POTENTIAL HERBICIDE COMBINATIONS FOR WEED CONTROL IN SHADE TREES

STEVEN C. PROCHASKA AND THOMAS A. FRETZ[1]

Ohio Agricultural Research and Development Center
Wooster, Ohio[2]

The demand for quality shade trees for landscape use has increased greatly during the past few years. Rising labor and operating costs, the demand for quality plants in a shorter period of time, and the need for improved cultural practices, necessitates the need for more efficient methods of reducing weed populations that compete with nursery crops for water, light and nutrients.

Several problems complicate the control of weeds in the shade tree nursery. First, heavy spring and fall workloads leave little time for weed control practices. Secondly, adverse weather in early spring and late fall make it difficult to cultivate, necessitating a greater dependence on herbicides. Thirdly, nursery crops are generally in the same location for several years and therefore it may be impractical to cultivate and impossible to fumigate. Fourth, most herbicides are developed for use on crops other than shade trees or nursery stock, consequently they usually do not provide the long soil residual desired, or control a wide enough spectrum of weed species to be of significant value to this industry. Furthermore, these herbicides may prove to be too phytotoxic for nursery crops.

No single compound has yet been manufactured that will control all undesirable weed growth and at the same time be non-phytotoxic for all crops. Therefore, it is important that nurserymen not only understand the properties of the various herbicides, but also crop tolerance, and the weed spectrum controlled.

REVIEW OF LITERATURE

Previous studies have indicated that glyphosate can be employed for post-emergent weed control in shade trees and nursery stock with no apparent injury when used as a directed spray (3,5). When applied directly to nursery stock, however, glyphosate has been noted to cause significant injury to California privet, forsythia, Toringo crabapple and American cranberrybush viburnum (2). This material has shown promise in controlling numerous perennial weeds which have been previously considered difficult to control (1,5).

In addition, oxadiazon has shown promise for control of annual broadleaf and grass weeds in both field and container grown nursery

---

[1]Graduate Student and Assistant Professor of Horticulture, respectively.
[2]Mailing address: Department of Horticulture, 2001 Fyffe Court, Columbus, Ohio 43210.

stock with no signs of phytotoxicity (5,6). Similarly, alachlor when employed singly or in combination with linuron or simazine has given safe effective weed control in a wide range of ornamental plant species with no apparent phytotoxicity (4).

The objective of these studies has been to evaluate several new herbicides, singly or in combination to determine weed control and crop phytotoxicity in commercially produced shade trees over an extended period of time.

MATERIALS AND METHODS

This study was performed at a commercial nursery in Ohio on a gravelly loam soil, using established 1-1½ inch dia Skyline honeylocust (*Gleditsia triacanthos f. inermis*) trees. Each of the separate experiments reported herein was composed of 6 treatments and a control, replicated 3 times in a completely randomized design. Individual plot size was 9 x 10 ft with 6 trees per replicate. The herbicides and formulations employed in this study were alachlor (Lasso-4EC), glyphosate (Roundup-2EC), linuron (Lorox-50WP), methazole (Probe-75WP), oxadiazon (Ronstar-2EC) and simazine (Princep-80WP).

All herbicides, with the exception of gylphosate, were applied on September 13, 1974. The glyphosate treatments, involving single and repeated applications, were begun May 20, 1975. Herbicide treatments were applied with a CO_2 constant pressure sprayer calibrated to deliver the herbicides in the equivalent of 36 gal of water per acre.

In the 3 studies initiated in the autumn of 1974, each had one herbicide which was employed at 2 rates throughout the test, either alone or in combination with linuron or simazine at 1 lb. ai/A (active ingredient per acre) in order to increase the spectrum of weed species controlled and to lengthen the period of weed control. All herbicide rates are in active ingredients per acre.

Evaluations of weed control and phytotoxicity were made at various dates during the spring and summer of 1975, using a 10 to 100 visual rating system with 10 representing no control and 100 representing complete control. The weed species present in the test are included: yellow foxtail (*Setaria lutescens*), large crabgrass (*Digitaria sanguinalis*), field bindweed (*Convolvulus arvensis*), galinsoga (*Galinsoga parviflora*), prostrate spurge (*Euphorbia supina*), lambsquarter (*Chenopodium album*), yellow nutsedge (*Cyperus esculentus*), common ragweed (*Ambrosia artemisaefolia*), giant ragweed (*Ambrosia trifida*), horsenettle (*Solanum carolinense*), daisy fleabane (*Erigeron annuus*), yellow rocket (*Barbarea vulgaris*), pennsylvania smartweed (*Polygonum pennsylvanicum*), redroot pigweed (*Amaranthus retroflexus*), common milkweed (*Asclepias syriaca*), Canada thistle (*Cirsium arvense*), marestail (*Erigeron canadensis*), wild sweet potato

(*Ipomoea pandurata*), and tall morning glory (*Ipomoea purpurea*).

