educational Resources Available

Items are available in English and Spanish and include:

- National Worker Protection Standard: A Manual for Trainers of Agricultural Workers and Pesticide Handlers
- EPA How to Comply With the 2015 Revised Worker Protection Standard For Agricultural Pesticides
- Workers Protection Standard Handbook for Agricultural Employers
- Pesticide protection laminated posters (small or large)





These free materials are available for pickup in the Extension Office at Tolland Agricultural Center or can be shipped at your own cost. If you are interested in having these items shipped, please reach out to Frances.Champagne@uconn.edu for an estimate of the shipping cost.

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