Sacramento Valley Almond News
Winters, 2025

In This Issue

Franz Niederholzer
UCCE Advisor
Colusa, Sutter, Yuba Counties

Almond Orchard Management Considerations: Late January - March

Becky Wheeler-Dykes, UCCE Farm Advisor, Glenn, Tehama, and Colusa Counties
Luke Milliron, UCCE Farm Advisor, Butte, Glenn, and Tehama Counties

Weed management: Prepare your preemergent herbicide program with your PCA. Cost savings in mature orchards can be minimized by narrowing the weed-free strip and relying more heavily on mowing in the middles. Preemergent herbicide is much more effective when applied to bare ground than when soil is covered by dead leaves or weed cover, so clean strips as much as possible before application. Make sure young trees are adequately protected by cartons or sleeves. A table detailing currently registered herbicides is included in this newsletter.

NOW sanitation: Sanitation NOW (pun intended) is the #1 thing you can do to prevent another 2023 style infestation disaster. Reduce mummy nuts to no more than 2 mummies/tree on average by early February. Blow/sweep nuts into middles and flail mow or otherwise destroy the downed nuts by March 1. Sanitation is more effective with community management – encourage your neighbors to sanitize as well. Don't overlook volunteer almonds along fence lines. Read more on the importance of sanitation in the "*The case for orchard sanitation*" found in this newsletter.

Irrigation maintenance: A thorough checkup of your well, pump, and irrigation system components is critical ahead of bloom to ensure the ability to mitigate frost damage. Growers in Tehama, Butte, Glenn and Shasta Counties can utilize free irrigation evaluations through the Tehama Resource Conservation District (RCD) Mobile Irrigation Lab. Growers in Yolo, Colusa, Sutter and Yuba Counties should contact the Yolo-/Sutter Mobile Irrigation Lab. Growers in Solano County can contact the Solano RCD.

Frost protection: The warmest orchard temperatures are when vegetation is maintained at 2 inches or shorter, the ground is firm (NOT cultivated), and moist. Be sure sprinkler irrigation systems are ready for deployment. Turn-on sprinklers when wet bulb temperature is above the critical temperature for the bloom stage in the orchard and turn off the sprinklers when the wet bulb temperature has recovered to above critical temperature. Frost increases the risk of bacterial blast damage.

Disease management: Check spray equipment and calibrate to prepare for bloom sprays. A single bloom spray (30-40% bloom) will protect the flowers if little to no rain occurred during bloom. The most recent fungicide efficacy and timing tables are included in this newsletter. Check with your PCA regarding blast control options if frost is in the weather forecast.
Bees: Talk with your beekeeper and use tools such as the BeeWhere system through CalAgPermits to check for beehive locations near your farm. Employ best practices to ensure honey bee safety.

Insect pests: Hang NOW traps in March to determine biofix. If using mating disruption, deploy dispensers by late March or early April. Although expensive upfront, UC research has shown that mating disruption can passively work in the background all season long, and yield a positive return on investment. Biofix dates for other pests should also be established by trapping. San

Jose Scale and Oriental Fruit Moth traps should be hung by mid- to late-February. Peach Twig Borer traps should be placed by mid-March.

Nutrition: Nitrogen and potassium used by the crop should be replaced each year to maintain yields and long-term health of trees, even in lean price years. Approximately 68 pounds of nitrogen and 80 pounds of actual potassium is used for every 1,000 pounds of kernel yield removed from the field the previous year. Consult with your CCA as you consider the right time, place, material, and amount for all fertilizer applications.

Almond Variety Evaluation (2025)

Luke Milliron, UCCE Orchards Butte, Glenn, Tehama; Phoebe Gordon, UCCE Madera and Merced; Roger Duncan UCCE Stanislaus, emeritus

Drone photo of the UC Cooperative Extension almond variety trial at the CSU, Chico Farm. In the trial every other row is Nonpareil, and the other rows are 12 tree replicates of 29 almond varieties (credit: Conservation Irrigation Lab).

What varieties do we know the most about?

New almond varieties are always coming out from public and private breeding programs around the world. It's tempting to plant the latest and greatest. Unfortunately, many growers in our area of Northern California have been burned by new varieties in recent years – Bennett-Hickman bud failure issues, and partial incompatibility of Independence and Shasta on the Krymsk 86 rootstock. Witnessing these painful and costly stories leads me to always ask growers to start variety selection with what has worked best for them in the past. Although, I have written extensively about the new mysterious issues with the Monterey variety in the northern Sacramento Valley, for other well-established varieties we have a good sense for both their advantages and warts. Your processor, experienced nursery professionals, and your farm advisor are all great resources for deciding what to plant.

What do we know a fair amount about?

A well-known nurseryman once said, "It takes 20 years to prove a variety". In the 3rd generation of almond variety trials planted at three locations across the Central Valley in 2014, we don't have 20 years of insights, however we have learned a great deal in the past 11 years (see table).

	Cumulative yields 2016-2024 (lb ac^{-1})	2024 yields (lb ac^{-1})	Days +/- NP Full Bloom	Days +/- NP 1% Hull Split	Avg. Hull Split Length
Nonpareil	26,751[a]	3,147[a]	0	"0"=7/17	13
Aldrich	24,198[ab]	2,286[ab]	0	15	17
UCD18-20	23,994[ab]	2,256[ab]	1	25	26
Booth	23,441[abc]	2,271[ab]	0	5	15
*Y117-91-03	23,207[abc]	2,004[b]	2	-5	14
Durango	21,992[bcd]	2,325[ab]	1	18	23
Jenette	21,645[bcd]	2,374[ab]	-2	8	27
Capitola	21,018[bcd]	2,407[ab]	-3	4	17
*Y117-86-03	20,628[bcd]	2,471[ab]	3	9	10
Kester	20,406[bcd]	2,065[b]	4	7	10
Eddie	19,333[cd]	2,225[ab]	-1	-4	15
Bennett	18,780[d]	1,672[b]	1	6	14
***Yorizane**	18,363[d]	1,783[b]	-1	-5	14

Bold = Commercially available varieties

* Self-compatible

In the table, looking at the cumulatively top five yielding varieties at the Butte site we see that despite efforts to try and develop superior varieties for nearly 150 years, **Nonpareil** still reigns king not only for kernel quality, but in our trials for yield as well. **UCD 18-20** and **Booth** are high-yielding self-sterile varieties – unfortunately they can both suffer from very high doubles (15-31% in some years), and high doubles might help explain their high yields.

