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Understanding Tank Mixing: Benefits, Challenges, and Best Practices

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Tank mixing involves combining multiple crop protection products into a single spray application. This method offers several benefits:

- Saving time and reducing application expenses.
- Controlling a broader spectrum of pests.
- Enhancing the efficacy of active ingredients.
- Reducing the risk of pest resistance.
- Allowing mixing with fertilizers.

However, tank mixing also presents challenges, particularly regarding potential incompatibilities among the mixed components.

Types of Incompatibility

Incompatibilities in tank mixing can be physical or chemical. Physical incompatibility occurs when ingredients do not mix well. This can lead to issues like sediment formation, clumping, excessive foaming, and separation of the spray mix into layers. Physical problems demand time and labor-intensive remediation. They can also result in additional expenses for cleaning sprayers and safely disposing of residues.

Chemical incompatibility refers to adverse interactions among components. In these cases, constituents of the mixture react chemically to form new, unlabeled, or unknown substances. Chemical incompatibilities might not always be immediately apparent. While the products may blend effectively in the spray tank, their combination could reduce efficacy, necessitating additional applications, or even cause visible crop injury, such as scorching or bleaching.

Common Mistakes and Best Practices

Several common mistakes can occur during the tank mixing process. These include:

1. **Not following label instructions**. The pesticide label is not just a piece of paper to be glanced at; it is a vital roadmap for proper application. Before mixing any chemicals, thoroughly review the label for crucial information. Pay attention to the recommended carrier volume, adjuvants and agitation requirements, temperature sensitivities, water pH considerations, and any prohibitions on tank mixing certain products. Follow these instructions diligently to ensure each application is a success.
2. **Not thoroughly mixing products before use**. Certain pesticide formulations are prone to separation if left undisturbed for extended periods. It is imperative to ensure thorough mixing of these products before use to achieve uniform distribution of the ingredients. Look for statements such as "shake well before using" or similar language on product labels.
3. **Using insufficient water volume during mixing**. Using a lower than recommended water volume can create a concentrated mixture that completely saturates the water, causing the active ingredients to precipitate out of solution. To prevent this and ensure optimal solubility of the pesticide(s), always adhere to the prescribed minimum water volume listed on the label.
4. **Adding pesticide products too quickly**. Patience is a virtue when it comes to tank mixing. Pesticide products do not dissolve instantly, especially in cold water. Allow sufficient time for each product to fully incorporate into the solution before adding additional products. For dry formulations, wait at least 3-5 minutes after adding each ingredient to ensure it thoroughly disperses.
5. **Improper agitation**. Products with dispersed active ingredients will settle out over time if they are not properly agitated in the spray tank. Aim for moderate agitation, indicated by a gentle movement of the spray mixture at the tank's surface. Agitation that is too aggressive (looks like boiling water) can result in foaming or clumping, or cause products to lose effectiveness.
6. **Failing to adjust for the carrier**. Different carriers require varying approaches to mixing. For instance, when using a liquid fertilizer as a carrier it is best to fill the spray tank to 50-75% of the required volume before adding products. A greater volume of solution is needed due to the fertilizer's concentrated salt content, which can affect product solubility. Always account for carrier differences and adjust mixing protocols accordingly to reduce the potential for incompatibilities.
7. **Mixing products in the wrong order**. The order in which pesticide products are added to the spray tank is critical for achieving proper dispersion and compatibility of ingredients. Add products one at a time and in the proper order following label instructions. If no label instructions are provided, use the "DALES" method for adding products (**D**ry formulations, **A**gitate each product addition, **L**iquid flowables and suspension concentrates, **E**mulsifiable concentrates, **S**urfactants).
8. **Not performing a jar test**. It is advisable to perform a jar test prior to mixing products in the spray tank. Jar tests are particularly important when mixing products in a liquid fertilizer carrier, or when using products that you have not used before. Rather than mixing large quantities directly in the spray tank, the jar test enables you to assess the compatibility of product combinations beforehand on a small scale. Consult product labels for guidance on conducting a jar test. Additionally, you may want to consider using commercial compatibility test kits. These can streamline the process of conducting a jar test and help determine the correct proportions of each tank mix component.

