

Greenhouse Weed Control

Horticulture Information Leaflets

Introduction

Weeds such as creeping woodsorrel (*Oxalis corniculata*), flexuous bittercress (*Cardamine flexuosa*), spotted spurge (*Chamaesyce maculata*), and others are persistent problems in greenhouses, propagation houses and other covered structures. Not only do these weeds detract from the perceived quality of plants produced, but some also are known to harbor insects, such as whitefly and thrips, and other pests such as mites, slugs and snails. Furthermore, woodsorrel and bittercress are known to be hosts for impatiens necrotic spot virus (INSV) and tobacco spotted wilt virus (TSWV) which may be vectored to susceptible host crops by certain thrips. Therefore, the removal of weeds from greenhouse pots, benches, and floors is important for aesthetic and pest management reasons. A number of options are available to the greenhouse manager for controlling these pests.

What is a “Greenhouse” and Why Does it Matter?

Most herbicides cannot be used in fully covered structures including traditional greenhouses as well as fully covered propagation houses and over-wintering houses. Vapors from herbicides can be trapped in closed structures, damaging crops and exposing employees. But, what exactly constitutes a greenhouse? A fully covered structure is a greenhouse. Even if the sides are removable and the doors open for venting, technically it is a greenhouse. Shade structures are not greenhouses and do not fall under the same restrictions. Because greenhouse managers have few herbicide options, it is imperative to have an integrated approach to weed management that starts with prevention and sanitation.

Prevention

The first and most important control measure is sanitation. Keep weed propagules (seed, rhizomes, tubers, etc.) out of the greenhouse by using sterile substrates, introducing only "clean" plant materials, and weed control outside of the greenhouse. Where possible, screen vents and other openings to limit the introduction of wind blown seed as well as flying pests. Concrete or mulched floors will also limit weed establishment. Despite such efforts, some weeds will get into the greenhouse. These should be removed manually or killed with a herbicide before going to seed.

Using Herbicides In and Around Covered Structures

Within covered greenhouse-like structures, crop injury from herbicide volatilization is likely. Consequently, no residual herbicides are labeled for application to containers within such structures. And, only three residual herbicides, sodium metaborate + sodium chlorate (BareSpot Monobor-Chlorate), flumioxazin (Sureguard), and indaziflam (Marengo), are currently labeled for preemergence control of weeds in greenhouses and greenhouse-like structures. BareSpot may be used to kill existing vegetation and prevent weed growth in ground areas within greenhouses. Do not use BareSpot in crop pots. Sureguard or Marengo may be applied to the gravel or ground under benches, around the foundation or to the ground before crops are placed in the house. The house should be empty at the time of treatment. Do not move plants into the greenhouse for at least 24 hours after Sureguard treatment. Although Marengo and Sureguard can be applied to certain woody container crops outside of the greenhouse, they are not labeled for use in the containers in the covered house.

Controlling Existing Weeds

If the weeds are already established in the greenhouse, they can be killed in the following ways:

- Manual removal
- Empty the range and allow weeds to dry up (solarization)
- Empty the range and fumigate (limited uses)
- Treat with a postemergence herbicide

Each method (except fumigation) will only remove the vegetation which is present but does nothing to prevent re-establishment from seed which will be present. Even solarization rarely produces sufficient heat to effectively kill weed seed. Continuous removal of weeds is expensive and time consuming. Currently the only residual herbicide available for use in greenhouses is BareSpot Monobor-Chlorate. The active ingredients in Barespot are sodium chlorate and sodium metaborate. This non-selective residual herbicide may be used under benches, in gravel walkways and around the foundation of the greenhouse. Do not allow the product to come in contact with containers or greenhouse ground beds. After application, water-in to activate the herbicide.

Where weeds are a continual problem, clean up the area, remove the soil or cover it with a mulch. Geotextiles or "weed block" fabrics covered by gravel (or other mulches) have been successfully used in many greenhouses.

