ILLINOIS
Pesticide Review
News About Pesticides & Regulations

January/February 2022 *Volume 35, No. 1*

In This Issue

PSEP Educators Participate in Pesticide Safety Education/ Regulatory Update Workshop

Hawaii Department of Agriculture, University of Hawaii, and the National Pesticide Safety Education Center recently welcomed pesticide educators and regulatory officials from around the country to Honolulu, Hawaii, to participate in their Pesticide Safety Education and Regulatory Workshop. This unique opportunity provided participants with several hands-on training exercises and the framework to replicate them in their states and regions.

Photo 1. Hands-on respirator fit-testing demonstration

Session topics included: respiratory protection, respirator compliance within the Agricultural Worker Protection Standard (WPS), sprayer calibration tools, pesticide toxicity and exposure reduction, and closed transfer systems for pesticides. Many of the educators in attendance appreciated the opportunity to participate in mock pesticide storage and WPS inspections. The view from a regulatory perspective will help PSEP educators provide real-world compliance assistance recommendations to our clientele. The group also shared some of the challenges and solutions many stakeholders have faced with pesticide regulatory compliance.

Illinois Extension
UNIVERSITY OF ILLINOIS URBANA-CHAMPAIGN

College of Agricultural, Consumer and Environmental Sciences

University of Illinois . U.S. Department of Agriculture Local Extension Councils Cooperating

Photo 2. Food and food containers found in a pesticide storage shed during a mock inspection

Closing sessions focused on a collaborative discussion that helped identify needs and priorities for future pesticide safety education workshops. The educators in attendance have already discussed plans to hold a similar training program in the north-central region.

Travis Cleveland

Farm Stress, Recognizing Symptoms, and Finding Assistance

Not to sugar coat anything, but farming is stressful. The growing season may be short but the pressures are constant and uncontrollable. Farmers must consider the environmental and economic impacts. In addition, the timing of pesticide applications, dealing with unpredictable weather, pesticide drift concerns, and machinery breakdowns are a few more items that weigh on minds. Farmers are also coping with rising input prices as well as the fluctuation of commodity prices. This only compounds the difficulty for farmers.

The centers for disease control stated that suicide rates are higher for farmers than any other occupation. Josie Rudolphi is an assistant professor of agricultural and biological engineering at University of Illinois. Through her research, Rudolphi has found that up to 60% of young farmers reported mild symptoms of depression and 70% reported mild anxiety. It is no wonder there is stress as the agricultural landscape has changed rapidly in past decades, leading to a lot of uncertainty. Farmers are aging – 62% of Illinois farmers were 55 or older, according to the USDA 2017 Census of Agriculture. Farming business management has evolved to more intense responsible practices and farmers are pressured to keep up with technological and production advances. This is compounded with factors involving everyday family life, health concerns and financial worries. So it is no wonder the National Safety Council ranked agriculture as one of the top two most hazardous occupations.

Chronic stress can take a huge toll on a person's physical and mental health. It can lead to depression, anxiety and even suicidal thoughts or actions. Prolonged stress can change the brain's structure and how it functions, which can lead to impaired thinking. Poor decisions when farming can lead to injury or more undue stress.

Some symptoms of stress include:

- **Physical** – Muscle aches, frequent headaches, frequent upset stomach and fatigue.
- **Behavioral** – Difficulty sleeping, irritability and easy to anger, inability to focus, difficulty making decisions and increased use of alcohol/drugs.
- **Emotional** – Feelings of anxiety, panic, frustration, impatience, restlessness, isolation, hopelessness and discouragement.
- **Relationships** – Communication difficulties and maybe conflict with family members and friends, strained interactions, avoidance of others and verbal or physical outbreaks.

Everyone handles pressure and copes with stress differently. Feelings of emotional distress, anxiety, depression, anger, suicidal thoughts, and substance abuse are all potential

warning signs. Sometimes people aren't aware of the warning signs, some ignore them, and some have become so accustomed to them that they don't realize the danger they are in. Others may be concerned about mental health stigmas.

People in rural communities are willing to help others, but rarely ask for favors or seek professional help. It is not always easy or comfortable to ask someone how someone is doing in stressful times, but more often than not, people will feel relieved that someone noticed, that someone cares. This might be all it takes.

And farmers want information from their innermost circles, their trusted friends and family members. But if that does not feel appropriate, a doctor or local health department can provide information, treatment or referrals. If you run into difficulty or resistance, suggest and accompany the person to a professional such as a clergy member, health-care professional, law enforcement agencies, and local counselors, social workers or other mental health professionals.

In severe or life-threatening situations where there is imminent danger, call 911, drive them to someone they trust, but please don't leave them alone.