Tank mixing is a valuable strategy in crop protection that offers many benefits when executed correctly. However, it requires careful consideration of potential incompatibilities and adherence to instructions outlined on product labels. By understanding these factors and following proper procedures, pesticide applicators can maximize the effectiveness of their treatments while minimizing risks to crops, the environment, and their bottom line.

Temperature Inversions and Pesticide Application

Kathleen Miller and Stephanie Blevins Wycoff – Extension Associates, VTPP

Pesticides can move away from the application site and through the environment in different ways.

Examples include hitchhiking on plants, animals, or people, as well as moving with water or air. One specific way pesticides can move is through temperature inversions. Most applicators know there is an increased risk of drift when applying pesticides during windy conditions. However, this same risk due to a temperature inversion often goes unnoticed.

What Is a Temperature Inversion?
A temperature inversion is a weather occurrence in which cool air settles near the earth's surface with warm air above it. This is opposite of typical air layering where warmer air sits close to the earth's surface.

Temperature inversions are most common during the early morning and late evening hours. Because cooler air is denser, in the absence of wind, there is little to no vertical air movement during an inversion. However, lateral or horizontal air movement can still occur.

How Does a Temperature Inversion Form?
A temperature inversion can form when the air near the ground cools more quickly than the air above it. This typically occurs when skies are clear and winds are calm. Low areas like valleys are more prone to temperature inversions because they are often sheltered from the wind and/or sun.

Signs of a Temperature Inversion
One characteristic sign of a temperature inversion is a lack of wind, often called a "dead calm". Also look out for clear skies, the presence of dew, and/or fog in low-lying areas (fig. 1). When conditions seem favorable for a temperature inversion, consult local weather services before making an application.

Figure 1. Horizontal concentration of smoke likely indicates the presence of a temperature inversion (Pat Hipkins, VTPP Digital Media Library).

You can check for the presence of an inversion on your own by deploying a smoke canister. If the smoke rises and disperses into the atmosphere, as shown in the figure below (fig. 2), then conditions are normal. If the smoke concentrates and drifts horizontally (fig. 2), an inversion is likely present.

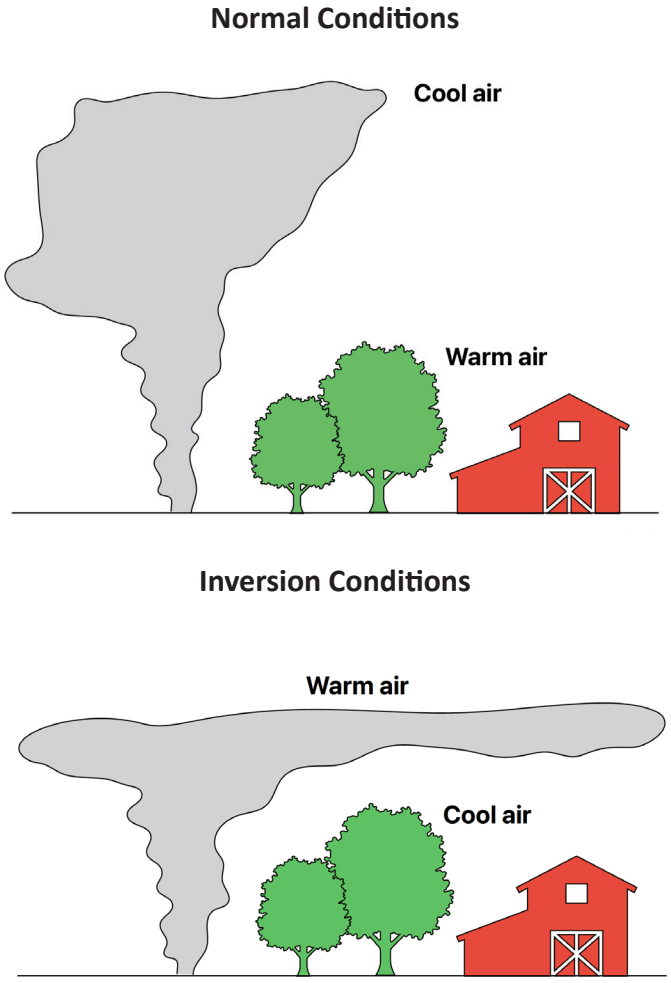

Figure 2. Check for the presence of an air temperature inversion by deploying a smoke canister. If the smoke rises and disperses, conditions are normal. If the smoke concentrates and drifts horizontally, a temperature inversion may be present.