Data was obtained on overall annual broadleaf and grass weed control. In addition, individual weed species were evaluated where populations were uniform.

RESULTS AND DISCUSSION

GLYPHOSATE: Glyphosate is a non-selective, translocatable herbicide that when applied to actively growing vegetation causes an initial loss in chlorophyll, followed by tip-dieback, wilting and eventual death in all but the most vigorous perennials. This material exhibits no residual soil activity or preemergent weed control activity.

When applied postemergently to annual grasses and broadleaf weeds, glyphosate completely killed existing vegetation in 7-10 days, but exhibited no residual control against germinating seedlings that emerged shortly after application (Table 1). Annual weeds controlled by postemergent applications of glyphosate included giant ragweed, lambsquarter, rough pigweed, horsenettle, yellow foxtail, crabgrass, pennsylvania smartweed and galinsoga. By repeated application, glyphosate controlled such perennial weeds as common milkweed, canada thistle, wild sweet potato, yellow nutsedge and field bindweed.

Since glyphosate is a postemergent herbicide, timing of the application is critical. In these studies, the initial application of glyphosate was made on May 20, 1975, followed by a second application 5 weeks later, resulted in excellent weed control. No further applications were necessary and control was equal to treatments which received 3 applications of glyphosate at 3 week intervals (Table 1). At no time was any visual phytotoxicity apparent on the Skyline honeylocust trees.

It appears from our observations that multiple applications of glyphosate exhibited outstanding weed control and that 2 or 3 applications at the 2 lb. rate, properly spaced during the growing season, would be a means of controlling weed growth in shade tree nurseries without building up residues in the soil. In addition, results from other studies would indicate that multiple applications at rates lower than 2 lb. may also be effective in controlling selected perennial weeds (1,2).

OXADIAZON: Oxadiazon and the various combinations employed in these tests exhibited outstanding preemergent winter annual and summer annual broadleaf and grass weed control for a period of greater than 9 mon. Annual grasses which included yellow foxtail and smooth crabgrass were completely controlled for over 9 months following treatment. Annual broadleaf weeds, which included horseweed, daisy fleabane, yellow rocket, prostrate spurge, giant ragweed, lambsquarter and horsenettle were

Table 1. Effect of single and multiple applications of gylphosate for weed control in Skyline honeylocust.

Treatment	Rate lb. ai/A	PERCENT WEED CONTROL (8-27-75) Annual Broad-leaves	Tall Morning-glory	Wild Sweet Potato
Single Application	2	80	97	97
	4	87	100	100
Applied every 3rd week	4	100	100	100
	4	100	93	100
Applied every 5th week	4	100	100	100
	4	100	97	100
Control	-	30	30	20

[1]Glyphosate applications were initiated on 5-20-75.

controlled through the June 26 evaluation, however by late July, 3 lb. of oxadiazon was no longer effective. Both of the 3 lb. rates of oxadiazon when combined with either the linuron or simazine were still giving effective weed control in late July (Table 2).

Table 2. Effect of oxadiazon and various combinations for weed control in Skyline honeylocust.

Treatment	Rate lb. ai/A	PERCENT WEED CONTROL Annual Broad-leaves 6-26-75	Annual Broad-leaves 7-23-75	Annual Grasses Grasses 6-26-75	Wild Sweet Potato 7-23-75	Tall Morning-glory 6-26-75
Oxadiazon	3	97	77	100	77	87
Oxadiazon	6	100	90	100	100	93
Oxadiazon + Linuron	3+1	100	97	100	100	80
Oxadiazon + Linuron	6+1	100	100	100	100	87
Oxadiazon + Simazine	3+1	100	90	100	100	93
Oxadiazon + Simazine	6+1	100	100	100	100	93
Control	-	10	40	40	10	30

Excellent control of the wild sweet potato was achieved with all treatments at all rates except 3 lb. of oxadiazon used singly (Table 2). In general, it was our observation that oxadiazon was the most promising of the preemergent herbicides evaluated. These results are similar to those observed previously when oxadiazon was used to control preemergent weeds in Jade Glen Norway Maple (*Acer platanoides* 'Jade Glen') trees (5).