Only under extremely rare circumstances would chemical fumigation be recommended for weed control. However, if fumigation is considered for other reasons, be sure the conditions are right for weed seed control as well. Before fumigating, kill above-ground portions of existing weeds and wash the interior walls, benches, and glass or plastic to remove and moisten weed seed. The soil and media should be moist but not wet and between 50 and 80°F. In plant beds or under benches, steam sterilization can be effective. Soil / substrate temperature must remain at or above 180°F for

at least 30 minutes to kill most weed seed. The most effective fumigant, Methyl Bromide, is no longer available. Other chemical fumigants currently on the market, such as Basamid and Metham Sodium, are not well adapted to greenhouse fumigation but may be useful in some situations.

Postemergence Control of Greenhouse Weeds

Five post-emergence herbicides are labeled for use inside greenhouses. There are very specific restrictions on the use of herbicides in greenhouses. With one exception, the products described below are only for use under benches, in walkways and around the foundation of the greenhouse. They are not for use in pots or ground beds where crop plants are growing. Read the label and carefully observe any precautions. Always wear personal protective equipment when applying pesticides in a greenhouse.

Envoy (clethodim, Valent Corp) is a post-emergence herbicide labeled to control grasses. It is effective on most annual and perennial grasses including annual bluegrass (*Poa annua*) and bermudagrass (*Cynodon dactylon*). Although it can be applied over the top of many broadleaf ornamentals, applications can cause significant injury to flowers of greenhouse grown plants. It is not widely used in greenhouses.

Reward (diquat, Syngenta Corp.) is a post-emergent contact-type, non-translocated weed killer. It is good for killing small annual weeds under plant benches, in walkways and around the greenhouse foundation. Large weeds will be burned but not killed. Reward is relatively toxic. Always use the recommended safety equipment when spraying Reward. Advantages of Reward include rapid kill of seedling weeds, it may be used when a crop is present in the house, relatively low cost, and small amounts of spray drift will cause only cosmetic damage to the crop but will not translocate to kill entire plants. Disadvantages of this herbicide are lack of control of perennial or well established weeds and the relatively high mammalian toxicity.

Scythe (pelargonic acid, Mycogen Corp.) is also a post-emergent, contact-type, non-translocated herbicide which controls small seedling weeds. Scythe works better when air temperatures are high (>80°F). Large weeds will be burned but not killed. Advantages of Scythe include lower toxicity (compared to Reward) and it may be used while a crop is in the house. Also, Scythe is the only herbicide which can be used to control weeds growing in woody plant production benches, such as rose benches. In all applications, avoid contact with desirable vegetation. The main disadvantages of Scythe are cost and it is somewhat less effective than Reward on larger weed seedlings. Additionally, the odor can persist and be offensive to some people.

In contrast to Scythe and Reward, **glyphosate** is a systemic, postemergence herbicide which kills annual and perennial weeds and has a lower mammalian toxicity than Reward. However, when applying any pesticide in a closed environment, like a greenhouse, one should wear protective clothing, eye protection, and a respirator. Advantages of glyphosate are the systemic kill of annual and perennial weeds and low mammalian toxicity. The main disadvantage is that small amounts of spray drift can severely injure greenhouse crops. Therefore, it is advisable to use glyphosate only in empty greenhouses (between crops) or to shut off ventilation and circulation fans to reduce drift. If

drift occurs, wait six hours then wash the benches and sides of the house; otherwise, condensation containing glyphosate may drip onto plants. Glyphosate is off-patent and there are many products available containing this active ingredient. Products from the major manufacturers, Roundup-Pro (Monsanto) and Touchdown (Syngenta), are labeled for use in greenhouses. Before purchasing and using other formulations, read the labels to determine if they are labeled for use in the greenhouse.

Finale (glufosinate-ammonium, Bayer Crop Science) is also a non-selective, systemic, postemergent herbicide which may be used to control weeds on greenhouse floors, under benches, and around the foundation. Air circulation fans must be turned off during the application. Avoid aerial drift by using a low pressure, large droplet type nozzle. Finale is similar to Roundup, in that it is a translocated, non-selective herbicide with no soil activity in clay soils. However, in contrast to Roundup, Finale produces symptoms more rapidly (often within 48 hours) but may not control rhizomatous perennial weeds as well as Roundup. Do not use Finale in greenhouses containing edible crops.

Table 1. A comparison of herbicides labeled for use inside greenhouses.

