

Weed Control in Container Nurseries

► Weed control is one of the most important management areas of container nursery production. Weeds can significantly reduce the growth and marketability of nursery crops.

Unlike other crops, there is zero-tolerance for weeds in ornamental crops because their value is based on aesthetics. Limited post-germination weed control options pose a major challenge for nursery growers. Hand-removal or weeding is the only method to effectively remove most weed species postgermination. With labor being a major production cost, proper weed control is crucial to a nursery's bottom line. Labor costs for pulling weeds can be between \$500 and \$4,000 per acre and do not include the costs associated with crop loss or reduced growth. Understanding the cost of managing existing weeds can help provide perspective when discussing the importance of weed prevention.

Sanitation and the use of preemergent herbicides can significantly reduce weed pressure in the container nursery. Weeds spread at an exponential rate like insects. By keeping the weed population low, the number of seeds will also be reduced. Procrastination can be a costly mistake. Scouting and monitoring weed populations are crucial in determining when action is warranted. This document presents key steps to reducing labor associated with weed control.

Top Alabama Weed Species for Container Nurseries

In Alabama, the top five weed species include bittercress (figure 1), spurge species (figure 2), oxalis (figure 3), *Phyllanthus* species (figure 4), *Eclipta* (figure 5), mulberry weed (figure 6), and crabgrass (figure 7). For a complete list of preemergent labeled for nursery

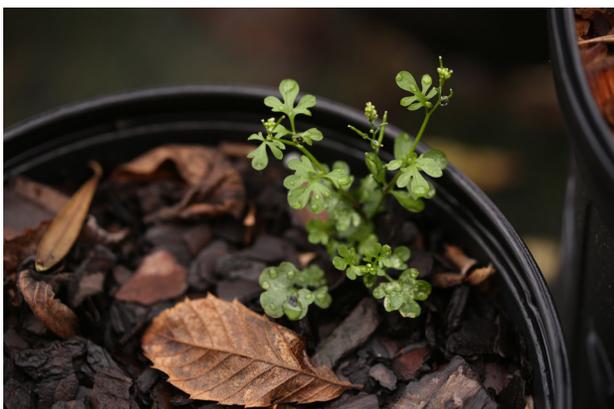


Figure 1. Bittercress (*Cardamine* spp.) with seed pods. (Photo credit: John Olive, Ornamental Horticulture Research Center)



Figure 2. Nodding spurge (*Euphorbia nutans* [Lag.]), left, and prostrate spurge (*Euphorbia prostrata*), right. Other spurge species include hyssop spurge (*Euphorbia hyssopifolia*), dove milk (*Euphorbia hirta*), and spotted spurge (*Euphorbia maculata*). (Photo credit: John Olive, Ornamental Horticulture Research Center)

crops and their efficacy, see the “2017 Southeastern U.S. Pest Control Guide for Nursery Crops and Landscape Plantings.”

Sanitation: Start Clean and Keep It Clean

Sanitation is a simple concept: If you see a weed, get rid of it. Remove all opportunities for weed seeds to spread to your crop. The following practices can drastically reduce weed seed introduction:

- Keep bark piles and surrounding areas weed free.
- Clean out weeds in roadways and ditches close to containers. These can allow seeds to be blown or washed into crop areas.
- Avoid reusing nursery pots, or if pots must be reused, properly clean and decontaminate them.
- Remove liners and discard the top layer of soil from liners at potting to reduce the chance of introducing weed seeds. Liners can be a major source of weed seeds, even if they arrive from shipment looking clean.
- If you see a weed, pull it. Even the best-managed nurseries still require some hand weeding. The more frequent weeding takes place, the lower the chances of a major outbreak. Frequent roguing for weeds can reduce labor needs significantly.
- Monitor and control weeds growing in noncrop areas. Greenhouse floors, walkways, aisles, and ditches can be ideal locations for weed growth. When weeds are not controlled in these areas, they will quickly spread and affect crops.



