



Check spray deposition on the top and bottom of leaves with water-sensitive paper.

When a pesticide doesn't work

By Juanita Popenoe

Editor's note: This article grants one continuing education unit (CEU) in the Core category toward the renewal of a Florida Department of Agriculture and Consumer Services restricted-use pesticide license when the accompanying test is submitted and approved.

esticides are only one part of a comprehensive integrated pest management (IPM) plan and should be used strategically. What happens when you apply the most toxic option and get no results? Many applicators jump to the conclusion that the target pest has acquired resistance, but usually operator error is to blame. This article will cover several reasons why a pesticide application might not work.

IDENTIFY PESTS CORRECTLY

The first key to successful IPM is correctly identifying the target pest. If you don't identify the pest, you might use the incorrect pesticide. If you confuse a mite with an insect and select an insecticide, it may not work, especially with the new chemistries of insecticides. Older broad-spectrum pesticides may have worked on any living thing and didn't require exact identification, but new chemistries are designed to kill only the target pest and have less effect on beneficial insects.

Likewise, sedges misidentified as grass will not be killed by grass selective herbicides and vice versa. Selective herbicides have provided an efficient way to kill only certain types of weeds while keeping your crop plants safe, but they require the user to be skilled at weed identification. Correct pest identification, whether it be a weed, insect or mite, is always the first step.

CHECK LABELS AND CALIBRATION

Do you carefully read the label one more time to get the correct dosage when you're getting ready to make a pesticide application? Even if you apply the chemical frequently, you should always read the label and make sure you're putting the correct amount in the tank.

Or is the problem that your sprayer isn't calibrated, so you're not applying the correct dosage? Sprayers should be calibrated frequently to ensure you're not wasting chemicals (and thus money). Applying the correct dose helps get the desired effect. University of Florida Institute of Food and Agricultural Sciences (UF/IFAS) provides step-by-step instructions at edis.ifas. ufl.edu/topic calibration on how to calibrate a variety of sprayers. Even spray guns can be calibrated. Don't let haste cause you to make the wrong dose and render your pesticide application ineffective.

GET THE TIMING RIGHT

Timing is critical. Correct timing of a pesticide application can be the difference between success and failure. New pesticide chemistries may target only a certain life stage of the pest, like eggs or larvae, so timing the application to the correct life stage is more critical than ever. Even with older chemistries, contact insecticides may only be effective on a certain life stage, like scale crawlers. It takes time to scout and determine exactly when the crawlers are exposed but applying too early or too late will be a waste of time, money and pesticide.

Some pesticides should only be applied a certain number of times or amount per year, so you must time the application to maximize its effectiveness. Sometimes the timing is based on the growth stage of the plant, such as timing psyllid sprays to growth flush. Timing your applications correctly can make the difference in efficacy.

COVERAGE IS KEY

Coverage is another critical aspect you may not be checking. If the pesticide does not reach the target pest, then it will be ineffective. This may not be critical with systemic pesticides, but it is important when using a contact pesticide.

Just as you calibrate your sprayer, you should be checking for deposition. You can check by putting water-sensitive paper in the tree and spraying the plant with water. Make sure you attach the paper under the leaves, on top of the leaves and at various depths and heights of the canopy. Come back after the spray and inspect the papers. Did you get anything on the paper? Is the deposition even across the various areas?

If the coverage was not what you want, there are several questions to ask: Are you driving too fast? Are the droplet sizes/nozzles right for the application? If using an airblast sprayer, are the nozzles correctly selected and adjusted for the various levels of tree height? Is the wind blowing too much at the time of application? Do you need to add an adjuvant to alter the droplet size or spread? There are many things an operator can do to adjust spray coverage. Ask your Extension agent or chemical sales rep for some water-sensitive paper and assistance if needed. We can all be lazy, but don't let the importance of coverage escape your attention.

CONSIDER **ENVIRONMENTAL** CONDITIONS

The environment is something that all growers deal with. Environmental conditions not only affect crop growth but also a pesticide application's efficiency. Temperature extremes may inactivate the pesticide or make it phytotoxic to the crop, like oil-based pesticides on a hot day. Check the label for any temperature requirements before making an application.

Wind is also an obvious component of application effectiveness. If it's too windy, pesticide coverage is impacted; you may be spraying your neighbor's field, or worse, the housing

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development nearby. Rain soon after an application may wash the pesticide off before it has a chance to work. Be sure to check your weather forecast before planning a pesticide application.