Resources

- National Suicide Prevention Lifeline: 1-800-273-8255
- National Suicide Prevention Crisis Chat: https://suicidepreventionlifeline.org/talk-to-someone-now
- Crisis Text Line: Text "GO" to 741741
- Veterans Crisis Line: 1-800-273-8255 or online chat
- Farm Aid Farmer Hotline- 1-800-FARM-AID (1-800-327-6243)
- Avera Farm and Rural Stress Hotline: 1-800-691-4336
- Greater Chicago/Illinois Chapter of American Foundation for Suicide Prevention: (312) 890-2377
- National Alliance on Mental Illness Helpline: 1-800-950-6264
- Substance Abuse and Mental health Services National Helpline: 1-800-662-4357
- The American Institute for Stress: www.stress.org
- National Institute of Mental Health: www.nimh.nih.gov

The original article, "Farm Life is Uncontrollable, Know the Warning Signs of Stress" was adapted by Maria Turner with permission by its authors Douglas B. Gucker and Emily Steele.

EPA Allows Ingredient Substitutions to Minimize Pesticide Supply Chain Disruptions

Since 2020, we have all experienced supply chain disruptions in many industries caused by Covid related restrictions, severe weather, cyber-attacks or a barge stuck in the Suez Canal. Unfortunately, this may be a continuing concern for pesticide applicators and operators in 2022.

Pesticide operators and applicators have experienced supply chain disruptions causing shortages and delays of goods including personal protective equipment, application equipment parts, containers and packaging materials. There have also been shortages and delays in receiving pesticides because certain active or inert ingredients are not available.

One pesticide component that has been in short supply is propylene glycol. Propylene glycol is a chemical used in both active and inert ingredients of pesticides, including herbicides, fungicides and insecticides. In hopes of circumventing supply chain

disruptions and pesticide shortages, EPA has allowed certain compounds that are similar to propylene glycol to be used in its place. Chemical substitutions must meet the following criteria:

- "Serve the same function in the product as propylene glycol;
- Maintain the validity of product-specific data submitted in support of the registration;
- Maintain the product's acute toxicity category and physical/chemical characteristics such that no label modifications are required; and
- Maintain the product's fitness for its intended purposes in terms of efficacy, phytotoxicity, and any other factor."

Currently, EPA is allowing the use of glycerin, diethylene glycol, ethylene glycol and/or 1,3-propanediol to be used in place of propylene glycol.

These substitution allowances were originally put into effect in July, 2021 and intended to remain in place until Dec. 31, 2021. However, in December, 2021, EPA decided to extend these substitution allowances until Dec. 31, 2022.

References:

US Environmental Protection Agency. Jan. 20, 2022. EPA Extends Flexibilities to Minimize Supply-Chain Disruptions Facing the Pesticide Industry. *https://www.epa.gov/pesticides/epa-extends-flexibilities-minimize-supply-chain-disruptions-facing-pesticide-industry*

US Environmental Protection Agency. Guidance Documents for Inert Ingredients. *https://www.epa.gov/pesticide-registration/guidance-documents-inert-ingredients*

Sarah Hughson

Laundering Pesticide-Contaminated Clothing – New Research Available

Your work clothes may be more exposing than you realize. Of course, I am referring to the potential exposure to pesticide residues lingering within the fabrics. While not officially considered as Personal Protective Equipment (PPE), most pesticide labels require the use of a long-sleeved shirt and long pants. Since these items are not officially PPE, employers aren't responsible for their use or care. You are. What clothing do you typically wear when using pesticides? What's the fabric type? Cotton? Polyester? Denim? Jeans are pretty popular. How soon after using pesticides are they washed? Are you washing them or is someone else and do they know how to safely and properly handle them? Do you wash your pesticide contaminated clothing daily and separately from other clothing?

Laundry tends to be a mindless task but if you apply pesticides for a living, you should reevaluate your practices to minimize pesticide exposure. Fortunately, new research is available on removing pesticide residues from clothing.

The recommended laundry procedure, across the nation, was based on laboratory research from the 1980's to early 1990's. It was modified over time with limited later research and in Illinois, our recommendations have gone a few steps further even. While this recommended procedure is sound, washers, detergents, and fabrics have changed considerably with time. Overall, this laundering process involves a lot of water when many currently available machines are high efficiency (HE). New machines have mandated energy saving settings and use less water and lower temperatures. Water saving settings may not be adjustable. Research has demonstrated that lowering water quantity and temperature likely will

reduce the effectiveness of pesticide removal from clothing. Less water means transfer to other items in the load can occur. Many new machines don't have agitators, but is agitation needed? With detergents, new improvements have been made in their ability to tolerate hard water, disperse contaminants and break down quickly after use but phosphates which were once used to break down oil and grease have now been removed. HE machines require low-sudsing soap. While recommended, "heavy duty" isn't really a prominent description found on most detergent labels. Nowadays, pods (encapsulated, highly concentrated liquid detergents in water-dissolvable pouches) are widely used, but are they effective in removing pesticides from fabric? Lastly, there is a lack of information on newer breathable fabrics. Athletic style shirts (polyester/cotton blends) are popular but they simply haven't been tested with pesticides. Are the current recommendations appropriate given the changes that have occurred since the 1980's research was conducted?