Figure 3. Oxalis (*Oxalis corniculata*) with flower. (Photo credit: John Olive, Ornamental Horticulture Research Center)

Preemergent Herbicides

Regardless of how well you sanitize and keep your nursery clean, there will still be weed seeds present. Using a labeled preemergent can significantly reduce the chances of weed outbreaks. These products work by creating a chemical barrier on the top 1 inch of the soil surface. Weed seeds typically germinate in the top ½ inch of the soil or potting mix. The chemical barrier does not prevent seeds from germinating, but instead it kills seedlings during germination when their shoots or roots contact the herbicide residues.

To create the chemical barrier, water is needed to wash the applied product from the plant onto the soil surface to create a ½ inch barrier. Leaching deeper than 1 inch into the potting mix is not a major problem because of its affinity to stick to organic matter in the potting mix. For the most part, large water volumes will not cause the preemergent to leach farther into the soil. Most labels recommend watering the product with at least a ½-inch irrigation event to activate the product. Some products may require more irrigation. The idea is to wash the product off the leaves and onto the potting mix that creates a chemical barrier. If the product is applied over the top of the crop, irrigate immediately after application. The chance of crop damage from the preemergent increases the longer a product remains on the leaves. Efficacy may also be reduced as the period between treatment and watering-in the product increases. Many preemergent labels include a time frame when activation must occur. Research has shown that higher application volumes (gallons per acre) can lead to greater control when using sprayable preemergent products. Higher application volumes will also reduce the chance of crop damage as the product is more diluted.

The chemical barrier is like a force field where gaps or voids can allow weed seeds to germinate. Gaps can be created by applying preemergent to freshly potted

or weeded unsettled soil. The potting mix needs to be settled by at least 1 inch of irrigation before applying a preemergent, as unsettled soil can result in voids of the chemical barrier after settling. There is a tight window of time between potting/weeding and application of preemergent before new weeds begin to germinate. Some preemergent products have some post-germination efficacy; however, these are usually specific to only a few species.



Figure 4. Chamberbitter (*Phyllanthus urinaria*), left, and long stalk phyllanthus (*Phyllanthus tenellus*), right. (Photo credit: John Olive, Ornamental Horticulture Research Center)

Granular versus Sprayable Preemergent Herbicides

Preemergent herbicides can be delivered through granular carriers or liquid sprays. Container nursery growers predominantly use granular forms as they are safer for crops and require less training for applicators. Granular products are typically applied using a hand cranked broadcast spreader. Granular products are inactive until they contact water allowing them to be safely applied to dry foliage. Granular products must be spread laterally across the potting mix. This requires the active ingredient to be very concentrated in the carrier. If dew or water droplets are present on the leaves at the time of application, the granule can release active ingredient on the foliage causing damage to the crop. Apply granular preemergent only to dry foliage and irrigate to the recommended level immediately after application.

Granular products typically come in 50-pound bags, and prices can range between \$92 and \$126 per bag. Rates are typically 150 or 200 pounds per acre. Treatment cost, excluding labor, can be between \$270 and \$500 per acre per application with 4 to 5 applications per year being typical (\$1,080 to \$2,500 per acre per year for materials).

Sprayable products can be more effective and are less expensive to apply. In some cases, labor can also be significantly reduced if the nursery design allows for boom application. Despite these advantages, few growers have switched to sprayable preemergent products due to a greater risk of phytotoxicity and increased technical skills required for calibrating spray equipment. An additional disadvantage of sprayable preemergence herbicides is that fewer options are available compared with granular herbicides. Sprayable products may be applied over the top of a crop or restricted by the label only to be applied as a direct spray around the base of the plant.

Application rates of 50 to 100 gallons are common for preemergent when applied over the top of the crop. Prices for sprayable products can come with sticker shock; for example, a 2.5-gallon container of a liquid formulation may cost \$950. When deciding between products, the buyer should consider the cost in terms of dollars per acre. A \$950 container of a sprayable product may cover 7.3 acres resulting in \$130 per acre in treatment cost compared to \$270 to \$500 per acre for some granular products. Costs for labor and other inputs can be further reduced by using a boom sprayer to apply sprayable products.