PROPER PESTICIDE STORAGE

What is your pesticide storage shed like? Unsuitable storage conditions can impact the quality of the pesticide and harm application effectiveness. Some pesticides, especially biologicals or biorationals, have stringent storage requirements and can be inactivated above or below certain temperatures. Some pesticides were just not created to maintain effectiveness if stored for too long or under conditions above 100° F, which most storage sheds can reach in the Florida climate.

Some pesticides have a use-by date. Pesticides should be stored on a "first-in, first-out" basis. If you have pesticides that are so old you cannot read the label anymore, you should consider using Operation Clean Sweep. This program is run by the Florida Department of Agriculture and Consumer Services and picks up old pesticides for free disposal. You can avoid unnecessary pesticide disposal by storing formulations appropriately to maintain effectiveness.

PESTICIDE RESISTANCE

Finally, let's look at the reason for pesticide failure that many jump to rather than admit they have been a little lazy, hasty or uninformed: pesticide resistance. Pesticide resistance is not a mutation in the pest caused by repeated exposure to a chemical. Resistant pests are not like superhero villains that mutated and have greater powers to destroy your crop.

Pesticide resistance is the result of a long period in which the same chemical has been used over and over again. You might not be at fault; it may be many of the growers in your area using the same chemical repeatedly.

Pesticide resistance is like selection of the fittest. Pests naturally have a range of genetics like all living organisms. Some may have genes that allow them to survive a specific chemical or class of chemical with a specific mode of action, and they are the ones left behind to breed when the same



chemical is used repeatedly. Eventually, the pest population consists of mainly resistant genetics, and the chemical ceases to work. Members of this resistant population may get transferred to other areas through plant distribution or pest migration and become a problem for many growers.

What can you do to keep pesticides working for you? There are several steps you can take.

ROTATE MODES OF ACTION

Never rely on a single pesticide class. Rotate modes of action, especially when there is more than one generation of the pest in a year.

Resistance may be observed with the use of neonic drenches on young citrus trees. So many people use this class of chemical for so long without rotating to another mode of action that psyllids may become resistant to it. Research on psyllids has shown that because of their rapid reproduction, five repeated sprays of the same chemical can cause the population to become significantly resistant to that chemical. Rotating modes of action for pesticides is critical to avoiding resistance.

Do not use tank mixtures of products with the same mode of action. This does not increase your ability to control the pest; it only increases the chances of selecting for pest resistance. Tank mixes should incorporate chemicals with various modes of action to ensure that any pests with resistance to one mode of action are killed by the others. Chemical companies are monetizing this and creating new pesticides that are mixtures of at least two classes of chemicals to create a more effective and easier to use pesticide.

USE NONCHEMICAL CONTROLS

Integrate chemical control with other IPM strategies like cultural and biological control. Sole reliance on chemical control takes away many of the other cheaper options to suppress pest numbers.

Using genetic resistance of the host plant to pests is the cheapest way to avoid pest issues and pesticide applications. Plant breeders are constantly working on this. New gene-editing techniques will make this option more widespread in the future.

Encouraging biological control agents like predatory insects is an easy way to suppress pest numbers to a level that doesn't require chemical control. Cultural practices like sanitation should always be used as a starting point for pest control. Consider all your pest control options before using a pesticide.

SUMMARY

Your goal should always be applying pesticides at the recommended rate with thorough coverage. Using a higher rate is illegal and may not be more effective. Using a lower rate also may not be effective. Applying pesticides without calibrating your equipment or checking the deposition uniformity can be dangerous and wasteful.

"If at first you don't succeed, try again" does not apply to pesticide applications of the same chemical. If control with a pesticide fails, do not retreat with the same chemical or another with the same mode of action. Re-examine your checklist. Did you properly identify the pest? Did you use the correct dosage and timing? Is your equipment properly calibrated and do you have good deposition? Were environmental conditions correct for the application? Was your pesticide quality still good and not out of date? If you answer yes to all these, then try another pesticide with a different mode of action or a tank mix with two different modes of action. Pest resistance is something we all need to work together to avoid.

Source: Applying Pesticides Correctly (7th Edition) by F. Fishel, 2014, UF/IFAS

Juanita Popenoe is a retired UF/IFAS multicounty commercial fruit Extension agent.

