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WEED CONTROL IN ORNAMENTALS WITH GLYPHOSATE[1]

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The herbicide glyphosate is well established as an important chemical for controlling many kinds of perennial weeds. These include Canada thistle (Cirsium *arvense*), field bindweed (Convolvulus *arvensis*), Japanese knotweed (*Polygonum cuspidatum*), mugwort (*Artemesia vulgaris*), bracken fern (*Pteridium aquilinum*) leafy spurge (*Euphorbia esula*), nutsedge (*Cyperus esculentus* and *C. rotundus*), and many perennial grasses such as quackgrass (*Agropyron repens*), Johnsongrass (*Sorghum halapense*), and Bermudagrass (*Cynodon dactylon*).

This report will not attempt to review in detail the great amount of work that has been done with glyphosate for weed control in ornamentals. Instead it will call attention to certain aspects that may influence successful use of this herbicide *when it becomes available for use on ornamentals*, and may account for some variability that is observed in weed control and crop response.

Timing of applications. To properly evaluate the effectiveness of a translocated herbicide such as glyphosate, observations should be made on regrowth after initial kill of weed foliage. What happens later in the year, or next year? Glyphosate is relatively slow acting. What is important is not how quickly the weed dies down, but how completely the root or rhizome system is killed, as measured by regrowth later.

On the basis of such an evaluation, the most effective time to apply glyphosate on Johnsongrass is in late summer or early fall when the grass is in the boot or full head stage of growth

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(15). August or September applications on quackgrass generally have given better control through the following year than May or June applications (12,22). However, there have been reports of excellent results from May applications (2).

Quackgrass is unsightly and a vigorous competitor in a nursery or ornamental planting. Rather than leave an infestation uncontrolled through the summer, it should be sprayed after it reaches the 4- to 6-leaf stage at a height of 8 to 10 inches. This will give control for two or three months during the summer, and a second application in the fall should result in minimum regrowth the second year (13,16).

Applications of glyphosate at late bud stage or full bloom have given better control of Canada thistle and field bindweed than earlier or later applications (19).

Even with a properly timed application, some regrowth of perennial weeds usually occurs later in the same year or the following years, and additional treatments are required for complete control (10,13,19).

Cultivation. Plowing or cultivating after glyphosate application to quackgrass or Johnsongrass generally appears to have little or no effect on control if it is delayed for at least 4 days after treatment (3,9,15). However, in one case there was no adverse effect from plowing one day after application (8) and there are reports of increased control from plowing or tilling one or more days after spraying (9,22).

Climatic effects. Rain within 8 hours after application of glyphosate may reduce effectiveness by washing off some of the herbicide before it has penetrated weed foliage (3). On the other hand, high humidity favors penetration (2), and wetting the foliage after herbicide treatment may enhance performance (11). Adequate soil moisture is essential. Control has not been satisfactory on Johnsongrass (13) or field bindweed under moisture stress.

Temperatures of 75°F or higher following application are less favorable for control than 60°F or lower temperatures (3, 5, 11).

Combinations with residual herbicides. Residual herbicides applied with glyphosate may reduce its effectiveness in controlling perennial weeds (4,17,23). Usually the effect is greatest at threshold rates of glyphosate, and in some cases it can be overcome by increasing the rate (4,17). Diuron apparently is less antagonistic than simazine or terbacil (17,18). In some cases the residual herbicide affects only how rapidly the glyphosate activity occurs, but does not reduce the final effect (18).

Combinations with other herbicides. Addition of amitrole to glyphosate resulted in less control of perennial grasses when evaluated the following summer (18). On the other hand the effects of 2,4-D and amitrole were at least additive and sometimes synergistic with glyphosate on nutsedge (23).

Effects of other chemicals. Addition of ammonium sulphate at 2.2 or 4.5 lb/A[2] to glyphosate at rates as low as 0.2 lb/A resulted in control of nutsedge and quackgrass equal to control from glyphosate alone at rates 2 to 4 times as high (7,23).

Tolerance of ornamentals. When glyphosate is registered for ornamentals it probably will be for preplant use, and also as a directed spray in plantings, avoiding contact with crop foliage. Most ornamental plants are injured to some degree if glyphosate is sprayed on foliage or on green bark. Out of 45 species or cultivars on which two or three branches were sprayed with glyphosate at 3 lb/A in August, 12 kinds did not show injury at the end of one month following spraying (21). More than half of these were conifers or broadleaf evergreen covers. Conifers in general are more tolerant than deciduous plants, and conifers are more tolerant when dormant or fully mature than when growing (1,6).

When only the lower 15 to 18 inches of trunk was sprayed two successive years on 45 kinds of shade and small ornamental trees, most were not injured. Slight trunk or foliage injury occurred on some kinds, especially the first year. Unacceptable foliage injury occurred on *Tilia cordata* 'June Bride' at 3 lb/A, and unacceptable bark discoloration on *Gleditsia triacanthos* var. *inermis* 'Sunburst' (20).

Glyphosate has great potential for solving a number of weed problems in ornamentals as it is now doing in other crops. One of its important uses should be for preplant elimination of perennial weeds. This is the best time to control perennial weeds, when there is no problem of possible injury to ornamental plants. More than one year should be allowed for preplant cleanup where possible, to permit the re-treatments that are usually necessary for complete control of difficult weeds.

When glyphosate becomes registered for directed application in ornamentals, it should be extremely useful, but care will have to be taken to avoid problems. Research in California in fruit trees and vines has led to the conclusion that glyphosate, in direct foliar applications or through drift, causes fewer immediate symptoms but more actual plant damage than other

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[2] Rates are in pounds of active ingredient per acre.

translocated herbicides, including the oil soluble amine of 2,4-D (14). Glyphosate translocates rapidly in most plants and moves farther into the unsprayed portions of trees and vines than other translocated herbicides. It is important to understand the potential damage from improper use of this herbicide, as well as its potential value when used carefully as labeled and recommended.

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GETTING THE MOST OUT OF HERBICIDES

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A continuously on-going program is necessaryy to get the most out of herbicides. Products are constantly being removed from or added to the market. Research projects are underway in many geographical areas and on many different products and combinations of products. I cannot begin to cover even our own experience in the allotted time, so I shall try to give some of the highlights in graphic form with slides and an attached table showing the products which have been most effective for us.

We started our chemical weed program in the 1950's with a few basic chemicals. In the years since then, we have added to the numbers of chemicals to develop an on-going program of application to a wide range of ornamental plant material on our 80 acres, including field plantings and some half a million containers. In the past, because of the risks and liability involved, I tried to do the major part of the application myself. Now, with a backlog of information and better new chemicals, this responsibility is gradually being delegated to others.

Along with field and container applications, each year we have run research and check plots to collect more information. We also cooperate with other growers, research stations and chemical companies to get more accurate evaluations. It is so very important to work with research and industry people, both