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170. Controlling container weeds. Altland, J. American Nurseryman 205(12):38-44. 2007.

Controlling

Weed species common to container crops differ from those in field soils. In many regions of the US, species — like bittercress *(Cardamine sp.),* creeping woodsorrel *(Oxalis comiculata),* prostrate spurge *(Chamaesyce maculata),* pearlwort *(Sagina procumbens),* Northern willowherb *(Epilobium ciliatum),* common groundsel *(Senecio vulgaris)* and liverwort *(Marchantia polymorpha)* — are common in nursery containers. There are some weed species in containers that are more regional, but the preceding species account for the majority of weed problems across the US.

The select few weed species that are problematic in nursery containers have common characteristics that allow them to adapt to the unique container environment. Generally speaking, they have very short life cycles, produce abundant seed, and seed have no innate dormancy mechanism (so they germinate immediately after being released from the mother plant). These characteristics allow a single plant to reproduce quickly and spread throughout a nursery in very little time.

Container weed species have some sort of active dispersal mechanism. Their seed don't passively drop to the ground beneath the mother plant; instead, their seed or propagules are dispersed away from the mother plant. For example, seed of pearlwort are splashed away when mature seedpods are hit with a drop of rain, while seed of common groundsel are attached to a tuft of hair and are carried away by the wind. Active dispersal mechanisms allow weeds to spread from one container to another, which is important when considering containers are separated from each other by some distance.

Weeds — such as creeping woodsorrel, pearlwort and Northern willowherb — can cause headaches for nursery professionals. However, persistent sanitation and judicious herbicide use can put an end to their spread and survival.

Container weeds also tend to germinate on top of the substrate surface. They can germinate in darkness or light, as well as in established or newly potted containers (canopy from the shrub or tree does not affect germination success). Many germinate in a wide range of moisture conditions, allowing them to establish successfully in container substrates that typically undergo cycles of wetting and drying between irrigation events.

The remainder of this article will discuss the specific biology and control of three weed species, each highlighting the unique adaptations discussed above. When you understand the biology of weeds and how they have adapted to containers, methods for subverting their spread and survival are easier to foresee and implement.

Creeping woodsorrel. Creeping woodsorrel produces large numbers of seed in cigar-shaped pods. It can project these seed up to 10 feet from the mother plant. This mechanism of seed dispersal allows plants to spread quickly throughout a container system. Seed are sticky and ridged, so they adhere to surfaces of ma-