Problems With Applying Pesticides During a Temperature Inversion
If an application is made during a temperature inversion, fine pesticide droplets can become sandwiched between the warm air above and the cool air at ground level. The pesticide droplets will remain suspended above the ground and can drift horizontally, sometimes moving far from the application site. Once the layers of warm and cool air eventually mix, the pesticide will settle, potentially harming sensitive and other off-target areas.

Timing Pesticide Applications to Avoid Temperature Inversions

Following a few simple guidelines can help you avoid spraying pesticides during a temperature inversion.

- Never spray pesticides during a "dead calm." It is best to make applications when winds are light and steady, between 3-9 mph.
- If fog is present in the early morning hours, wait for foggy conditions to dissipate before making an application. Check your local weather service for advisories or special weather statements regarding fog.
- Read the product labels of each pesticide you use. Look for statements regarding temperature inversions (fig. 3).
- Some pesticides are known to be volatile, meaning they can evaporate quickly and turn into a gas or vapor. These product labels will list special directions to avoid spraying during temperature inversions.

SPRAY DRIFT ADVISORIES

TEMPERATURE INVERSIONS

- **Drift potential is high during a temperature inversion. If inversion conditions are suspected, consult with local weather services before making an application.**
- **DO NOT apply this product during a temperature inversion.**
- **ONLY apply this product between one hour after sunrise and two hours before sunset.**
- **The presence of an inversion can be indicated by ground fog or by the lateral movement of smoke from a ground source.**

Figure 3. An example of statements found on pesticide labels regarding air temperature inversions.

For further information on temperature inversions, please visit: https://www.ndsu.edu/agriculture/extension/publications/air-temperature-inversions-causes-characteristics-and-potential-effects.

Blast From the Past

Stephanie Blevins Wycoff – Extension Associate

Mort-O-Mist Aerosol DDT Bomb

The Mort-O-Mist Aerosol DDT Bomb was produced by ASCO Laboratories following World War II (fig.4). Canisters such as these were originally manufactured to protect United States Armed Forces from malaria-vectoring mosquitoes during the war. Countless companies produced similar products and continued to do so after the war ended in 1945. These products were marketed to American consumers to rid their homes of unwanted pests. Company advertisements often

Figure 4. Mort-O-Mist Aerosol DDT Bomb.

emphasized how their products were used during the war. The Mort-O-Mist label states, "The DDT Aerosol Bomb is a highly concentrated insecticide as used by the Armed Forces during the War." Instructions on the container describe how to use the product by pressing the "top of valve with finger and nozzle pointed toward ceiling, spraying for four seconds" to control flies and mosquitoes. The label also describes directing the spray toward baseboards or under sinks for cockroach control.

DDT (dichloro-diphenyl-tricholoroethane) was marketed heavily to American consumers in the mid to late 1940s, and substantial use of pesticides became common during this time. Scientists warned this practice could have devastating effects on the balance of nature. In the late 1950s, a young fish and wildlife biologist named Rachel Carson began researching the effects

of indiscriminate spraying of pesticides on the environment. She later published her findings in a book known as Silent Spring in 1962. Carson's book was an instant sensation across the United States and sparked a movement among the American public to move away from heavy use of DDT. This eventually led to the formation of the Environmental Protection Agency in 1970. DDT was banned soon thereafter.

References

Schmitt, J. E. (2016). From the Frontlines to Silent Spring: DDT and America's War on Insects, 1941-1962. *Concept Interdisciplinary Journal of Graduate Studies*, 39, 1-29.