Return the completed test via mail or email to:

Matt Smith UF/IFAS Extension 7620 State Road 471, Suite 2 Bushnell, FL 33513 352-569-6862 smith197@ufl.edu

If you have questions regarding this form, test or CEUs, email Matt Smith at smith197@ufl.edu or call 352-569-6862.

'When a pesticide doesn't work' test

To receive one Core continuing education unit (CEU), read "When a pesticide doesn't work" in this issue of Citrus Industry magazine. Answer the 20 questions on the magazine's website (www.CitrusIndustry.net) or mail the answers and application information to the address at the end of the article. You must answer 70 percent of the questions correctly to receive one Core CEU. The article and test set are valid for up to one year from the publication date. After one year, this test will no longer grant a CEU.

1. A single pesticide	A single pesticide class can usually provide all the control you need.									True False
2. Tank mixtures with	2. Tank mixtures with chemicals with the same mode of action are more effective than spraying with a single pesticide.									
3. Integrated pest co	3. Integrated pest control methods are not needed if you have a good chemical control program.									
4. If a pesticide fails, do not retreat with a chemical that has the same mode of action.										ΤF
5. If there are multip	5. If there are multiple generations of the pest in one season, you do not need to alternate pesticide modes of action.									
6. If you are using the correct pesticide rate, coverage is not as critical.										ΤF
7. Correct pest ident	7. Correct pest identification is key to pest control.									
8. Timing the pestici	8. Timing the pesticide application to the susceptible life stage of the pest is critical to its control.									
9. Checking the wear	Checking the weather forecast is important before planning a pesticide application.									
10. Pest resistance is c	10. Pest resistance is caused by genetic mutations in the pest from repeated exposure to a chemical.									
11. As long as you can read the label on the pesticide container, it should be good for use.										ΤF
12. Correct pesticideA) The level of perB) Equipment cal	 A) The level of pest pressure B) Equipment calibration and following the label C) How long it has been since your last spray D) How steady your hand is while measuring the 									
13. You can check youA) Having your as and see where the and see where the approximation of the a	 13. You can check your pesticide application coverage by: A) Having your assistant stand in the field to watch and see where the spray goes B) Seeing if the application worked C) Using water-sensitive paper attached to leaves in the D) Seeing if you emptied your spray tank in the application. 									
14. Effective tank mix A) Include chemic B) Be more expen	es should: cals with diff sive than app	erent mo plying ch	odes of actions of actions of actions of actions of a ction of a c	on parately	C) Ta D) O:	ke more tin nly be appli	ne to app ed with c	ly proper aterpilla	'ly r track wł	eeled vehicles
15. IPM strategies other than chemicals include:C) Laser beamsD) Cultural and biological controlsA) Wishful thinkingB) Organic productsC) Laser beamsD) Cultural and biological controls										
16. Pesticide classes an	re based on:	A) Mod	es of actior	n B) E	ducation	level C) E	xtension	educatio	n D) So	cial hierarchy
17. Using a higher rat A) More likely to B B) Illegal	e of chemica kill the pests	l than th C L	e label spec C) Not a pro D) Just a lot	cifies is: oblem; a of gove	allowance ernment o	s are made over-regulat	for poor tion	measurii	ng	
18. Pesticide failure is A) Pest resistance	most likely o B) Ch	caused b emical c	y: ompany hy	vpe	C) C	perator err	or I)) Alien i	nvaders p	osing as pests
19. Environmental co A) Proximity to a h	nditions that 10using devel	t might a opment	iffect pestic B) El Niño	cide app o or La	lication s Niña C)	uccess inclu Barometric	ıde: pressure	D) Wir	nd, rain an	d temperature
 20. Selection of pestic A) Newer chemist B) Older chemistr C) You can only ap D) Spray schedule 	ide and timi ries may be v ies were ofte pply in the d es take out al	ng of pes very selec n broad- ay. l the gues	sticide appl ctive to the spectrum a sswork.	lication pest an and wo	is import d pest life uld not ki	ant because e stage. ll much.	e:			
	P	lease circ	le the num	ber belo	w to rate	this article a	and test:			
Not very useful 1	2	3	4	5	6	7	8	9	10	Very useful
Pesticide Applicator CEU Form										
First Name:				_ Last	Name:					
E-mail:				Pho	ne:					
Address:	er:									
City:				Sta	te:		Zip:			