Multi-state applicator surveys have been used to indicate trends and help guide pesticide safety educators. From these, we know that the majority are following most of these guidelines, but there is still room for improvement. Nearly a third reported that they washed clothes weekly rather than daily and a little less than a quarter reported that items were not separated from the family wash. Additionally, results indicate that HE machine use has risen as expected.

In 2016, Pesticide Safety Educators from various states compiled what we knew about washing pesticide-contaminated clothes into a publication. This publication also brought to light all that we didn't know. More research was needed and our colleagues from Colorado and Wyoming got right to work. Recently, their research article, "Comparing the Removal of Pesticide Residue from Clothing with Different Washing and Drying Methods," was published in the Journal of Pesticide Safety Education. This study involved several factors including pesticide formulation type, application rate, washing machine type (full-fill agitator vs. HE), clothing type, and drying method. To test for the transference of pesticide from work clothes to the other family laundry, an uncontaminated baby Onesie® was included in each load.

In addition to some of the questions previously discussed, the researchers also considered:

- Are the temperatures hot enough?
- Does fabric type matter? For example, does cotton wash better than a cotton/poly blend?
- Do any residues remain in the washer or dryer after use? Is it still necessary to run an empty cycle and if so, should bleach be added as research has shown it can deactivate certain pesticides?
- Can line drying be effective if it occurs in a basement or is ultraviolet light (UV-B) light needed? Fresh air and sunlight could further break down pesticides. Previously, this was theorized but never actually studied.

In this study, the researchers selected pesticide products that were commonly used and labeled for multiple application sites to represent a broad range of applicator types. Different formulations were selected:

- permethrin insecticide as Perm-UP 3.2EC, containing petroleum distillates which cause difficult to remove stains as oil is resistant to water.
- carbaryl insecticide as Sevin XLR Plus, which does NOT contain petroleum distillates.
- 2,4-D herbicide as Shredder LV4 Ester, which contains petroleum distillates. Research has shown that the ester formulation of 2,4-D is more difficult to remove from clothing than the amine formulation.

Each product was applied at 2 rates: 1X to represent a single application at the maximum labeled rate and 9X to represent multiple

applications or a spill of diluted spray. To achieve the 9X rate, clothing items were sprayed nine times with the 1X solution. Clothing types included a long-sleeved work shirt, a pair of jeans, two long-sleeved T-shirts, and a baby Onesie®. All items were 100% cotton with the exception of one T-shirt that was a 50/50 cotton/poly blend.

It was thought that a heavier weight fabric would provide better protection so weight was considered during selection. Of the fabrics used, the jeans were the heaviest weighing roughly double that of the other fabrics. But when considering threads per inch, the work shirt was the highest with a tighter weave (almost double) than that of the jeans. While heavy, the jeans had fewer threads per inch with a greater yarn size. Both the work shirt and jeans were cross-woven fabrics with two separate threads woven together. All t-shirts and Onesies® were made of a single, continuous thread (knitted).

The clothes and cut out swatches were laid out on turf and sprayed with a wet boom on a backpack sprayer. Once the clothing had dried, they were placed in plastic bags for transport to be washed. Exposed fabric swatches were included to assess the concentration prior to washing. Pesticides were extracted using methanol and analyzed using a mass spectrometer.

Two washing machines were used in the study: one HE and one agitator. The HE used less than half the total water of the agitator, and less than 1/3 of the hot water of the agitator. Appropriate cycles were selected for each machine but the HE wash cycle also included a pre-wash and an extra rinse. These extras were not options in the agitator washer or they would have been included in the study.

Clothing being sprayed in the study. Source: Thia Walker, Colorado State University.

The researchers indicated that while detergent options are numerous, they had trouble finding products that claimed to be "heavy duty". Persil ProClean 2 in 1 detergent was chosen based off high *Consumer Reports* (2016) ratings and good product availability in stores. A set amount of this detergent was used in each load in the study but additional detergent was required for the HE's prewash cycle. Each machine was cleaned after the wash cycle by running an empty load using detergent and ½ cup of bleach.

Previous research determined that a temperature of 140F was more effective in removing pesticides than lower temps of 115F, but on average, machines these days do not get that hot. In this study the on-demand water heater was placed within 6 ft of both washers and set to 120F per manufacturer instructions. Water temperature was measured throughout the cycles but 90F was the highest temperature reached. They discovered that while filling with hot water, some cold water was mixed in too. Unfortunately, this could not be adjusted. Washers were swabbed to check for pesticide residues after the washing cycle and again after running a cleaning cycle (no clothing) using detergent and bleach.