Y117-91-03 is an up-right, vigorous, and high-yielding self-fertile variety from the USDA. Its kernels consistently have few defects, although they do produce a smaller kernel than Nonpareil (0.9g vs. 1.2g in 2024, respectively). It shakes well, has had very few insect or disease problems, and harvests before Nonpareil. It is currently under virus clean-up at the Foundation Plant Services facility at UC Davis and could be released to nurseries for propagation as early as fall 2025. Of the remaining varieties in the top five, **Y117-86-03** and **Yorizane** also from the USDA are self-fertile (*), while the other varieties above are self-sterile.

Yorizane is the first variety to be released from these regional trials. It is self-fertile, has excellent kernel quality, and has shown few insect or disease problems, although we have seen an undefined staining on the kernel pellicle in some years. The Yorizane tree is smaller than a Nonpareil but has shown to be one of the most yield efficient varieties in the trials. Yorizane yields have performed considerably better at the Stanislaus and Madera sites compared to Butte. Despite the mediocre yields at Butte, Yorizane is a top five yielding variety when all three sites are averaged. Given its high yield efficiency and compact size – there is potential it could perform better on a higher vigor rootstock than Krymsk 86 and/or at a tighter spacing than the 18 x22 at the CSUC Farm. Yorizane blooms and harvests about the same time as Nonpareil and shakes very well. Because this variety was developed by the USDA, it is available from all nurseries with no proprietary fees.

Kester has yielded well and has exhibited few problems. However, it blooms too late to be a good Nonpareil pollinizer and harvests too early to be harvested with Butte, so it is difficult to see how this variety fits.
You can learn more about results from all three trial sites at: fruitsandnuts.ucdavis.edu/resourcesreports and growingthevalleypodcast.com/podcastfeed/rvt3-10.

What are we starting to learn about?
In the fall of 2022 and spring of 2023, the 4th generation of UC almond variety trials funded by the Almond Board of California were planted in Butte, Stanislaus, and Kern counties. Another 30 varieties are under evaluation – the vast majority of which are self-fertile. New test varieties are from breeding programs at UC Davis, USDA, Australia, Spain, and Burchell Nursery. This is also the first time we have been allowed to include the popular Independence variety in our UC trials, and I have added an Independence rootstock trial to my site. Other varieties under evaluation that you may have heard of include Shasta, Pyrenees, Lassen, and Conway – all from Burchell nursery. At the Stanislaus site with tight 10' x 20' spacing, minimal pruning, and the high vigor Hansen 536 rootstock, Yorizane yielded just over 1,000 lbs to the acre in the second leaf! Meanwhile at the Butte site – the planting has had a rocky start with a late spring planting out of cold storage resulting in high mortality and extensive replant needs. We will keep you updated in the years to come in articles, podcasts, and field days on what we learn from these three new trial sites.

What do we know the least about and will require extensive testing?
Self-fertile Nonpareil is an exciting topic of coffee shop talk these days. Both Sierra Gold Nursery (FruitionOne™) and Burchell Nursery (Nonpareil SC+) announced in late 2024 their partnerships with biotech companies to develop a self-fertile Nonpareil. Both nurseries plan to begin delivering these trees to growers in 2027. However, many questions remain. My current understanding is that the self-fertile Nonpareil trees from both nurseries would not be considered GMOs in the United States because of the less invasive genetic modifications made through the CRISPR technique when compared to the earlier generations of biotech modified crops. However, the EU, our largest export region, currently would consider kernels from these trees as GMOs. Former farm advisor David Doll (aka The Almond Doctor) who farms in Portugal thinks there is a "reasonable probability that the EU will loosen the rules that define 'genetically modified'" in the next five years. Of course this is only a prediction. Clearly the road forward for self-fertile Nonpareil and potentially other previously self-sterile almond varieties is not yet lit. I hope to be trialing these trees as early as 2026. This is a case where researchers can learn early lessons and mistakes with these new trees so that growers aren't in the potentially costly position of finding themselves in the role of experimental researcher.

The Case for Orchard Sanitation

Franz Niederholzer, UCCE Farm Advisor, Colusa and Sutter/Yuba Counties
Sudan Gyawaly, UC IPM Advisor, Sacramento Valley

Is winter sanitation really necessary? This question was asked at a recent grower meeting. Our answer is YES, now, more than ever in the last 20 years. This is why…

- Multiple research studies confirm more mummies per tree in the spring results in more navel orangeworm (NOW) damage at harvest.
- Low reject numbers are no longer the norm in the Sacramento Valley. Nut damage levels in the Sacramento Valley are up and now are similar to levels in the San Joaquin Valley where damage was historically higher.
- Each mummy can host up to a dozen NOWs, producing high damage risk from just a few mummies.
- NOW are the major cause of rejects in almonds, but *Carpophilus* beetle is a new nut pest and overwinters in mummies. Orchard sanitation is the **only** proven control tool for *Carpophilus* beetle.

Details:
Research results consistently show that winter sanitation reduces NOW nut damage at harvest. In the early 1980's, based on research in 15 ranches in the southern San Joaquin Valley, a recommendation of two mummy nuts per tree in February was set. The most recent, comprehensive study on almond orchard sanitation and harvest damage was done in Kern County in 2003-2006. This was a huge study done across 50 ranches and 20,000 acres of conventionally farmed almonds receiving hull split sprays. The researchers concluded that a target of one mummy per 5 trees was needed to deliver field damage less than 2%. (See data in Table1.)

Reject levels in the last decade are up in all almond growing regions of California. Sacramento Valley growers are as vulnerable as Kern County growers in any given year (Table 2). Careful NOW control, including winter sanitation, where mummy counts show more than 2/tree, is a recommended practice throughout California almond growing districts.

There is no 1:1 ratio of %mummies to %damage (see Table 1). Almond mummies can host multiple worms with reports of up to 12 insects in a single nut. (Every mummy is a potential NOW condo.)

****

Table 1. The relationship between almond mummies in the tree and field damage from the area around those trees in a large study in Kern County, 2003-2006. These data (first two columns) are from Table 2 in California Ag journal article by Higbee and Siegel, 2009. Reject damage is estimated *for this newsletter article* by halving the field damage value due to expected damage loss through the pickup and processing.

Mummies per tree	% Field damage	Estimated % Reject sheet damage
<0.5	1.22	0.61
0.5-0.7	1.57	0.79
0.7-0.8	2.32	1.16
0.8-1.75	3.35	1.68
>1.75	7.85	3.93

Table 2. Total percent rejects for five counties from different growing regions of California in select years from 2006 through current reporting (November) for the 2024 crop. Data are from the Almond Board of California's Position Reports.

