Postemergence Control of Grasses With Selective Herbicides in Pine and Hardwood Seedbeds

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Tests of selective herbicide at several southern nurseries led to effective gross control in both softwood and hardwood seedbeds. Tree seedlings were not damaged and seedling production was increased. Tested herbicides are not on the market at present; application for registration for tree nursery use is planned when they become available.

Annual grasses continue to be a problem in both pine and hardwood nurseries. A survey of 57 southern forest nurseries in 1979 indicated that large crabgrass (*Digitaria sanguinalis* (L.) Scop.), goosegrass (*Elusine indica* (L.) Gaetn.), and crowfoot grass (*Dactyloctenium aegyptium* (L.) Richter) were troublesome at 60 percent, 12 percent, and 10 percent of the nurseries, respectively. In addition to the annuals, common Bermuda grass (*Cynodon dactylon* (L.) Pers.) (troublesome at 16 percent of the nurseries) is becoming more of a problem because of reduced mineral spirit use. At one nursery, competition from Bermuda grass reduced the number of plantable seedlings by 66 percent (*4*). Grass populations in hardwood seedbeds are often greater than in pine seedbeds because hardwoods have higher moisture, nutrient, and pH requirements, which result in ideal growing conditions for grasses. This was demonstrated at one nursery where hand-weeding, primarily of grasses, exceeded 9,000 person-hours per hectare (*2*).

Since 1970, the Auburn University Forest Nursery Cooperative has been screening herbicides for use in pine and hardwood seedbeds. Several herbicides including diphenamid, bifenox, oxyfluorfen, napropamide, and oxadiazon have been registered for use in pine seedbeds using data gathered by the cooperative. In recent years, testing has focused on diphenylether herbicides because pines have shown excellent tolerance to herbicides in this family. This article describes the results of studies conducted in pine and hardwood seedbeds with sethoxydim and two new diphenylether herbicides, difenopenten and RO-13-8895 (*1, 3*). (See table 1 for chemical names.)

Materials and Methods

In 1980, postemergence tests were installed at five pine nurseries in four States. Seedbeds of loblolly pine (*Pinus taeda* L.) were treated at the Hammermill and Miller Nurseries in Alabama, the Great Southern Nursery in Georgia, and the Columbia Nursery in Louisiana. Eastern white pine (*Pinus strobus* L.) was treated at the Kentucky Dam Nursery in

Table 1.—*Chemical identification of herbicides*

Common name	Formulation	Chemical name	Trade name or number	Manufacturer
Difenopenten ethyl ester	4EC	Ethyl 4- (4- (4- (trifluoromethyl) phenoxy) phenoxy)-2-pentenoate	KK-80	Kumiai Chemical
–[1]	3EC	Acetone-0-(D-2-(p-((a, a, a-trifluoro p-tolyl)-oxy)-phenoxy) propionyl) oxime	RO-13-8895	Maag Agrochemicals
Sethoxydim	1.53 EC	2- (1-ethoxyimino)-butyl)-5-(2-(ethylthio)-propyl)-3-hydroxy-2-cyclohexene-1-one	Poast	BASF Wyandotte

[1]– = not applicable.

Kentucky. At each nursery, herbicides were applied with a CO_2-backpack sprayer to 1.8- by 2.0-meter plots, which were arranged in a randomized complete block design with four replications. Seedlings were at least 4 weeks old when treated. At several nurseries, grasses had already emerged, but were less than 10 centimeters in height. Weed control ratings were made 1 to 4 weeks after treatment. Seedling tolerance was based on visual observations and on seedling counts at the end of the growing season. Sethoxydim was tested at all nurseries at 0.5 and 1.0 kilogram of active ingredient per hectare (kg ai/ha) with the addition of a crop oil (Atplus 411 F). RO-13-8895 was tested at four nurseries at 1.0 and 2.0 kg ai/ha with the addition of a surfactant (X-77). Difenopenten was tested only at the Columbia Nursery at 0.5 and 1.0 kg ai/ha with surfactant (X-77).

Similar tests were also conducted on six hardwood species at three nurseries. Treatments with difenopenten and sethoxydim were at the same rates as in the pine studies, but RO-13-8895 was tested at 0.25 and 0.5 kg ai/ha with a surfactant (X-77).