Text and photos by Dr. James Altland

Container Weeds

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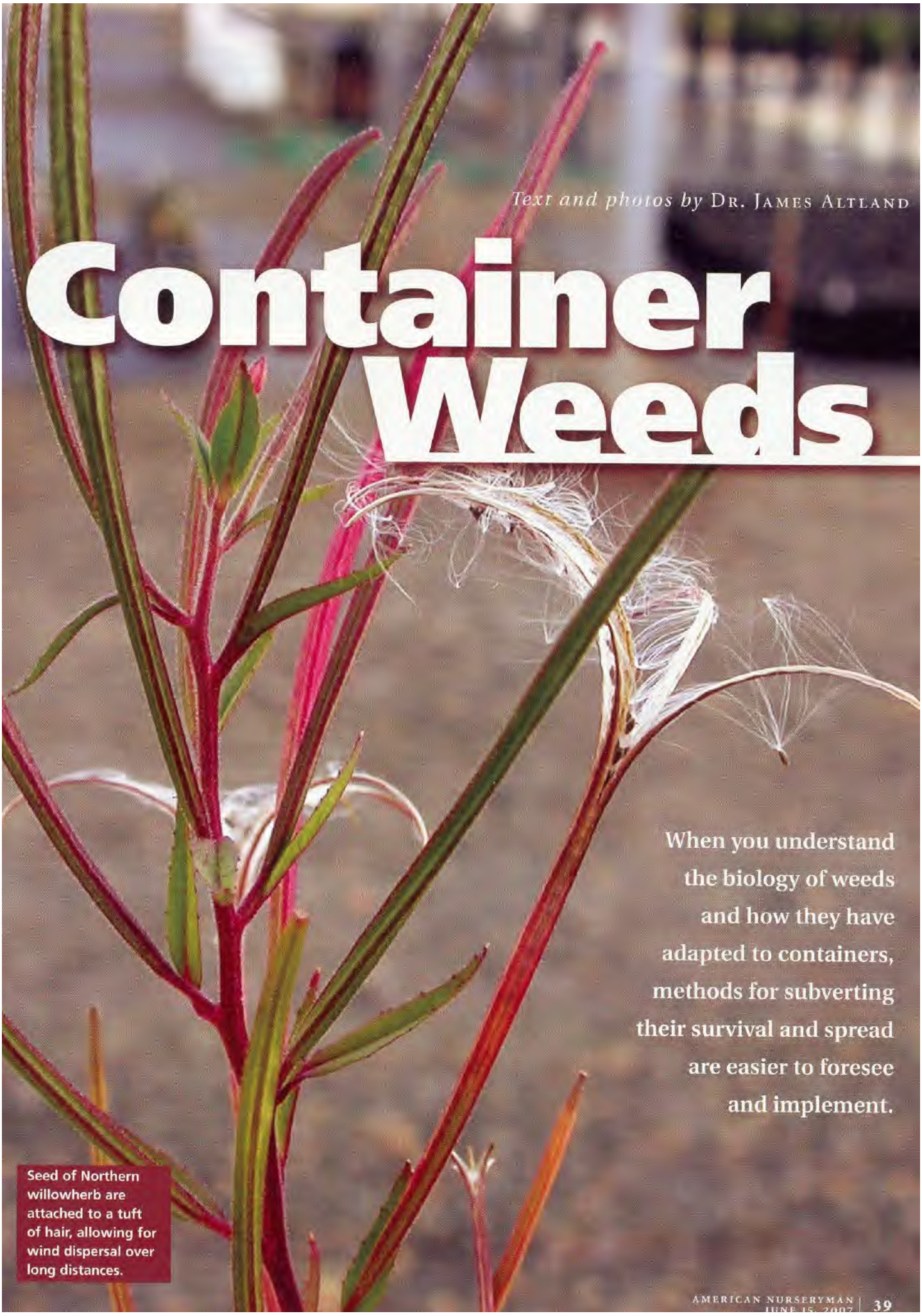
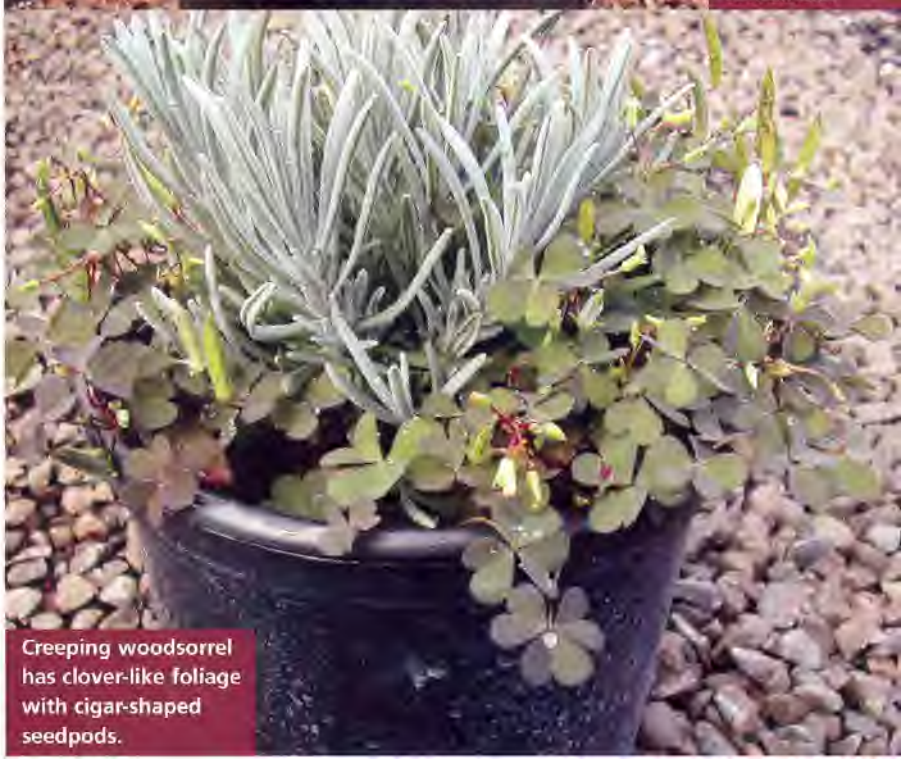


Seed of Northern willowherb are attached to a tuft of hair, allowing for wind dispersal over long distances.