Figure 5. Eclipta (*Eclipta prostrata*). (Photo credit: John Olive, Ornamental Horticulture Research Center)

Choosing Preemergent Herbicides

Many new preemergent products that cover a wide range of weeds are available for nursery growers. Some products work well on some weeds and poorly on others. There is no one-stop-shop when it comes to herbicides. Applicators must know the predominant weed species for their site during each season. Decisions on products must include efficacy of targeted species, the ability to rotate to prevent herbicide resistance development, safety of the given crop, and label restrictions. Herbicides must include an EPA pesticide label. The label will contain a list of tolerant nursery crops. Often, these labels will also include a list of restricted species where an application is not allowed because of chances of phytotoxicity.

In many cases, the label may also have a clause stating that the product can be used on any nonlabeled species and suggesting that the applicator experiment on a small area to determine crop tolerance. In these cases, the applicator assumes liability. While examining the label, the applicator should also note restricted sites, crops, and crop types.

Most labels restrict the use of preemergent products inside greenhouses. Labels might also restrict use on crop types, like nonbearing fruit and nut trees. Some labels allow for nonbearing fruit and nut trees, and some forbid it. Propagation is another tricky area with limited application options. The label may also restrict applications on ornamentals in small containers, for example, 4 inches or less.

In the past, preemergent products primarily were divided into broadleaf or grass active herbicides. Some grass active herbicides also have activity on small-seeded broadleaves. It was common for applicators wanting broad spectrum control to mix broadleaved and grass preemergent products. Today, available for purchase are several broad-spectrum active ingredients and combination products with multiple active ingredients that allow control of both grass and broadleaf weeds with a single application.



Figure 6. Mulberry weed (*Fatoua villosa*). (Photo credit: John Olive, Ornamental Horticulture Field Station.)

Rotating products is a best management practice to reduce the chances of resistant weeds, increase crop safety, and achieve a higher level of weed control. If the same products are used repeatedly, the development of resistant strains can occur. Rotating herbicides can also reduce the chances of phytotoxicity. Certain preemergence herbicide labels restrict sequential or back-to-back applications due to the increased risk of crop injury. To reduce this risk, rotate products with different Weed Science Society of America (WSSA) group numbers between applications. WSSA group numbers can be found on most labels and represent

different modes of action. If combination products are being used, try to rotate with products that are different from both group numbers associated with the previous product(s). Label compliance is another great reason to rotate products as many products have a cap on how much product can be applied to a crop in a year. Reaching the maximum amount of product that can be applied can occur quickly, considering growers should be applying five to six applications a year. One of the most important reasons to rotate involves efficacy. Some products work better at certain times of the year or on certain weed species. Some broad-spectrum products cover a wide range of weeds, but growers should pick products best suited for their predominant weed species.



Figure 7. Crabgrass (*Digitaria sanguinalis*). (Photo credit: John Olive, Ornamental Horticulture Research Center.)