Herbicide	Mode of action	Time for symptoms	Use with crop In house	Use in soil beds or in benches	Toxicological properties	REI**
Reward	contact	2 to 12 hr.	Yes	No	Eye and skin irritant LD ₅₀ : 230 mg/kg	24 hr.
Scythe	contact	½ to 2 hr.	Yes	Yes, directed in roses and other woody crops	Severe eye irritant LD ₅₀ : >5000 mg/kg	24 hr.
Finale	systemic	~2 days	Yes	No	May cause eye or mild skin irritation LD ₅₀ : 3570 mg/kg	12 hr.
Roundup-Pro	systemic	~7 days	No	No	May cause mild skin or	4 hr.

					eye irrigation LD ₅₀ : >5000 mg/kg	
BareSpot Monobor Chlorate	Contact / residual	Hours	Yes	No	May cause moderate skin irritation and severe eye injury LD ₅₀ : >6800 mg/kg	12 hr.
Marengo	Residual	NA -- preemergence only	No	No	May cause mild irritation to skin and eyes LD ₅₀ : >5000 mg/kg	12 hr
Sureguard	Residual	1 to 2 days -- Preemergence with post activity on seedling broadleaf weeds	No	No	May cause mild irritation to skin and eyes LD ₅₀ : >5000 mg/kg	12 hr

* LD₅₀ : the dosage required to kill 50% of the test animals, expressed as the milligrams (thousandths of a gram) of herbicide active ingredient per kilogram (1000 grams) of body weight. The larger the LD₅₀, the safer it is.

** REI: Worker protection standard prescribed restricted-entry intervals. For this time interval following a herbicide application, workers are not to enter treated areas without wearing personal protective equipment (PPE) for activities that would bring them in contact with treated surfaces. Depending upon the herbicide, the PPE required may be as simple as shoes, socks, coveralls, and rubber gloves. Check the AGRICULTURAL USE REQUIREMENTS section of the label for required PPE.

Outside of the Greenhouse

The primary objective of weed control outside the greenhouse is to eliminate a major source of airborne weed seed and to prevent perennial weeds such as bermudagrass or bindweed from growing under the foundation and into the greenhouse. Additionally, weed control around the greenhouse may also serve to reduce populations of arthropod pests. Many options are available for controlling these weeds. Mowing will prevent the majority of weed seed formation. However, a vegetation-free strip is recommended immediately adjacent to the foundation. Use a geotextile fabric covered with gravel or other inorganic mulch.

As an alternative to the geotextile, or as a supplement when weeds grow in the mulch, postemergent and soil residual herbicides may be used. Use only low-volatile herbicides labeled for use in nurseries. Indaziflam (Marengo), flumioxazin (Sureguard) and proflamone (Barricade) have been used successfully by many growers for residual weed control. Apply residual herbicides with a calibrated sprayer. Residual herbicides may be mixed with Reward, Finale or glyphosate for post- and preemergence weed control. When spraying weeds around greenhouses, close windows and vents to prevent spray drift from entering the greenhouse. Vents and windows may be opened after spray particulates have settled.

Do not use herbicides that might contaminate the greenhouse environment by volatilization or movement in water. **Do not use** auxin-type herbicides, such as those labeled for broadleaf weed control in turf, near greenhouses. **Do not use** soil sterilant herbicides such as Picloram, Arsenal, Oust, or Casoron around greenhouses.

No herbicide controls all weeds, so some weeds will escape control. Remove these escaped weeds by hand before they go to seed. When sanitation, mulching, postemergent herbicides, and manual weed removal are combined into a comprehensive weed management program, weed populations will be reduced. This results in less time spent removing weeds, lower costs for weed control, and more grower time available for other jobs. In addition, the control of weeds under the benches will prevent weed introduction to plants growing on the benches, and reduce other weed-related pest problems such as whitefly, mites, thrips, slugs and snails.

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Recommendations for the use of agricultural chemicals are included in this publication as a convenience to the reader. The use of brand names and any mention or listing of commercial products or services in this publication does not imply endorsement by North Carolina Cooperative Extension nor discrimination against similar products or services not mentioned. Individuals who use agricultural chemicals are responsible for ensuring that the intended use complies with current regulations and conforms to the product label. Be sure to obtain current information about usage regulations and examine a current product label before applying any chemical. For assistance, contact your county Cooperative Extension agent.

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