Results and Discussion

No injury was observed on pines with any of the herbicides tested. Because of reduced competition from Bermuda grass, plantable-seedling production increased at the Louisiana Nursery. Even though the seedlings in the control treatments were handweeded four times during the growing season, a 50-percent increase in plantable seedlings occurred with the difenopenten treatments and a 41-percent increase was observed with the sethoxydim treatments (table 2). Similar increases in seedling production were not observed at nurseries where competition from Bermuda grass was absent.

As in the pines, no injury was observed for any of the hardwood treatments. Difenopenten was tested only at the Miller Nursery, in Alabama on 4-week-old yellow poplar *(Liriodendron tulipifera* L.) and black walnut *(Juglans nigra* L.). At this nursery, the density of yellow poplar seedlings *was* increased fourfold to fivefold with the difenopenten and sethoxydim treatments (table 3). At the Union Camp Nursery in Virginia, RO-13-8895 and sethoxydim

Table 2.—*Pine seedling production following postemergence herbicide applications at southern forest nurseries during 1980*

Treatment	Rate	State				
		Alabama[1]	Alabama[1]	Georgia[1]	Kentucky[2]	Louisiana[1]
	Kg ai/ha	Plantables/m^2				
Difenopenten+ surfactant	0.5	—[3]	—	—	—	184**
Difenopenten + surfactant	1.0	—	—	—	—	181 **
RO-13-8895 + surfactant	1.0	199	162	97	87	—
RO-13-8895 + surfactant	2.0	199	150	119	119	—
Sethoxydim + crop oil	.5	—	165	90	93	171*
Sethoxydim+ crop oil	1.0	—	168	101	82	168*
Control	0	201	164	84	94	120

*Indicates significantly different from controls at the 5-percent level of probability.
**Indicates significantly different from controls at the 1-percent level of probability (Dunnett's T-test).
[1]Loblolly pine.
[2]Eastern white pine.
[3]– = not tested at that location.

Table 3.—*Hardwood seedling production following postemergence herbicide applications at southern forest nurseries during 1980*

Treatment	Rate	Alabama		Virginia			
		Yellow poplar	Black walnut	Sweet -gum	Sycamore	Green ash	Oak
	Kg ai/ha			*Plantables/m²*			
Difenopenten + surfactant	0.5	30**	15	—[1]	—	—	—
Difenopenten + surfactant	1.0	28*	13	—	—	—	—
RO-13-8895 + surfactant	.25	—	—	84	39	68	40
RO-13-8895+ surfactant	.5	—	—	72	31	77	40
Sethoxydim+ crop oil	.5	29**	17	73	32	81	43
Sethoxydim + crop oil	1.0	22	17	78	39	75	35
Control	0	5	10	63	38	74	37

*significantly different from controls at the 5-percent level of probability.
**significantly different controls at the 1-percent level of probability (Dunnett's T-test).
[1]– = not tested.

were tested on 8-week-old sycamore *(Platanus occidentalis* L.), sweetgum *(Liquidambar styraciflua* L.), green ash *(Fraxinus pennsylvanica* Marsh.), and water/willow oak (Quercus *nigra-phellos). Neither* herbicide caused injury to the hardwood species. At the Kentucky Dam Nursery, 2-week-old sycamores were treated. Even though the sycamore seedlings were in the cotyledon stage, no injury was observed with either RO-13-8895 or sethoxydim.

Table 4 shows the grass control obtained at nurseries where grass had emerged at time of treatment. The difenopenten treatments provided 65- to 86-percent control of crabgrass and 70- to 87-percent control of Bermuda grass, while sethoxydim provided 82- to 100-percent control of crabgrass and 90- to 92-percent control of Bermuda grass. At two nurseries, RO-13-8895 provided 100-percent control of crabgrass. Figure 1 illustrates grass control obtained at the Kentucky Dam Nursery. Competition from grasses, along with handweeding losses, eliminated all seedlings in the control plots (fig. 2).