County	Year							
	2006	2010	2013	2017	2019	2022	2023	2024
Colusa	0.83	0.76	0.63	1.99	1.75	3.29	5.47	2.53
Sutter	1.38	1.06	1.29	2.26	1.79	2.94	2.71	3.43
Stanislaus	1.46	1.00	0.77	2.10	1.75	1.52	3.91	3.33
Fresno	1.75	1.12	1.24	2.62	1.64	2.33	5.48	2.87
Kern	3.26	1.36	1.12	2.75	1.54	2.73	4.72	4.09

Timeline for almond orchard sanitation

(https://ipm.ucanr.edu/agriculture/almond/)

January 15: Count mummies in at least 20 trees of all varieties in an orchard. If there are more than 2 mummies/tree (averaged across all varieties) per orchard, sanitation is needed to reduce damage at harvest. If counts show a need, all varieties should be sanitized.

February 1: Remove mummies from all trees by shaking with a harvester and/or hand polling. Count mummies after sanitation to confirm effective sanitation (<2 mummies/tree). More than 2 mummies per tree means risk of unacceptable worm damage at harvest. One mummy in 5 trees is the highest standard for damage reduction, but don't let perfect be the enemy of good. The basic target is less than two mummies per tree averaged over 20 trees per block. Check tree crotches to make sure all mummies get to the ground.

The recommended mummy removal timing is before Feb 1. Trees can be sanitized into early February without harming crop yield at harvest, but some bud loss occurred. Growers considering late sanitation (after Feb 1) should test shake and decide if bud loss is acceptable or not, relative to risk of damage at harvest.

March 1:Sweep/blow mummies into the row middles and destroy them by flail mowing. Check the orchard floor after mowing to ensure all mummies are destroyed. If not, mow again until all are crushed.

Optimizing preemergent herbicide applications

Ryan J Hill, UCCE Tehama County, Agronomy and Weed Science Advisor

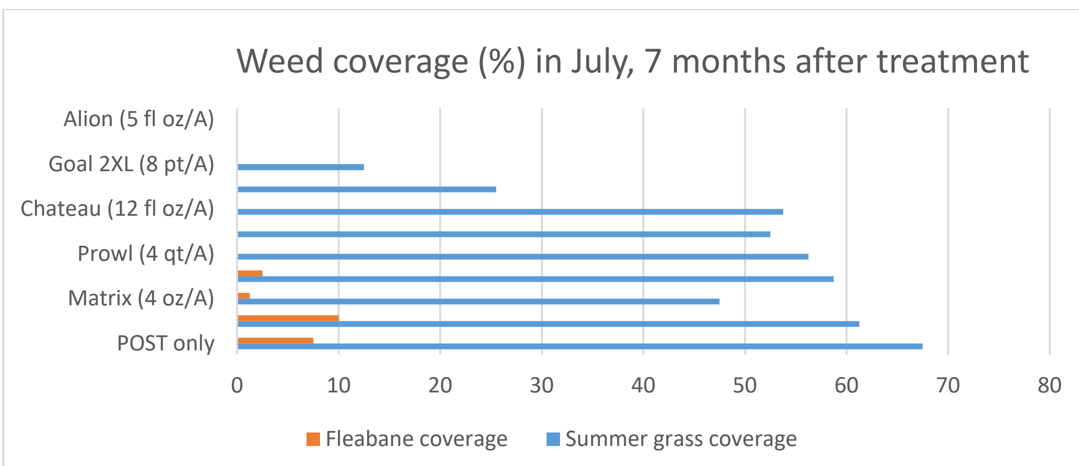
Preemergent herbicides are a valuable tool in an orchard's integrated weed management plan. If you survey a room full of growers, you will get answers across the board as to when it is best to apply preemergent herbicides in almonds. Do you apply after harvest to stop those early emerging winter weeds? Do you wait until late winter/early spring to get ahead of the summer annuals? What about rates? Is it better to apply a high rate in winter or multiple applications at a lower rate? These are all good questions, and the best answers usually differ from farm to farm. Weed populations vary and so should management choices.

Waiting to apply until early spring may save some costs and it also may be effective enough for your needs. As the rains stop and irrigation resumes it is absolutely essential to keep sprinklers unobstructed and to reduce weed competition in your orchards. The chaos of the growing season makes it easy to miss weed control timings if things get out of hand. Having a good residual herbicide holding off new flushes of germination can be a lifesaver and spring-applied preemergents have a better chance of lasting through the summer season than winter applications. However, waiting to apply preemergents until spring means you may have winter weeds growing when the herbicide goes down. Some preemergents have no effect on emerged weeds so you will need to consider including a good postemergent treatment to target weeds that already emerged. This essential component of the spring application brings up two major considerations:

First, if coverage of winter annuals is dense, you could be left with a mat of thatch after your clean up treatment. Thatch can interfere with effective preemergent application, binding up the herbicide in the dead organic matter before it reaches the soil. The picture below shows the results of a spring application of Matrix (rimsulfuron) or Prowl (pendimethalin) intended to control johnsongrass seedlings (both products are labeled for this weed) in a heavy thatch situation in an orchard. Bermudagrass is the only weed left in the Matrix plots, but in the Prowl plots johnsongrass control was much lower, likely because the thatch prevented herbicide from reaching the soil where the seeds were germinating. Pendimethalin, the active ingredient in Prowl, binds tightly with organic materials (leaves and living or dead weeds) and this can affect its performance in settings like this. Thatch is not typically quite this thick in almond orchards, but the plots shown below demonstrate the principle.

Second, postemergent clean-up treatments may not be as effective as expected if you have herbicide resistance in your field. Herbicide resistance in winter annuals like hairy fleabane and Italian ryegrass will most likely remove some postemergent herbicide options from your toolbox.

If this second point is true of your operation, consider applying preemergent herbicides in the fall before germination of these species. Both hairy fleabane and Italian ryegrass are typically very sensitive to preemergents. Last season I installed a trial demonstrating the effect of several preemergent herbicides (though this list is not exhaustive) applied in December on hairy fleabane populations. All treatments were tank-mixed with postemergent herbicides to control weeds that had already germinated, and one plot received only the postemergent treatment ("POST only", at the bottom of the graph). Below are the weed coverage numbers (averaged across 4 replications) from July, seven months after treatment.



The summer annual grasses were coming on strong by July and you can see from the figure that only Goal and Alion were still having any effect reducing weed coverage by then. This doesn't mean Matrix, Chateau, and Prowl are not useful herbicides, but their residual activity simply does not last a full seven months. Hairy fleabane was controlled by most treatments that included a preemergent (Prowl is not labeled for control of fleabane). If another preemergent herbicide application was included in the spring to control those summer annuals, I expect this field would have seen season-long control in most plots.