ALACHLOR: All levels of alachlor and the various combinations employed for preemergent weed control in Skyline honeylocust with the exception of alachlor at 3 lb. applied singly, exhibited excellent control of annual broadleaf weeds on June 26, 1975, 9 mon following herbicide application. However, by the July evaluation period it appeared that none of the alachlor treatments were still effective in controlling the annual broadleaf weed population which consisted of marestail, daisy fleabane, yellow rocket, prostrate spurge, giant ragweed and lambsquarter (Table 3).

Preemergent annual grass control on June 26, 1975 was not particularly outstanding with 3 or 6 lb. of alachlor. When alachlor at either rate was used in combination with linuron at 1 lb., annual grass weed control was greatly improved, however, similar combinations with simazine were unsatisfactory. In addition, alachlor at 6 lb. alone or in combination with linuron or simazine exhibited some control of wild sweet potato (Table 3).

Table 3. Effect of alachlor and various combinations for weed control in Skyline honeylocust.

		PERCENT WEED CONTROL				
Treatment	Rate lb. ai/A	Annual Broadleaves 6-26-75	Annual Broadleaves 7-23-75	Annual Grasses 6-26-75	Tall Morningglory 6-26-75	Wild Sweet Potato 7-23-75
Alachlor	3	70	17	33	77	67
Alachlor	6	80	13	63	97	100
Alachlor + Linuron	3+1	93	43	80	80	53
Alachlor + Linuron	6+1	87	30	80	87	90
Alachlor + Simazine	3+1	87	57	67	87	70
Alachlor + Simazine	6+1	90	40	73	87	100
Control	-	43	40	43	33	10

METHAZOLE: Methazole at all rates and in all combinations gave outstanding annual broadleaf and grass control 9 mon following application. Upon evaluation of the methazole treated areas 1 mon later, annual broadleaf weed control was unsatisfactory where methazole was used singly at either 3 or 6 lb. At this same period, methazole in combination with either linuron or simazine at 1 lb. had lost effectiveness and substantial quantities of annual broadleaf weeds had germinated. Similarly, annual grass weed control with methazole was beginning to lose its effectiveness in the 10 mon following application (Table 4).

Table 4. Effect of methazole and various combinations for weed control in Skyline honeylocust.

Treatment	lb. ai/A	PERCENT WEED CONTROL			
		Annual Broadleaves		Annual Grasses	
		6-26-75	7-23-75	6-26-75	7-23-75
Methazole	3	93	60	100	73
Methazole	6	100	77	100	83
Methazole + Linuron	3+1	100	87	100	67
Methazole + Linuron	6+1	97	80	100	80
Methazole + Simazine	3+1	100	83	100	83
Methazole + Simazine	6+1	100	83	100	80
Control	-	10	30	30	30

SUMMARY

From these studies, it appears that several new herbicides may be available in the future which will give not only a longer period of weed control in the commercial shade tree nursery but will provide control over a much broader spectrum of weed populations especially when combined with another herbicide.

Early fall applications of promising new herbicides appear to be a means of obtaining long season weed control, particularly through the busy spring period, with no observed phytotoxicity to Skyline honeylocust. In particular, the herbicides oxadiazon and methazole appear to be the most promising in providing this type of extended weed control. In addition, multiple applications of glyphosate during the active growing season appeared to be a highly successful means of controlling annual and perennial weeds.

LITERATURE CITED

1. Ahrens, J. F. 1974. *Selectivity of glyphosate and asulam in ornamental plantings and Christmas trees. Proc. Northeastern Weed Sci. Soc. 28:361-368.*
2. Bing, A. 1974. Glyphosate on ornamentals. *Proc. Northeastern Weed Sci. Soc.* 28:357-360.
3. Bing, A. 1975. Further studies on the use of gylphosate on ornamentals. *Proc. Northeastern Weed Sci. Soc.* 29:336-339.
4. Bing, A. 1974. Weed control on ornamentals. *Proc. Northeastern Weed Sci. Soc.* 28:357-360.
5. Fretz, T. A. 1974. Evaluation of herbicide combinations for use in shade trees nurseries. *Ohio Agri. Res. Dev. Center Res. Sum.* 79:65-70.
6. Merrick, J. R. 1975. *Oxadiazon — weed control in ornamentals. Proc. Northeastern Weed Sci. Soc.* 29:341.