Table 1a. Efficacy of Preemergent Herbicides on Alabama's Top Weeds

Brand Name	Active Ingredient	WSSA Group	Bittercress	Eclipta	Crabgrass Large	Crabgrass Smooth	Mulberry-weed	Oxalis
Barricade/Regalkade	Prodiamine	3	f	p	G	G	f-g	G
Biathlon	Oxyfluorfen + prodiamine	14, 3	G	p	G	g	g	G
Broadstar/Sureguard	Flumioxazin	14	G	f	F	F	G	G
Dacthal	DCPA	3	p	-	f	f	-	-
Devrinol	Napropamide	3	-	-	G	G	p	p
Dimension	Dithiopyr	3	G	p	G	G	-	g
Fortress	Isoxaben + Dithiopyr	21, 3	nd	nd	nd	nd	nd	nd
Freehand	Dimethenamid-P + pendimethalin	15, 3	G	F	G	G	g	G
Fuerte	Flumioxazin + Prodiamine	14, 3	nd	nd	nd	nd	nd	nd
Gallery	Isoxaben	21	G	p	p	p	g	G
Gemini	Isoxaben + Prodiamine	21, 3	G	P	G	G	g	F
Goal	Oxyfluorfen	14	g	p	F	f	g	G
Marengo	Indaziflam	29	G	G	G	G	-	F
OH2	Oxyfluorfen + pendimethalin	14, 3	G	p	G	g	g	G
Pendulum	Pendimethalin	3	f	p	G	G	f-g	G
Pennant Magnum	S-Metolachlor	15	p	p	G	G	p-f	p
Princep	Simazine	5	f	p	p-f	p-f	-	p
Regal OO	Oxadiazon + oxyfluorfen	14, 14	G	p	G	G	g	G
Ronstar G	Oxadiazon	14	G	p	G	G	f-g	G
Rout	Oryzalin + oxyfluorfen	3, 14	G	f	G	g	g	G
Snapshot TG	Isoxaben + trifluralin	21, 3	G	p	G	G	f-g	G
Tower	Dimethenamid-P	15	G	F	G	G	f-g	g
Trifluralin	Dimethenamid-P	3	p	p	G	G	p	f

G = good control based on label (80% to 100%)

F = fair control based on label (50% to 80%)

P = poor control based on label (0 to 50%)

g = good control based on research (80% to 100%)

f = fair control based on research (50% to 80%)

p = poor control based on research (0 to 50%)

nd = no data at this time

Selected herbicides summarized from 2017 Southeastern US Pest Control Guide for Nursery Crops and Landscape Plantings

Neal, J.C., Chong, J.C., and Williams-Woodward, J. (eds.). (2017). The 2017 Southeast pest management guide for nursery crops and landscape plantings. Southern IPM Center.

Table 1b. Efficacy of Preemergent Herbicides on Alabama's Top Weeds

Brand Name	Active Ingredient	Phyllanthus (Chamber-bitter)	Phyllanthus (Long Stalk)	Spurge-garden	Spurge-hyssop	Spurge-petty	Spurge-spotted
Barricade/Regalkade	Prodiamine	p	p	g	g	p	g
Biathlon	Oxyfluorfen + prodiamine	f	g	f	f	g	f-g
Broadstar/Sureguard	Flumioxazin	G	G	g	g	G	G
Dacthal	DCPA	-	-	-	-	-	f-g
Devrinol	Napropamide	-	-	-	-	-	p
Dimension	Dithiopyr	p	p-f	f-g	f	-	G
Fortress	Isoxaben + Dithiopyr	nd	nd	nd	nd	nd	nd
Freehand	Dimethenamid-P + pendimethalin	f	f	g	G	f	G
Fuerte	Flumioxazin + Prodiamine	nd	nd	nd	nd	nd	nd
Gallery	Isoxaben	p	p	f	f	f	f-g
Gemini	Isoxaben + Prodiamine	G	p-f	g	F	F	G
Goal	Oxyfluorfen	f-g	f-g	f	f	-	f-g
Marengo	Indaziflam	f	G	g	g	p-f	G
OH2	Oxyfluorfen + pendimethalin	f	g	f	f	g	f-g
Pendulum	Pendimethalin	p	p	f-g	f	p	f-g
Pennant Magnum	S-Metolachlor	p	p	f	p-f	p	p
Princep	Simazine	-	-	-	-	-	f-g
Regal OO	Oxadiazon + oxyfluorfen	g	g	f-g	f	-	f-g
Ronstar G	Oxadiazon	g	f-g	f	p-f	p-f	p-f
Rout	Oryzalin + oxyfluorfen	f	g	f	f-g	g	f-g
Snapshot TG	Isoxaben + trifluralin	p-f	p-f	f-g	f	p	f-g
Tower	Dimethenamid-P	f-g	p-f	g	g	f	G
Trifluralin	Dimethenamid-P	p	p	f	-	p	p

G = good control based on label (80% to 100%)
 F = fair control based on label (50% to 80%)
 P = poor control based on label (0 to 50%)

g = good control based on research (80% to 100%)
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