Matrix (rimsulfuron) is labeled for control of hairy fleabane so I was curious to see so much fleabane in my Matrix plots. It is possible, though not certain, that this is an example of herbicide resistance, particularly since this herbicide had been used repeatedly in this field in the past. Rimsulfuron, the active ingredient in Matrix, has a group 2 mode-of-action, and group 2 herbicides are the greatest offender worldwide for herbicide resistance. Herbicides are classified by the Weed Science Society of America based on what they target in the weed and all group 2 herbicides target the same protein. If you are using products in this category, be sure to follow careful resistance management practices. This means not using the same type of herbicide to control the same weed year after year (look at the herbicide label to see what group number you are using). Switching through different groups is referred to as rotating herbicides.

The above trial demonstrates that very few preemergents can be applied in winter at a high rate and keep an adequate level of control through harvest. Relying too often on one or two very strong preemergents is a recipe for herbicide resistance. Weeds can also develop resistance to preemergent herbicides! Indeed, all herbicides come with the risk of resistance. Applying different preemergent treatments at lower rates in both winter and spring can give long-term control while also following good resistance management principles, as seen this article from Brad Hanson and Caio Brunharo for more information on split application timings:
https://ucanr.edu/blogs/blogcore/postdetail.cfm?postnum=29080

ALMOND: FUNGICIDE EFFICACY - CONVENTIONAL

Fungicide	Resistance risk (FRAC)[1,7]	Brown rot	Jacket rot	Anthrac-nose	Shot hole	Scab[3]	Rust[3]	Leaf blight	Alternaria leaf spot[3]	PM-like[5]	Hull rot[16]
Adament	medium (3/11)	5	4	4	5	4	5	ND	4	4	4
Axios	high (52)[7]	5	4	ND	4	3	ND	ND	3	ND	4
Bumper**, Tilt, Propicure, Propiconazole[4]	high (3)	5	1	5	3	3	4	ND	3	4	3
Cevya	high (3)	5	1	5	5	3/4	4	ND	4	ND	4
Fontelis[3]	high (7)[7]	5	5	3	5	3	3	ND	4	ND	0
Kenja[4]	high (7)[7]	5	5	3	5	4	0	ND	4	ND	0
Parade*	high (7)[7]	5	5	ND	5	3	ND	ND	3	ND	1
Indar	high (3)	5	1	4	3	3	NL	ND	2	ND	0
Inspire	high (3)	5	3	5	3	4	5	ND	5	ND	4
Protocol[2]	med.-high (1/3)	5	5	ND	4	4	5	ND	3	ND	2
Inspire Super[4]	medium (3/9)	5	5	ND	4	4	5	ND	5	ND	4
Luna Experience[3]	medium (3/7)	5	4	5	4	5	5	ND	5	4	4
Fervent	medium (3/7)	5	4	5	4	5	5	ND	5	4	4
Luna Sensation[3]	medium (7/11)	5	5	5	5	5	5	ND	5	4	4
Miravis Duo	medium (3/7)	5	4	5	4	5	5	ND	5	4	4
Miravis Prime	medium (7/12)	5	4	5	5	5	5	ND	5	5	4
Merivon[3]	medium (7/11)	5	5	5	5	5	4	ND	5	5	4
Pristine[3]	medium (7/11)	5	5	5	5	5	4	ND	4	4	4
Quadris Top[3]	medium (3/11)	5	5	5	4	5	5	ND	4	4	4
Quilt Xcel, Avaris 2XS[3]	medium (3/11)	5	4	5	4	5	5	ND	4	4	4
Quash[4]	high (3)	5	3	5	4	4	5	ND	5	4	4
Rovral + oil[8, 9]	low (2)	5	5	0	4	1	3	ND	4	ND	0
Scala[3, 10]	high (9)[7]	5	5	ND	3	0	ND	ND	2	0	0
Tebucon,Toledo, Teb, Tebuconazole**	high (3)	5	1	4	3	3	4	ND	2	ND	3
Viathon	medium (3, P 07/33)	5	1	4	3	3	4	ND	2	ND	3
Topsin-M, T-Methyl, Incognito, Cercobin**[2,6,8]	high (1)[7]	5	5	0	0	4	2	4	0	3	0
Vangard[3, 7,9, 10]	high (9)	5	5	ND	3	0	ND	ND	2	0	0
Quadris, (Abound discontinued)	high (11)[7]	4	2	5	4	5	5	4	4	4	4
Aproach[3,4]	high (11)[7]	4	2	5	4	5	5	4	4	4	4
CaptEvate**	low (M 04/17)	4	4	4	4	4	0	4	2	0	0
Elevate[7]	high (17)	4	5	0	2	ND	ND	ND	ND	ND	0
Gem[3,4]	high (11)[7]	4	0	5	4	5	5	4	4	4	4
Laredo, Rally[13]	high (3)	4	0	3	3	0	2	4	0	4	0
Luna Privilege**	high (7)[7]	4	3	3	3	4	4	ND	4	3	3
Rovral[9], Meteor[9], Iprodione**, Nevado**	low (2)	4	4	0	4	0	0	ND	3	0	0
Regev*	high (3/BM 01)	5	2	4	3	4	4	ND	4	ND	4
Rhyme	high (3)	4	1	ND	2	3	ND	ND	3	ND	ND
Bravo, Chlorothalonil, Equus, Echo[11, 12, 15]	low (M 05)	3	NL	4	4	4	5	NL	NL	0	0
Captan[4, 6, 12]	low (M 04)	3	3	4	4	3	0	4	2	0	0
Mancozeb	low (M 03)	3	3	4	4	3	4	4	2	0	0
Ph-D	medium (19)	3	4	0	3	4	4	ND	5	ND	4
Ziram	low (M 03)	3	2	4	4	4	0	3	2	0	0
Syllit	medium (U 12)	2	0	ND	4	5	ND	ND	2	ND	0
Copper[14,15]	low (M 01)	1	1	0	2	2	0	0	ND	0	0
Lime sulfur[12,15]	low (M 02)	1	NL	0	1	3	3	NL	NL	0	0
Sulfur[4,12]	low (M 02)	1	1	0	0	3	3	0	0	4	0
Copper + oil[14,15]	low (M 01)	ND	ND	0	2	4	0	0	ND	0	0

FUNGICIDE EFFICACY - PHYTOPTHORA ROOT AND CROWN ROT (PRCR) USING CONVENTIONAL TREATMENTS

Fungicide	Resistance risk (FRAC code)[1]	PRCR
Orondis	high (49)	5
Revus*	high (40)	5
Presidio	high (43)	4
Elumin*	high (22)	4
Ridomil**, Metalaxyl**	high (4)	3
Ridomil Gold, ProPhyt, Mefenoxam***	high (4)	4
Aliette***, Fungi-Phite, K-Phite	low-medium (P07/33)	4

Rating: 5 = excellent and consistent, 4 = good and reliable, 3 = moderate and variable, 2 = limited and/or erratic, 1 = minimal and often ineffective, 0 = ineffective, NL = not on label, and ND = no data.

