The Effectiveness of Glyphosate in the Control of Field Bindweed

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Single and repeat glyphosate applications and single amitrole-T applications were applied to field bindweed between field-grown ornamental nursery rows. Single and repeat applications of glyphosate provided significantly better control than amitrole-T during the first season and control by the two applications of glyphosate was significantly greater than other treatments during the second season after application.

Control of annual weeds with preemergence herbicides is a common practice among nursery personnel and has reduced the competition to perennial weeds, which have become a greater problem. One of the most important perennial weeds of concern to midwestern nursery personnel is field bindweed (*Convolvulus arvensis* L.)

A current recommended control measure for field bindweed is 2,4-D (2,4-dichlorophenoxyacetic acid) in June, followed by a fall treatment of 2,4-D or dicamba (3,6-dichloro-o-anisic acid). Other control techniques include deep cultivation followed by a crop of perennial grass or other close-growing type of cover and other cropping-fallow measures with and without the use of 2,4-D (*5*).

These control measures cannot be used in the nursery. The vast number of different ornamental plant species grown in close proximity make selection of any one particular herbicide difficult because of differences in tolerance.,Many ornamental species grown in the nursery are not tolerant of the growth regulator herbicides such as 2,4-D. Ornamental crops, such as shade trees and specimen evergreens, are often grown in the same area for long periods. This long-term cropping makes deep cultivation and fallow-type cultural control of perennials impossible.

Alternate methods of perennial control in nurseries include the periodic use of herbicides such as paraquat (1,1'-dimethyl-4,4'-bipyridinium ion) and amitrole (3-amino-s-triazole). Paraquat, a contact herbicide, is registered for use around tree and vine crops, but kills only the tops of the perennials, leaving the underground parts and the consequent potential for regeneration unaffected (*7*). Amitrole is translocated in the phloem and xylem, but requires several applications for bindweed control (*6*).

These herbicides can be used to control vegetation around the base of large woody plants, such as shade trees, since they are absorbed only by the foliage. Several applications can be made during the growing season and the population of perennials can be reduced. However, care must be taken to avoid using these materials around the base of plants whose bark contains chlorophyll or other pigments (such as the Japanese pagoda tree (*Sophora japonica* L.)). Amitrole may be absorbed through the bark resulting in injury to small trees. Paraquat can cause girdling of these species.

Glyphosate (N-(phosphonomethyl) glycine) appears to have potential for controlling perennial weeds in nurseries. Over 90-percent control of quackgrass for over 4 months was achieved with a single application (*4*). Good control of many perennial species, including johnsongrass (*Sorghum halepense* (L.) Pers.) and purple nutsedge (*Cyperus rotundus* L.) was also achieved (*3*). In field tests with annual weeds and grasses, glyphosate proved slightly more active than paraquat (*3*).

Glyphosate injury to ornamental crop plants has varied with species, rate, and time of application. Ahrens found that injury occurred only when the foliage was sprayed; Douglas-fir (*Pseudotsuga taxifolia (*Poir.) Britt) and Scotch pine (*Pinus sylvestris* L.) were sensitive to foliar applications during active

shoot growth, but white spruce (*Picea glauca* (Moench) Voss) was tolerant (*1*). Early spring application of glyphosate did not injure yews (*Taxus* sp. L.), white pine *(Pinus strobus* L.), Mugo pine *(Pinus mugo* Turra), or Euonymus *(Euonymus, s* p. L.); and a late fall application gave no apparent injury when applied over the top of Taxus (*7*). Glyphosate has been applied to the trunks of a wide variety of tree crops, up to 4.48 kilograms per hectare, without apparent injury (*2, 3*). Glyphosate has been shown to kill deciduous shrubs, but there have been few studies to determine the possibilities of dormant applications (*1*).

The effectiveness of glyphosate for control of field bindweed was studied at a commercial nursery in Anderson, Ind. The soil was a Camden silt loam, and the crop consisted of alternate rows of yew (*Taxus* sp. L.) and spruce (*Picea* sp. L.). The weed population consisted primarily of field bindweed with isolated areas of quackgrass and Canada thistle. Simazine (2-chloro-4, 6-bis (ethylamino)-s-triazine) at 3.36 to 3.95 kilograms per hectare was applied by the owner in February.