Pre-emergence herbicides can be used to control creeping woodsorrel.

Hand-removal of creeping woodsorrel is difficult because it roots deep in containers.



Creeping woodsorrel has clover-like foliage with cigar-shaped seedpods.

chinery or clothing. Seed also are small and light, and they can be carried by surface runoff water, natural streams or irrigation water.

Germination rate is high, from 86 percent to 90 percent, in a greenhouse environment. Seed require low levels of light, making this weed well-adapted for germinating in shaded canopies of container plants. Germination is optimum when temperatures are greater than 60°. Creeping woodsorrel is not photoperiod sensitive, so it germinates, grows vigorously, flowers and produces seed as long as temperatures are adequate. Continual germination should be expected in greenhouses and heated hoop houses throughout the year. As winter temperatures drop below 60° in outdoor containers and unheated hoop houses, creeping woodsorrel germination declines.

Control. Diligent sanitation is the first step to controlling creeping woodsorrel. Allowing plants to grow below containers on gravel or beneath greenhouse benches provides an abundant seed source for infesting nearby containers. Using gravel or weed fabric is not a deterrent for creeping woodsorrel. It easily will germinate in small piles of spilled potting mix or decaying plant debris. Before placing containers in a production area, remove spilled bark and plant debris. Also, remove any weed that is large enough to produce seed. For smaller weeds, remove or kill with postemergence herbicides. Formulations of glyphosate (Roundup and many other products) will provide effective, broad-spectrum control. If using a weed fabric beneath containers, sweep the fabric clean of debris, and repair any torn or worn areas.

Apply pre-emergence herbicides to the gravel prior to placing containers in that area. Spray-applied herbicides, such as prodiamine (Factor or Barricade), pendimethalin (Pendulum) and flumioxazin (SureGuard), provide excellent creeping woodsorrel control. Tank-mix SureGuard with either Pendulum or Barricade at the highest labeled rates for the best, long-term, pre-emergence weed control on the gravel. If small weeds are present at the time of application, a postemergence herbicide can be tank-mixed and applied at the same time as the pre-emergence herbicides.

Pre-emergence herbicides also form a chemical barrier over the container surface. As seed germinate and grow through the chemical barrier, they either are stunted or killed. Most products are effective if uniformly applied to clean, weed-free containers.

University research (mine included) claims that pre-emergence herbicides provide effective control of creeping woodsorrel from seed; however, I believe that most nurseries are fighting creeping woodsorrel that are regenerating from roots and stolons. Using liners that previously were infested with creeping woodsorrel likely will result in major infestations in the potted crop.

I conducted a series of experiments to determine which herbicides provide ef-

fective re-emergence control of creeping woodsorrel. I hand-weeded containers severely infested with creeping woodsorrel, then applied various herbicides to see which products controlled the weed as it re-emerged from its established root system. Snapshot 2.5 TG provided excellent re-emergence control. It comprises two herbicide ingredients — trifluralin and isoxaben. Isoxaben is shoot-absorbed, which likely is the reason why creeping woodsorrel that emerged through this treatment were injured severely and grew poorly. If isoxaben is the component providing re-emergence control, then Gallery 75 DF might be as effective for nurseries that prefer spraying pre-emergence herbicides.