*** Registration pending in California.**
****Not registered, label withdrawn or inactive in California.**
***** - 12-month PHI**

[1] Code numbers are assigned by the Fungicide Resistance Action Committee (FRAC) according to different modes of actions (for more information, see http://www.frac.info/). Fungicides with a different Code number are suitable to alternate in a resistance management program. In California, make no more than one application of fungicides with mode-of-actions (MOA) with high resistance risk before rotating to a fungicide with a different MOA (Code number); for other fungicides, make no more than two consecutive applications before rotating to fungicide with a different MOA (Code number).
[2] Strains of the brown rot fungi *Monilinia laxa* and *M. fructicola* resistant to Topsin-M and T-Methyl have been found in some California almond orchards. MBC-resistant strains of the jacket rot fungus, *Botrytis cinerea* and powdery mildew fungi, have been reported in California on crops other than almond and stone fruits and may have the potential to develop in almonds with overuse of fungicides with similar chemistry. MBC-resistant strains of the scab fungus, *Venturia* (*Fusicladium, Cladosporium*) *carpophila*, have been found in California.
[3] Field resistance of *Alternaria* sp. and *Fusicladium carpophilum* to QoI and SDHI fungicides has been detected in almond orchards. AP-resistant populations of *Monilinia* spp. have been found on other stone fruit crops in California.
[4] Of the materials listed, only sulfur, Captan (FRAC Code M 02, M 04), Kenja (FRAC Code 7), Aproach, Gem, Quadris (FRAC Code 11), and some of the DMI fungicides (FRAC Code No. 3) are registered for use in late spring and early summer when treatment is recommende.
[5] PM-like refers to a powdery mildew-like disease on almond fruit. Information suggests an *Acremonium* species is involved.
[6] Excellent control obtained when combinations of Topsin-M or T-Methyl and Captan are used.
[7] To reduce the risk of resistance development, start treatments with a fungicide with a multi-site mode of action; rotate or mix fungicides with different mode of action FRAC numbers for subsequent applications, use labeled rates (preferably the upper range), and limit the total number of applications per season.
[8] Oils recommended include "light" summer oil, 1-2% volume/volume.
[9] Do not use later than 5 weeks after petal fall.
[10] Efficacy reduced at high temperatures and relative humidity.
[11] Bravo Ultrex, Bravo WeatherStik, Echo, and Chlorothalonil are currently registered.
[12] Dormant applications with oil are highly effective against scab, Do not use in-season combinations with oil or shortly before or after oil treatment.
[13] Efficacy is better in concentrate (80–100 gal/acre) than in dilute sprays.
[14] The low rates necessary to avoid phytotoxicity in spring reduce the efficacy of copper.
[15] "Burns out" scab twig lesions when applied at delayed dormant. (Chlorothalonil can be applied with dormant oil during tree dormancy).
[16] Hull rot ratings are for the disease caused by *Rhizopus stolonifer*. Ratings for the disease caused by *Monilinia* or *Aspergillus* spp. will be provided in the future.
[17] PlantShield is best used for wood-exposing wounds to prevent silverleaf and wood decay.

ALMOND: FUNGICIDE EFFICACY - BIOCONTROLS AND NATURAL PRODUCTS

Trade name	Biocontrol or natural product (FRAC code)[1,6]	Brown rot	Jacket rot	Anthrac -nose	Shot hole	Scab	Rust	ALS[2]	Hull rot[3]	PM-like[4]	Silver leaf	Bac. Spot, Bac. Blast
Botector	*Aureobasidium pullulans* (BM 02)	3	2	NL	NL	NL	NL	NL	NL	NL	NL	NL
Double Nickel 55	*Bacillus amyloliquefaciens* D747 (BM 02)	2	2	ND	2	NL	NL	NL	NL	NL	NL	2
Serifel	*B. amyloliquefaciens* MBI600 (BM 02)	2	2	NL	2	2	1	1	1	ND	ND	2
Sonata	*B. pumilis* QST2808 (BM 02)	2	NL	NL	NL	NL	NL	NL	NL	NL	NL	NL
Serenade	*B. subtilis* QST 713 (BM 02)	3	3	2	2	1	1	1	NL	ND	NL	3
Aviv	*B. subtilis* IAB/BS03 (BM 02)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Theia	*B. subtilis* AFS03232 (BM 02)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dart	capric and caprylic acids (BM 01)	3	2	ND	2	1	1	2	2	ND	0	3
Cinnacure, Seican, Cinnerate	Cinnamaldehyde/Cinnamon oil (BM 03)	1	1	NL	NL	NL	NL	NL	NL	NL	NL	2
EF400	clove, rosemary, peppermint oils (BM 01)	1	2	1	NL	ND	NL	NL	NL	NL	NL	NL
Vectorite	*Clonostachys rosea* CR-7 (BM 02)	4	2	ND	2	ND	ND	ND	ND	ND	ND	ND
BacStop-OPL,-XL	quaternary ammonia (NC-sanitizer)	1	1	1	NL	ND	NL	NL	NL	NL	NL	3
Employ	harpin (P unspecified)	NL	1	NL	NL	NL	NL	NL	NL	NL	NL	NL
Kasumin*	kasugamycin (24)[1] – Section 18 registr.	0	0	0	0	0	0	0	0	0	0	4
ProBLAD Verde	*Lupinus albus* (BM 01)	3	2	NL	NL	NL	NL	NL	NL	NL	NL	NL
Timorex (Act, Gold)	natural oil (BM 01)	1	1	2	1	2	2	1	ND	2	NL	NL
Trilogy, Rango	neem oil (BM 01)	1	1	1	1	1	2	1	ND	2	NL	NL
Oxidate 5.0	peroxyacetic acid (NC)	1	2	1	1	NL	NL	1	ND	ND	NL	2
Milstop	potassium bicarbonate (NC)	NL	NL	NL	NL	1	NL	NL	ND	3	NL	NL
All Phase	potassium sorbate (NC)	NL	NL	NL	NL	2	NL	NL	NL	NL	NL	NL
Howler	*Pseudomonas chlororaphis* strain AFS009 (BM 02)	2	1	NL	NL	NL	NL	NL	NL	NL	NL	3
Regalia	*Reynoutria sachalinensis* (P 05)	2	2	1	1	1	1	1	ND	2	NL	3
Actinovate AG	*Streptomyces lydicus* (BM 02)	1	1	NL	NL	NL	NL	NL	NL	1	NL	2
EcoSwing	*Swinglea glutinosa* (BM 01)	3	2	NL	NL	1	NL	1	NL	ND	NL	ND
PlantShield**	*Trichoderma harzianum* (BM 02)	NL	NL	NL	NL	NL	NL	NL	NL	NL	4	0
Vintec	*Trichoderma atroviride* (BM 02)[5]	NL	NL	NL	NL	NL	NL	NL	NL	NL	4	0
Procidic	citric acid (NC)	ND	ND	ND	NL	NL	NL	ND	NL	NL	NL	NL

Rating: 5 = excellent and consistent, 4 = good and reliable, 3 = moderate and variable, 2 = limited and/or erratic, 1 = minimal and often ineffective, 0 = ineffective, NL = not on label, and ND = no data.