Herbicide treatments of glyphosate at 2.24 and 4.48 kilograms per hectare and amitrole-T (3-amino-s-triazole and ammonium thiocyanate mixture) at 2.24 and 4.48 kilograms per hectare were applied with CO_2 backpack sprayer on June 13 and replicated three times. Fifty-six days after the first treatment, glyphosate at 2.24 and 4.48 kilograms per hectare was applied to one-half of each plot that previously received the same rate of glyphosate. The lower rate of herbicide treatment was applied using 262 liters per hectare water. To obtain the higher rates, two applications were made.

Since the plants were eventually to be harvested and sold, plant growth data was impossible to obtain; therefore, only observations for injury symptoms were made. Observations were made 14, 30, 56, and 85 days after the first application; and weed population data were taken 85 days after the first application.

During the second growing season field bindweed control data were taken during mid-June. Because of the size of individual field bindweed plants and the area covered by each plant, the fresh weight of field bindweed in approximately 1 square meter was determined in each replicate. Percentage of control was determined from the fresh weight data. No additional herbicide treatments were applied.

Severe chlorosis of field bindweed, quackgrass, and Canada thistle was observed 14 days after treatment with glyphosate. Field bindweed was not flowering in the glyphosate treatments, while flowering was profuse in the amitrole-T and check plots. There was no apparent damage to yews or spruce at this time.

Thirty days after treatment, all Canada thistle and quackgrass in the single-application glyphosate treatments were dead. Some field bindweed in the glyphosate (2.24 kilograms per hectare) treatment was still green, but quite small, while the majority of the field bindweed receiving higher rate of glyphosate was dead. Field bindweed and quackgrass remained chlorotic but alive in both amitrole-T treatments; however, all Canada thistle in all treatments was dead. There was no apparent damage to either yews or spruce at this time.

Observations made 56 days after treatment indicated a regrowth of field bindweed was occurring in the glyphosate 2.24 kilograms per hectare treatment. However, control by glyphosate at 4.48 kilograms per hectare remained acceptable. Control of field bindweed was very poor in both amitrole-T treatments. The new growth of all Taxus bordering both amitrole-T treatments was chlorotic, but there was no injury in

areas bordering the glyphosate or check treatments.

Observations made 85 days after the first application and 29 days after the second application showed that the second application of glyphosate had nearly eliminated field bindweed. Leaves of the majority of the remaining plants were reduced in size by as much as 4 to 6 times, and injury was quite severe. The observed control in the one-application glyphosate treatments was poorer than that of two-application treatments, though differences were not significant statistically. All glyphosate treatments gave significantly better control than both amitrole-T treatments (table 1). Chlorotic foliage still persisted on the yews bordering amitrole-T treatments, but there was no apparent damage associated with any of the glyphosate treatments.

By the second season, only the two applications of 4.48 kilograms per hectare glyphosate were providing satisfactory control of field bindweed (table 1). Control with all other treatments was approximately 50 percent or less, and this would not be satisfactory for most nursery situations.

Glyphosate is an effective control for field bindweed. The field bindweed population was reduced by all treatments of 2.24 and 4.48 kilograms per hectare, regardless of the number of applications. Split applications of higher rates of glyphosate gave the best total control. Injury to the remaining bindweed was quite severe. Glyphosate can be used as a directed spray around *Taxus* and spruce in the nursery with the same precautions afforded to paraquat and other postemergence herbicides.

Table 1.—*Control of field bindweed by glyphosate and amitrole-T 85 and 359 days after application*

Treatment	Percent of control	
	85 days[1]	359 Days[2]
Check	0.0a[3]	0.0a
Glyphosate 2.24 kg /ha (one application)	80.1b	45.6a
Glyphosate 2.24 kg/ha (two applications)	87.7b	52.7b
Glyphosate 4.48 kg/ha (one application)	95.3b	36.8a
Glyphosate 4.48 kg/ha (two applications)	99.1 b	80.2b
Amitrole-T 2.24 kg/ha (one application)	0.0a	0.0a
Amitrole-T 4.48 kg/ha (one application)	0.0a	30.9a

[1]Percentage of control based on 228.0 individual field bindweed per square meter in the check.

[2]Percentage of control based on 489.0 grams fresh weight bindweed per square meter in the check.

[3]Values under each percentage control column followed by the same letter are not significantly different (Duncan's multiple range test).

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