Program Updates

VTPP Updates

PSEW 2024

The 2024 Pesticide Safety Educators Workshop (PSEW) will be held on Sept. 5 and 6 at the Hotel Roanoke in Roanoke, VA.

This event is for all Agriculture and Natural Resource (ANR) VCE agents who teach pesticide certification prep and recertification courses. PSEW will include important updates from VTPP and the Virginia Department of Agriculture and Consumer Services (VDACS) that you do not want to miss. It has been approved for private applicator recertification and is under review for commercial applicator recertification, Category 10.

The deadline to register for the conference is Sept 1, however the hotel room reservations deadline is Aug 9. There will be no virtual option.

An email with conference and registration details was emailed on June 28 to all VCE ANR agents, VDACS–Office of Pesticide Services personnel, and other constituents. If you did not receive the email and would like more information about PSEW, contact Rachel Parson at rparson@vt.edu.

To register, please visit

- Conference registration: https://www.eventbrite.com/e/2024-virginia-pesticide-safety-educators-workshop-tickets-933538818737
- Hotel registration: https://book.passkey.com/e/50841796.

NOTE: If you plan to attend the Fall Program Team Forum in Charlottesville, VA on Sept. 4 and 5, please contact Scott Barrett at sbarrett@vt.edu for tips on how to fit both events into your schedule.

We can't wait to see you at PSEW 2024!

VTPP Seeks Your Input

To better inform VTPP programming efforts, we have developed two short surveys to gather information about our quarterly newsletter and digital media library. Your responses will help us gauge overall use of these resources and if/how they are being used in Extension programming. Both surveys should take you no more than a few minutes to complete. Links can be found below. The deadline to submit your responses is July 29th.

VTPP Quarterly Newsletter survey: https://vce.az1.qualtrics.com/jfe/form/SV_3KOc9R1hWBq0SDs

VTPP Digital Media Library survey: https://vce.az1.qualtrics.com/jfe/form/SV_9Bl98P0Ycqp8clg

Thank you in advance for your participation!

VDACS Updates

The VDACS Plastic Pesticide Container Recycling Program provides pesticide dealers and applicators with a convenient, cost-effective, and environmentally friendly option for disposing properly rinsed plastic pesticide containers.

What is the Pesticide Container Recycling Program?

The Plastic Pesticide Container Recycling Program is a free service that assists with the disposal of properly rinsed plastic pesticide containers. The program is available to any pesticide applicator or dealer in Virginia and is part of a nationwide effort by chemical manufacturers to reduce the waste generated by disposing of plastic pesticide containers.

What are the benefits to your company?

- Cost savings through waste reduction. (By rinsing your containers, you will save money by using all chemical products.)
- Reduced carbon emissions and environmental protection.

Who can participate?
Many localities, dealers, and applicators (both private and commercial) are currently participating in this program. More than 20 cities and counties have collection sites available for public participation. At the same time, many agricultural pesticide dealers, private producers of agricultural commodities, and commercial applicators (such as golf course applicators, aerial applicators, and management companies) participate by simply storing their empty, properly rinsed containers for annual or biannual collection. For a collection site near you, visit participating localities (virginia.gov).

What do you have to do differently?
Applicators must rinse containers and remove label booklets and caps. To participate, you can either find a collection site near you or can contact the program coordinator at the end of this article. Handlers will store containers on their property in a covered location until the contractor schedules a visit to pick them up. Most participating companies, for example, store their containers in an empty fertilizer bin, stacked on pallets in a warehouse, or in a tractor-trailer van body.

Is there a minimum number of containers required before scheduling a pickup?
The contractor will visit any locaton with at least 500 properly rinsed plastic pesticide containers. Most custom applicators generate that many containers in a very short period in heavy agricultural production applications.

How is the recycled plastic used?
After the plastic is granulated, it is used to manufacture agricultural drainpipes, cinder blocks, fence posts, signposts, industrial pallets, and more.

For more information on container recycling, visit Ag Container Recycling Council (ACRC) (agrecycling.org)

To participate in the program, please contact Marlene Larios at 804-371-6561 or marlene.larios@vdacs.virginia.gov


Dennis Brown, Overlook Farms with recyclable pesticide containers.