*** Registration pending in California.**
**** Not registered, label withdrawn or inactive in California.**

[1] Alphabetically arranged organic treatments. Note that kasugamycin is a fermentation (natural) product, but not an organic treatment. FRAC Codes are also provided as BM-, NC, or P-number codes. NC = not coded in FRAC. In general, sulfur compounds are fungicidal and may affect applications of fungal biocontrols (e.g., Botector); whereas copper may affect applications of bacterial biocontrols (e.g., Actinovate, Double Nickel 55, and Serenade). Rotations must consider these factors.
[2] ALS = Alternaria Leaf Spot caused by *Alternaria alternata* and *A. arboresscens*.
[3] Hull rot ratings are for the disease caused by *Rhizopus stolonifer*.
[4] PM refers to a powdery mildew disease.
[5] Labeled for *Eutypa* sp., *Botryosphaeria* sp., *Cytospora* sp., and other trunk diseases of almond.
[6] Sodium laruryl sulfate is not organically approved for crop production (synthetic substance approved for noncrop areas); All Phase is not organic. Cinnacure, PlantShield and Vintec do not have OMRI/WSDA certification and do not claim to be compliant, but their active ingredients are allowed for organic production.

ALMOND: TREATMENT TIMING

Note: Not all indicated timings may be necessary for disease control.

		Bloom			Spring[1]		Summer	
Disease	**Dormant**	**Pink bud**	**Full bloom**	**Petal fall**	**2 wks**	**5 wks**	**May**	**June/ July**
Alternaria	0	0	0	0	0	2	3	3
Anthracnose[2]	0	2	3	3	3	3	3	2
Bacterial spot	1	0	2	3	3	2	1	0
Brown rot	0	2	3	1	0	0	0	0
Green fruit rot	0	0	3	2	0	0	0	0
Hull rot[7]	0	0	0	0	0	0	0	3
Leaf blight	0	0	3	2	1	0	0	0
Rust	0	0	0	0	0	3	3	1[6]
Scab[3]	2	0	0	2	3	3	1	0
Shot hole[4]	1[5]	1	2	3	3	2	0	0

Disease	**At planting**	**Spring root flush**	**Summer**	**Fall root flush**
Phytophthora root and crown rot	3	3	2	3

Rating: 3 = most effective, 2 = moderately effective, 1 = least effective, and 0 = ineffective

[1] Two and five weeks after petal fall are general timings to represent early postbloom and the latest time that most fungicides can be applied. The exact timing is not critical but depends on the occurrence of rainfall.
[2] If anthracnose was damaging in previous years and temperatures are moderate (63°F or higher) during bloom, make the first application at pink bud. Otherwise, treatment can begin at or shortly after petal fall. In all cases, application should be repeated at 7- to 10-day intervals when rains occur during periods of moderate temperatures. Treatment should, if possible, precede any late spring and early summer rains. Rotate fungicides, using different fungicide classes, as a resistance management strategy.
[3] Early treatments (during bloom) have minimal effect on scab; the 5-week treatment usually is most effective. Treatments after 5 weeks are useful in northern areas where late spring and early summer rains occur. Dormant treatment with liquid lime sulfur improves efficacy of spring control programs.
[4] If pathogen spores were found during fall leaf monitoring, apply a shot hole fungicide during bloom, preferably at petal fall or when young leaves first appear. Reapply when spores are found on new leaves or if heavy, persistent spring rains occur. If pathogen spores were not present the previous fall, shot hole control may be delayed until spores are seen on new leaves in spring.
[5] Dormant copper treatment seldom reduces shot hole infection but may be useful in severely affected orchards and must be followed by a good spring program.
[6] Treatment in June is important only if late spring and early summer rains occur.
[7] Make application at 1 to 5% hull split to manage hull rot caused by *Rhizopus stolonifer*; use earlier June timings for hull rot caused by *M. fructicola.* Apply a second application, mid-way through hull split especially if hull split is progressing slowly.

ALMOND: SUGGESTED DISEASE MANAGEMENT PROGRAMS BY FRAC[1] CODES - CONVENTIONAL GROWERS

Note: Not all indicated timings may be necessary for disease control (*see* Treatment Timing Table). If treatments are needed based on host phenology, weather monitoring, inoculum models, or environmental-disease forecasting models, suggested fungicide Codes are listed for each timing.

How to use this table:

1) Identify the disease(s) that need(s) to be managed. Know the disease history of the orchard, especially from the last season.
2) Select one of the suggested fungicide Codes. *Numbers separated by slashes are pre-mixtures, whereas numbers separated by pluses are tank mixtures.* If several diseases need to be managed, select a Code that is effective against all diseases. Refer to the fungicide efficacy table for fungicides belonging to each FRAC Code. Code numbers are listed in numerical order within the suggested disease management program.
3) Rotate Codes for each application within a season and, if possible, use each Code only once per season, except for multi-site mode-of-action materials (e.g., M 02).