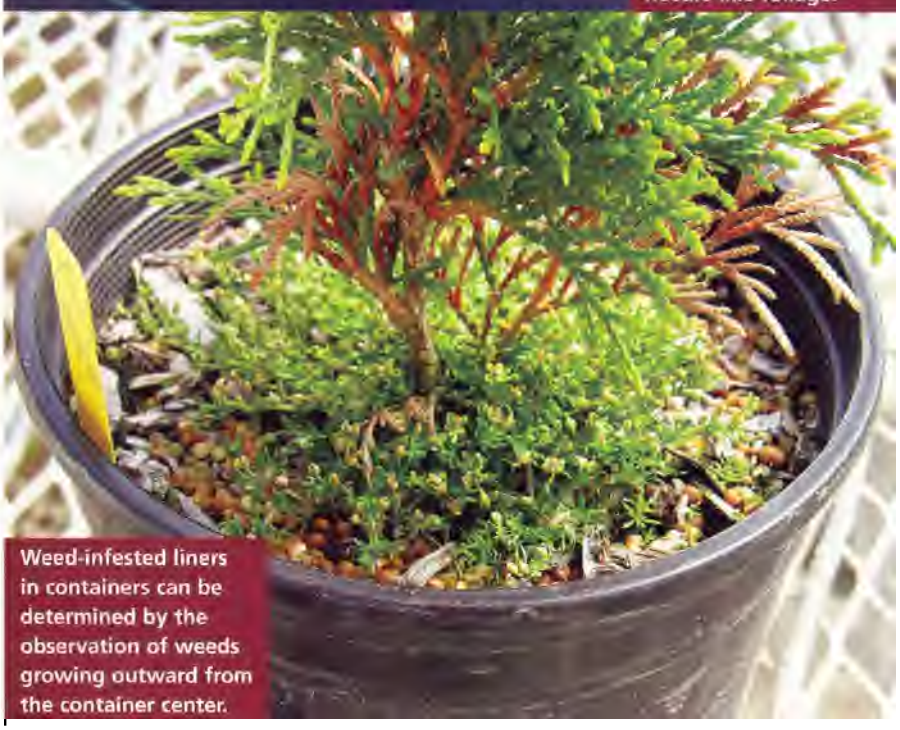
The select few weed species that are problematic in nursery containers have common characteristics that allow them to adapt to the unique container environment.

Creeping woodsorrel might be the perfect weed. It produces an abundance of seed, it can disperse seed far from the mother plant, and upon establishment, it develops deep taproots and an extensive array of stolons. Sanitation and use of clean, weed-free liners are key to keeping this weed out of your nursery. When infestations occur, hand-weed the containers and follow immediately with the maximum labeled rate of Snapshot 2.5 TG.

Pearlwort. Pearlwort is a perennial weed introduced from Europe. The plant resembles moss because of its needle-like, linear-shaped leaves and mat-like growth habit. It naturally occurs in cool, moist climates typical of coastal regions, and, thus, becomes particularly troublesome on moist, frequently irrigated container nursery crops.

The blooming period for pearlwort occurs from mid- to late spring and lasts approximately one month for a colony of plants. Pearlwort produces an average of 4,600 to a maximum of 26,300 seeds per plant. The longevity of pearlwort seed viability in soils or container substrates is unknown, but research has shown they last at least seven years.

Pearlwort appears moss-like, growing prostrate along the container surface with small, needle-like foliage.



Weed-infested liners in containers can be determined by the observation of weeds growing outward from the container center.

Seed from pearlwort growing on the gravel beneath containers can be splashed up and onto the substrate surface.

Seed are dispersed by splashing. We have no data on dispersal distance for *S. procumbens;* however, closely related trailing pearlwort *(S. decumbens)* and sticky-stem pearlwort *(S. maxima)* disperse their seed up to 16 inches and 30 inches, respectively, by splashing from rain drops. When splashed, multiple seed are contained within a single, splashed water droplet. It's not certain how high from the soil surface seed can be splashed, but it's safe to assume that seed could be splashed from plants growing on the gravel floor up and onto containerized nursery stock.

Based on my observations at nurseries and conversations with nursery producers, I believe the primary way pearlwort is introduced into a nursery is through propagation liners. Pearlwort can infest liners, even if they appear clean and weed-free. Once introduced into the nursery, this weed spreads out from the liner and disperses seed onto the gravel. Pearlwort growing on the gravel easily distributes seed back into subsequent crops.

Control. The first step in controlling this weed is to prevent it from entering the nursery site. If you purchase liners from another operation, examine them closely for signs of pearlwort infestation. Demand liners that are free of pearlwort and other weeds.