Table 4.—*Weed control ratings for grasses at forest nurseries in 1980*

Treatment	Rate	Crabgrass					-Bermudagrass-
		Alabama[1]	Alabama[1]	Kentucky[1]	Georgia[2]	Louisiana[2]	Louisiana[2]
	Kg ailha			Percent control			
Difenopenten + surfactant	0.5	80	74	—[3]	—	65	70
Difenopenten + surfactant	1.0	80	86	—	—	72	87
RO-13-8895+ surfactant	.25	—	—	100	—	—	—
RO-13-8895+ surfactant	.5	—	—	100	—	—	—
RO-13-8895 + surfactant	1.0	—	—	—	100	—	—
RO-13-8895+ surfactant	2.0	—	—	—	100	—	—
Sethoxydim + crop oil	.5	91	86	100	100	82	90
Sethoxydim + crop oil	1.0	92	91	100	100	95	92
Control	0	0	0	0	62	0	19

[1]Hardwood.
[2]Pine.
[3]– = not tested at that location.

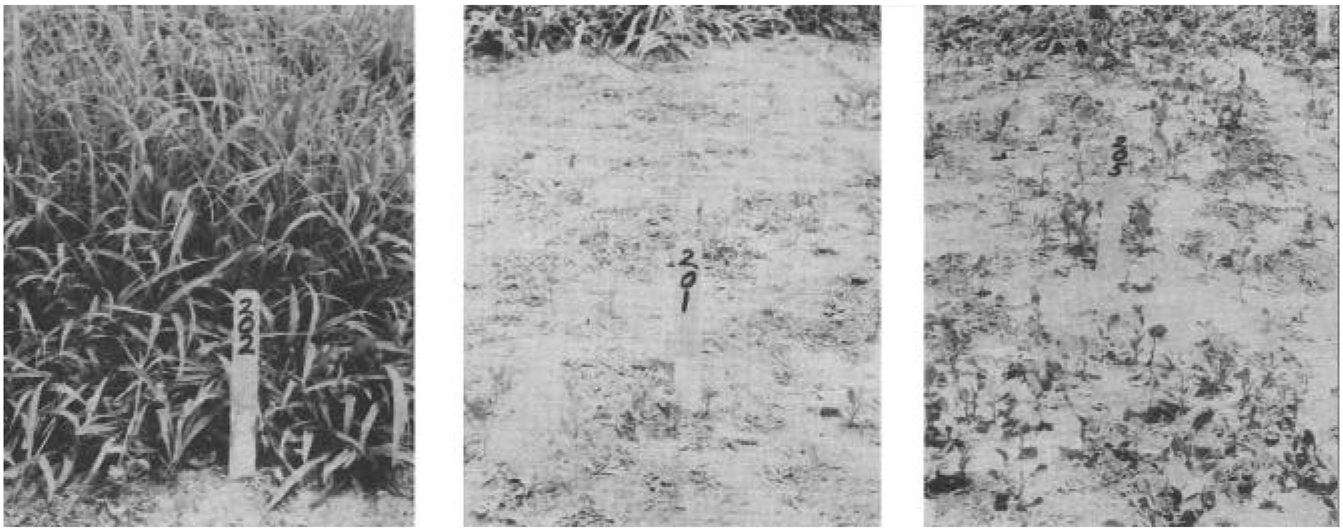

Figure 1.—*The stage of grass development 2 weeks after herbicide treatment is shown on the control plot (202). Plots treated with either* 1/s *kg ai/ha of RO-13-8895 (plot 201) or* 1/z *kg ai/ha of sethoxydim (plot 205) showed 100-percent control of crabgrass.*

Figure 2. *–Sycamore seedlings on the control plot (left) did not survive the grass competition and handweeding. No injury was observed for seedlings treated with 1/2 kg ai/ha of RO-13-8895 (middle) or 1.0 kg ai/ha of sethoxydim (right).*

Conclusions

There is a great need for selective herbicides to control grasses in forest nurseries. Tree-seedling production could be increased and handweeding-labor reduced. All three herbicides tested provided good contact activity on grasses. No other herbicides tested by the cooperative have been this effective on grasses and have shown selectivity on both pines and hardwoods. These herbicides are the only known selective herbicides that control Bermuda grass in both pine and hardwood nurseries. The only obstacle to widespread use of these herbicides in forest nurseries is proper labeling. Once these herbicides are on the market, the Auburn University Forest Nursery Cooperative plans to submit data for national and State labels for use in forest nurseries.

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