Disease	Dormant	Bloom			Spring		Summer	
		Pink bud	Full bloom	Petal fall	2 weeks	5 weeks	May	June/July
Alternaria	----	----	----	----	----	2	3, 7, 11, 19, 3/7, 3/9, 3/11, 3+P 07/33, 7/11, 52	3, 3/7, 7, 3/9, 3/11, 3+P 07/33, 7/11, 11, 19, 52
Anthracnose	----	3, 3/7, 3/9, 3/11, 3+P 07/33, 7	3, 3/7, 3/9, 3/11, 3+P 07/33, 7, 7/11, 11	3, 3/9, 3/7, 3/11, 3+P 07/33, 11, M3, M4, M5	3, 3/9, 3/11, 3/7, 7, 7/11, 3+P 07/33, 11, M3, M4, M5	3, 3/7, 3/9, 3/11, 3+P 07/33, 7, 7/11, 11 M3, M4, M5	3, 3/7, 3/9, 3/11, 3+P 07/33, 7, 7/11, 11, M4	3, 3/7, 3/9, 3/11, 3+P 07/33, 7, 7/11, 11, M4
Bacterial spot	M1, M1+M3	----	M1, M1+M3	M1, M1+M3	M1, M1+M3	M1, M1+M3	M1	----
Brown rot	----	1[2], 2+oil, 3, 3/7, 3/9, 3/11, 3+P 07/33, 9, 52	1[2], 2+oil, 3, 3/7, 3/9, 3/11, 3+P 07/33, 7, 7/11, 9, 11, 19, 52	1[2], 2+oil, 3/11, 3+P 07/33, 7, 7/11, 9, 19, 52	----	----	----	----
Jacket rot	----	----	1[2], 2 +oil, 3/7, 3/9, 3/11, 7, 7/11, 9, 19, 52	1[2], 2+oil, 3/7, 3/9, 3/11, 7, 7/11, 9, 19, 52	----	----	----	----
Hull rot[5]	----	----	----	----	----	----	3, 3/7, 3/9, 3/11, 7/11, 11, 19, 52	3, 3/7, 3/9, 3/11, 7/11 11, 19, 52
Leaf blight	----	----	1[2], 2, 3, 3/7, 3/9, 3/11, 3+P 07/33, 11	1[2], 2, 3, 3/7, 3/9, 3/11, 3+P 07/33, 11, M3, M4, M5	3, 3/7, 3/9, 3/11, 3+P 07/33, 11, M3, M4, M5	----	----	----
Rust	----	----	----	----	----	3, 3/7, 3/11, 3+P 07/33[1], 7, 7/11, 11, 19, M3	3, 3/7, 3/11, 3+P 07/33, 7, 7/11, 11, 19	3, 3/7, 3/11, 3+P 07/33, 7, 7/11, 11, 19
Scab[4]	M1+oil, M2[3], M5+oil	----	----	1[2], 3/7, 3/9, 3+P 07/33, 3/11, 7, 7/11[2], 11[2] M3, M4, M5	1[2], 3/7, 3/9, 3+P 07/33, 3/11,7, 7/11[2], 11[2] M3, M4, M5	3, 3/7, 3/9, 3/11, 3+P 07/33, 7, 7/11[2], 11[2] M2[3], M3, M4	M2[3], M4	----
Shot hole	M1	2, 3, 3/7, 3/9, 3/11, 7, 9, 11, 52	2, 3, 3/7, 3/9, 3/11,7, 7/11, 9, 11, 19, 52	2, 3, 3/7, 3/9, 3/11, 7, 7/11 9, 11, 19, 52	7, 7/11, 11, 19, 52, M3, M4, M5	7, 7/11,11, 19, 52, M3, M4, M5	----	----

[1] Code numbers are assigned by the Fungicide Resistance Action Committee (FRAC) according to different modes of actions (for more information, see http://www.frac.info/). Code numbers are listed in numerical order within the suggested disease management program. Fungicides with a different Code number are suitable to alternate in a resistance management program. Refer to the fungicide efficacy table for fungicides belonging to each FRAC Code. Note: FC 33 is currently P 07 but it is indicated as P 07/33.

[2] Strains of *Monilinia fructicola* and *M. laxa* resistant to Topsin-M and T-Methyl are present in some California almond orchards. Resistant strains of the jacket rot fungus, *Botrytis cinerea*, and powdery mildew fungi have been reported in California on crops other than almond and stone fruits and may have the potential to develop in almond with overuse of fungicides with similar chemistry.

[3] Use liquid lime sulfur in dormant applications and wettable sulfur at and after pre-bloom.

[4] Apply petal-fall treatments based on twig-infection sporulation model.

[5] Effective hull rot management is dependent on integrated strategies including dust control, reduced irrigation, and limiting nitrogen fertilization prior to and during hull split, as well as ensuring adequate air circulation (appropriate pruning or hedging practices) in the orchard.

ALMOND: SUGGESTED DISEASE MANAGEMENT PROGRAMS BY FRAC[1] CODES - ORGANIC GROWERS

Note: Not all indicated timings may be necessary for disease control (*see* Treatment Timing Table). If treatments are needed based on host phenology, weather monitoring, inoculum models, or environmental-disease forecasting models, suggested fungicide Codes are listed for each timing.

How to use this table:

1) Identify the disease(s) that need(s) to be managed. Know the disease history of the orchard, especially from the last season.
2) Select one of the suggested fungicide Codes. If several diseases need to be managed, select a Code that is effective against all diseases. Refer to the fungicide efficacy table for fungicides belonging to each FRAC Code. Code numbers are listed in numerical order within the suggested disease management program.
3) Rotate Codes for each application within a season and, if possible, use each Code minimally per season.

Disease	Dormant	Bloom			Spring		Summer	
		Pink bud	Full bloom	Petal fall	2 weeks	5 weeks	May	June/July
Alternaria	----	----	----	----	----	BM 01, -02, -03,oxidizer	BM 01, -02, -03,oxidizer	BM 01, -02, -03,oxidizer
Anthracnose	----	BM 01, -02, -03, P 05, oxidizer	BM 01,-02, -03, P 05, oxidizer	BM 01,-02, -03, P 05, oxidizer	BM 01,-02, -03, P 05, oxidizer	BM 01,-02, -03, P 05, oxidizer	BM 01,-02, -03, P 05, oxidizer	BM 01,-02, -03, P 05, oxidizer
Bacterial spot	M1 + BM 01 (oil)	----	BM 01,-02, -03, M1, oxidizer	BM 01,-02, -03, M1, oxidizer	BM 01,-02, -03, M1, oxidizer	BM 01,-02, -03, M1, oxidizer	BM 01,-02, -03, M1, oxidizer	----
Brown rot	----	BM 01,-02, -03, P 05, oxidizer	BM 01,-02, -03, P 05, oxidizer	BM 01,-02, -03, P 05, oxidizer	----	----	----	----
Jacket rot	----	----	BM 01,-02, -03, P 05, oxidizer	BM 01,-02, -03, P 05, oxidizer	----	----	----	----
Hull rot[2]	----	----	----	----	----	----	----	BM 01,-02, -03,
Leaf blight	----	----	BM 01,-02, -03, P 05, oxidizer	BM 01,-02, -03, P 05, oxidizer	BM 01,-02, -03, P 05, oxidizer	----	----	----
Rust	----	----	----	----	----	BM 01,-02, -03, P 05, M2	BM 01,-02, -03, P 05, M2	BM 01,-02, -03, P 05, M2
Scab[3,4]	M1 + BM 01 (oil), M2	----	----	BM 01,-02, -03, P 05, NC	BM 01,-02, -03, P 05, NC	BM 01,-02, -03, P 05, NC	BM 01,-02, -03, P 05, NC	----
Shot hole	M1 + BM 01 (oil)	M1+BM 01 (oil)	BM 01,-02, -03, P 05, oxidizer	BM 01,-02, -03, P 05, oxidizer	BM 01,-02, -03, P 05, oxidizer	BM 01,-02, -03, P 05, oxidizer	----	----

[1] Code numbers are assigned by the Fungicide Resistance Action Committee (FRAC) according to different modes of actions (for more information, see http://www.frac.info/). Code numbers are listed in numerical order within the suggested disease management program. Fungicides with a different Code number are suitable to alternate in a resistance management program. Refer to the fungicide efficacy table for fungicides belonging to each FRAC Code. NC = not coded in FRAC.