If you propagate your own liners, then the responsibility of using pearlwort-free liners is yours. Options for pearlwort control in propagation are limited. Eradicate this weed with herbicides containing glyphosate (Roundup and many other products) when propagation houses are empty. Diquat dibromide (Reward), glufosinate-ammonium (Finale) and pelargonic acid (Scythe) are other options for postemergence weed control in greenhouses; however, glyphosate is preferred for killing the perennial roots of pearlwort. Unfortunately, pearlwort seed are long-lived (at least seven years, probably longer), so scouting and subsequent control measures will be necessary. Pearlwort does not grow quickly, so semifrequent scouting to remove germinated plants is suggested.

Once liners are potted into larger containers and placed outdoors, you have more herbicidal control options. Under ideal circumstances, propagation liners and the gravel over which the potted containers are placed should be clean and weed-free.

Many pre-emergence herbicides are effective in preventing pearlwort germination. Products containing oxadiazon offer poor control. Ronstar, Regal 0-0 and Pre Pair contain oxadiazon and generally provide moderate to poor control of pearlwort. Products containing dinitroaniline herbicides (oryzalin, pendimethalin, pro-

diamine and trifluralin) seem to be most effective. RegalKade (0.5 percent prodiamine) and Pendulum (2 percent pendimethalin) provide outstanding control. Snapshot 2.5 TG contains trifluralin and also provides excellent pearlwort control in trials I have conducted.

Pearlwort is not an aggressive plant. My research has shown that it germinates slowly and then grows even more slowly. However, lack of control options in propagation houses allows even this dawdling weed to grow rampant. Sanitation in the container yard and strict use of weed-free liners are the best ways to control this species. If infested liners are used, it is extremely difficult to remove pearlwort from potted container crops. Thorough handweeding, followed by applications of either Snapshot 2.5 TG, Pendulum or RegalKade, should provide effective control in the aftermath of a pearlwort infestation.

Allowing plants to grow below containers on gravel or beneath greenhouse benches provides an abundant seed source for infesting nearby containers.

Northern willowherb. The seed of Northern willowherb develop in long, pubescent capsules approximately 3 centimeters in length. The seed are attached to a tuft of hair, which aids in wind dispersal. Seed dissemination occurs from June to September. Wind dispersal mandates excellent sanitation for controlling this weed. Eliminate any plants growing in noncrop areas in and around the nursery. Northern willowherb establishes readily in coarse gravel beneath containers. Handweed or use postemergence herbicides to eliminate these plants; do not allow them to mature and disperse seed.

The container environment provides an ideal site for germination. Seed can germinate in low-light conditions, making them well-adapted to germination under the canopy of container crops and over a range of temperatures — from 40° to 86° — although germination is more rapid in warmer conditions. Germination occurs just four days after seed are dispersed from the mother plant.

Recently potted containers are highly susceptible to infestation from Northern willowherb. Herbicides should be applied soon after potting (within three to five days). Waiting more than one week provides ample time for containers to become infested with wind-borne seed and for germination of those seed to occur. Herbicide application soon after potting is especially important during mid- to late summer when plants actively are disseminating seed.


Northern willowherb grows upright and often overshadows smaller container plants.

Control. Granular Ronstar provides the most effective control. Ronstar contains 2 percent oxadiazon and is labeled for applications up to 4 pounds active ingredient per application. Other granular herbicides, such as Regal 0-0 and Pendulum, also contain oxadiazon, but the amount of active ingredient or application rate is lower — and the control is somewhat less — than that of Ronstar.

Sprayable herbicides are becoming increasingly popular in container production because they are easy to apply with large boom sprayers, they can be applied more uniformly, and they often are less expensive. Among sprayable herbicides, Devrinol (napropamide) and Surflan (oryzalin) provide effective control, whereas Factor provides poor control, and Gallery 75 DF provides no control. When sprayable herbicides were compared to granular herbicides in the same experiment, granular Ronstar was again the most effective product.

The container environment is unique, thus only a few select weed species are adapted to growing in containers. Unfortunately, those few weeds species are problematic and difficult to control. By understanding how weed species have adapted to containers, especially with respect to seed production and dissemination, we are better able to develop management programs to control them. Study the biology of weeds infesting your nursery. Ask your extension weed scientist to help with collecting information on each species. Then tailor your weed-management program to disrupt the reproduction and growth of those species.

This article is for educational purposes only. Mention of a specific product should not be interpreted as an endorsement, nor should failure to mention a product be considered a criticism. Always read the product label prior to using any herbicide.

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