High heat was used with the machine dryer for 40 minutes or until dry. The dryer was swabbed after the cycle to check for pesticide residues. For line drying, the time was the same. Additional samples were exposed to UV-B for the same amount of time. The dryer temperature was measured at each minute of the cycle. The average peak temperature of 138F was reached at about 25 minutes, and then started to decline again. Here again, 140F was not reached.

Provided here is a brief summary of findings. For specific details, please read the journal article. It's important to remember that this study looked at only 3 different pesticides at 2 different rates and not all pesticides may be removed from clothing with a similar efficiency. Due to difficulties encountered in the lab analysis of the 2,4-D samples, some results were not presented and that portion is being repeated.

For washing, both machines were effective but how well they worked depended on the fabric. The jeans had the highest level of residues regardless of washing or drying method. Remember the jeans weighed the most. The researchers indicate that heavier fabric may allow for deeper penetration of pesticides. Residues on the washer drum were detected at times and the empty bleach cycle helped to remove them. **All pesticides were transferred to the baby Onesie which is alarming.**

For drying, the results of this study suggest it is not possible to generalize that specific drying methods will further reduce pesticide residues. Each pesticide had different results. The authors suggest that convenience be the determining factor in choosing a drying method. Additionally, they determined that UV-B can further reduce some pesticide residues after washing but it appears to be dependent on active ingredient.

The general recommendations from this study mostly align with past recommendations. It is good to learn that both machine types were effective as HE washers are commonly used and fewer options exist for agitator washers. Continue to use the heaviest cycle with the most water possible. Supplementing with a pre-wash and extra rinse may be more effective even. Don't delay washing pesticide contaminated clothing. Preliminary observations with 2,4-D ester in this study suggested that delaying may result in more pesticide being absorbed by the clothing. So clean PPE immediately after use each day. Running the machine empty on a cleaning cycle with bleach is best to help remove any lingering residues. A dryer or clothesline can be used and always keep your pesticide contaminated clothes separate from all other clothing!

Finally, a big take away from this study is that applicators should avoid wearing 100% cotton jean type materials when applying pesticides. If choosing to wear them, applicators should consider an additional protective layer in the form of waterproof/ rain pants or chemical-resistant chaps. Other options include applying starch to form a repellent surface, however, starch must be reapplied after each washing. Starch was not included in this study. Possible alternatives to jeans include ripstop fabric, Teflon-coated pants that are water, dirt and oil resistant.

To further summarize all recommendations, *when washing pesticide contaminated clothing*:

- Keep it separate from family laundry while washing or storing to avoid transferring residues to uncontaminated clothing.
- Handle with unlined, chemical-resistant gloves.
- Wash soon after use, at least daily.
- Don't pack clothes too tightly. (Fill to no more than 50-75% clothing capacity.)
- HE or full-fill agitator washing machines may be used.
- Prewash or presoak using hot water if possible.
- Wash using hot water. (Hot is more effective than warm which is more effective than cold.)
- Use the longest or heaviest wash cycle with the highest water level, for at least 20 min.
- Rinse using hot water, if possible. (If cold, then rinse twice.)
- Use a high-speed spin cycle or increase spin time if possible.
- Use liquid or granular detergent that is

heavy duty or of high quality. (Detergent labels may not directly state this.)

- Multiple launderings remove more pesticide residues from clothing.
- Run an empty cycle with detergent and bleach.
- Line dry outside if practical. Otherwise, line dry inside or use an electric dryer.
- Starch clothing for added stain protection. (Starch coats fibers.)
- Discard any clothing contaminated with liquid concentrates or highly toxic pesticides.

Consider that last bullet carefully and plan accordingly. Even with proper laundering, enough residues can remain in the fabric to be absorbed through the skin. Accidents happen so don't wear your favorite concert T-shirt while measuring liquid concentrates or applying highly toxic pesticides. Instead, wear only items you can part with in the event of a spill.

Michelle Wiesbrook

February is National Pesticide Safety Education Month

NATIONAL PESTICIDE SAFETY EDUCATION MONTH

The purpose of National Pesticide Safety Education Month is to reinforce core principles of safe pesticide use with many audiences and raise awareness of and support for the land-grant university Pesticide Safety Education Programs (PSEPs).

The National Pesticide Safety Education Month webpage contains a quiz to check your knowledge of some basic pesticide safety principles and a self-assessment to review some of your own pesticide safety practices at home and at work. You can also view a sample of educational resources produced by land-grant university Pesticide Safety Education Programs and learn the importance of these programs.

https://pesticidestewardship.org/national-pesticide-safety-education-month/

The development and/or publication of this newsletter has been supported with funding from the Illinois Department of Agriculture.

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