[2] Effective hull rot management is dependent on integrated strategies including dust control, reduced irrigation, and limiting nitrogen fertilization prior to and during hull split, as well as ensuring adequate air circulation (appropriate pruning or hedging practices) in the orchard.

[3] Use liquid lime sulfur in dormant applications and wettable sulfur at and after pre-bloom.

[4] Apply petal-fall treatments based on twig-infection sporulation model.

Herbicide Registration on California Tree and Vine Crops - *(reviewed January 2025 - UC Weed Science)*

	Herbicide-Common Name *(example trade name)*	Site of Action Group[1]	Almond	Pecan	Pistachio	Walnut	Apple	Pear	Apricot	Cherry	Nectarine	Peach	Plum / Prune	Avocado	Citrus	Date	Fig	Grape	Kiwi	Olive	Pomegranate
			----- tree nut -------				- pome -		---------stone fruit ---------												
Preemergence	**dichlobenil** *(Casoron)*	L / 20	N	N	N	N	R	R	N	R	N	N	N	N	N	N	N	R	N	N	N
	diuron *(Karmex,Diurex)*	C2 / 7	N	R	N	R	R	R	N	N	N	R	N	N	R	N	N	R	N	R	N
	EPTC *(Eptam)*	N / 8	R	N	N	R	N	N	N	N	N	N	N	N	R	N	N	N	N	N	N
	flazasulfuron *(Mission)*	B / 2	R	N	R	R	N	N	N	N	N	N	N	N	R	N	N	R	N	R	N
	flumioxazin *(Chateau)*	E / 14	R	R	R	R	R	R	R	R	R	R	R	NB	NB	N	NB	R	N	R	R
	indaziflam *(Alion)*	L / 29	R	R	R	R	R	R	R	R	R	R	R	N	R	N	N	R	N	R	N
	isoxaben *(Trellis)*	L / 21	R	R	R	R	NB	NB	NB	NB	NB	NB	NB	NB	NB	N	NB	R	NB	NB	NB
	mesotrione *(Broadworks)*	F2/27	R	R	R	R	N	N	N	N	R	N	R	N	R	N	N	N	N	N	N
	napropamide *(Devrinol)*	K3 / 15	R	N	N	N	N	N	N	N	N	N	N	N	N	N	N	R	R	N	N
	norflurazon *(Solicam)*	F1 / 12	R	R	N	R	R	R	R	R	R	R	R	R	R	N	N	R	N	N	N
	orthosulfamuron *(Craze)*	B / 2	R	R	R	R	N	N	NB	NB	NB	NB	NB	N	N	N	N	R	N	N	N
	oryzalin *(Surflan)*	K1 / 3	R	R	R	R	R	R	R	R	R	R	R	R	R	N	R	R	R	R	R
	oxyfluorfen *(Goal, GoalTender)*	E / 14	R	R	R	R	R	R	R	R	R	R	R	R	NB	R	R	R	R	R	R
	pendimethalin *(Prowl H2O)*	K1 / 3	R	R	R	R	R	R	R	R	R	R	R	N	R	N	NB	R	R	R	R
	penoxsulam *(Pindar GT)*	B / 2, E/14	R	R	R	R	N	N	N	R	R	R	R	N	N	N	N	N	N	R	R
	pronamide *(Kerb)*	K1 / 3	N	N	N	N	R	R	R	R	R	R	R	N	N	N	N	R	N	N	N
	rimsulfuron *(Matrix)*	B / 2	R	R	R	R	R	R	R	R	R	R	R	N	R	N	N	R	N	N	N
	sulfentrazone *(Zeus)*	E / 14	N	N	R	R	N	N	N	N	N	N	N	N	R	N	N	R	N	N	N
	simazine *(Princep,Caliber 90)*	C1 / 5	R	R	N	R	R	R	N	R[2]	R	R	N	R	R	N	N	R	N	R	N
	trifluralin *(Treflan)*	K1 / 3	R	R	N	R	N	N	R	N	R	R	R	N	R	N	N	R	N	N	N
Postemergence	**carfentrazone** *(Shark EW)*	E / 14	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
	clethodim *(SelectMax)*	A / 1	R	R	R	R	R	R	R	R	R	R	R	N	R	N	N	NB	N	NB	N
	2,4-D *(Embed Extra, Orchard Master)*	O / 4	R	R	R	R	R	R	R	R	R	R	R	N	N	N	N	R	N	N	N
	diquat *(Diquat)*	D / 22	NB	NB	NB	NB	NB	NB	NB	NB	NB	NB	NB	NB	NB	NB	NB	NB	NB	NB	NB
	fluazifop-p-butyl *(Fusilade)*	A / 1	NB	R	NB	NB	NB	NB	R	R	R	R	R	NB	R	NB	NB	R	N	NB	NB
	glyphosate *(Roundup)*	G / 9	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
	glufosinate *(Rely 280)*	H / 10	R	R	R	R	R	R	R	R	R	R	R	N	R	N	N	R	N	R	N
	halosulfuron *(Sandea)*	B / 2	N	R	R	R	R	N	N	N	N	N	N	N	N	N	N	N	N	N	N
	paraquat *(Gramoxone)*	D / 22	R	R	R	R	R	R	R	R	R	R	R	R	R	N	R	R	R	R	R
	pelargonic acid *(Scythe)*	NC	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	N
	pyraflufen *(Venue)*	E / 14	R	R	R	R	R	R	R	R	R	R	R	N	NB	R	R	R	R	R	R
	saflufenacil *(Treevix)*	E / 14	R	N	R	R	R	R	N	N	N	N	N	N	R	N	R	N	N	R	R
	sethoxydim *(Poast)*	A / 1	R	R	R	R	R	R	R	R	R	R	NB	NB	R	NB	NB	R	N	NB	NB
Organic	**ammonium nanoate** *(Axxe)*	NC	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	N
	ammoniated fatty acids *(Final-San-O)*	NC	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
	caprylic/Capric acid *(Suppress)*	NC	R	R	R	R	R	R	R	R	R	R	R	R	R	N	N	R	R	R	R
	d-limonene *(AvengerAG)*	NC	R	R	R	R	R	R	R	R	R	R	R	N	R	N	N	R	N	N	N
	eugenol *(Weed Slayer CA)*	NC	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R

Notes: R = Registered, N = Not registered, NB = nonbearing. This chart is intended as a general guide only. Always consult a current label before using any herbicide as labels change frequently and often contain special restrictions regarding use of a company's product.