Chemical Mowing in Indiana: Three Years Of Success

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ABSTRACT

Currently the Indiana Department of Highways is responsible for vegetation management on about 100,000 acres of roadside that receives at least one full cycle of mowing and includes other areas, such as medians and corridors adjacent to traffic lanes, that are mowed twice or three times. Both force-account and contract means are used at a total cost of $3,250,000/year. As an alternative to mechanical mowing, a program of chemical mowing was implemented for the state of Indiana in 1983 with 3 consecutive years of success with use on Interstate and dual-lane roads. Using a combination of primary growth retardant, cost-reducing additive, surfactant (detergent) to enhance penetration and primary broadleaf herbicide, a single spray application in the spring controls weeds, prevents seedhead formation, and retards growth of grass blades so that no further spraying or mechanical mowing is required for full-season vegetation management. By employing cost-saving combinations of material, costs are equal to or slightly higher than the per acre cost of a single mowing cycle. This program was designed primarily for use on tall fescue-bluegrass mixed turf and resulted in both seedhead suppression and weed control in excess of 90 percent. Those few seedheads that do form are short and do not appear unsightly. Weeds that remain are largely resistant perennials (common milkweed, Canada thistle, and horse nettle) and late-germinating annuals (black medic, upright spurge, common ragweed, wild lettuce, and various foxtails). Grass heights at the end of the growing season remain well within the standards (12 to 18 in.) of the state of Indiana to eliminate any need for mechanical mowing.

Current safety and esthetic standards require that roadsides be mowed. In Indiana, costs are between $20 and $25/acre for one mowing cycle; one to three cycles are required per growing season to establish and maintain adequate sight distances and visual appearances of tall fescue-bluegrass mixed stands.

On the basis of research initiated in 1977 at Purdue University (1), a program of chemical mowing was initiated in the state of Indiana in 1983 as an alternative to mechanical mowing (2-3). The requirements were for a single spray application, effective in preventing growth and seedhead formation in bluegrass and fescue. There should be no damage to roots or weakening of turf and no carryover that would limit repeated use on an annual basis. The treatment should be environmentally safe and should control the majority of turf weed species. In addition, the treatment must be cost effective. These various criteria have been met by employing a combination of materials that, when applied together, yield cost effective, full-season vegetation management.

PROGRAM DESCRIPTION

The general guidelines for Indiana's current program of chemical mowing are discussed in the following sections. The components of the spray mixture are given in Table 1. No component should be eliminated or changed in rate of application without anticipation of a reduction in treatment effectiveness.

Spray Mixture

The rates for the mixture (as product) are as follows: 1 pt of Embark 2S plant growth regulator (as mefluidide) + 1/4 oz Telar (as chlorsulfuron) + 1/2 gal 2,4-D amine (4 lb acid equivalent per gal) + 0.1 gal X-77 nonionic surfactant (detergent) equivalent to 0.25 percent of the final solution + 40 gal of water. This mixture is applied to one acre.

Time of Application

Dates of application are generally between April 1 and May 10 shortly after spring green-up and before seedhead emergence. The mefluidide and chlorsulfuron combination is fast acting, and generally grass growth can be expected to be stopped at the time of application. Blade growth may resume at a later time but seed stalk growth will not.

Area of Treatment

Application may be fence-to-fence including interchanges or corner cuts, or both, at public road intersections. Variability in results may be expected if applied by off-road equipment because of differences in speed of equipment in traveling rolling terrain. Satisfactory results may be expected with truck-mounted sprayers operated on pavement or shoulders. Full median and 18-ft wide shoulder sections may be treated in this manner because of uniform operating speeds of the spray trucks. This spray area conforms to the standards for limited-width mowing in Indiana.

Application Methods

Although the rate for application can be varied by a factor of two without total loss of effectiveness or permanent injury to the turf, it is essential that the mixture be applied as evenly as possible to

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TABLE 1 Component of Treatment Mixture

Component	Generic Name	Trade Name	Application Rate/Acre (ai)	Amount Per 40-gal Spray Solution	Function in Mixture
Primary retardant	Mefluidide	Embark	1/4 lb	1 pt	Prevents seedhead formation in fescue and slows blade growth of grasses
Additive	Chlorsulfuron	Telar	0.1875 oz	1/4 oz	Reduces mefluidide requirements by 50 percent through synergistic interaction; enhances weed control on 2,4-D resistant species, that is, wild carrot
Surfactant	X-77 (or equivalent)			0.1 gal	Enhances penetration of primary retardant and herbicide
Primary herbicide	2,4-D		2 lb	0.5 gal	Wide spectrum control of broad leaf weeds

TABLE 2 Results of 1983 Application

Date of Application	Amount/Acre (ai) Embark (lb)	Surfactant[a] (%)	Telar (oz)	2,4-D (lb)	Fescue Seedheads Number per ft^2	Height (in.)	Weeds per 100 ft^2[b]	Cost per Acre[c] ($)
March 18	–	–	–	–	12	47	160	–
	0.50	0.25	–	2	3	31	25	21.70
	0.25	0.25	0.1875	2	2	29	25	16.70
May 3	–	–	–	–	17	46	124	
May 4	0.50	0.25	–	2	5	5	10	
	0.25	0.25	0.1875	2	1	22	10	
May 9	–	–	–	–	17	46	64	
	0.50	0.25	–	2	7	24	2	
	0.25	0.25	0.1875	2	0	14	0	

Note: Detailed is the effect of mefluidide in combination with surfactant and 2,4-D as influenced by addition of chlorsulfuron at early and late dates of application.

[a] In 1983 several different surfactants were evaluated and X-77 was selected for continued use in the program.
[b] Exclusive of common milkweed.
[c] Based on Embark $32/lb; surfactant $10/gal; Telar $12/oz; 2,4-D $1.60/lb.

achieve uniform seedhead suppression and to obtain the desired control of weeds. Excellent results have been obtained in Indiana using the basic Swinglok® sprayer with computer-controlled injection system.

Treatment effectiveness may be diminished by rainfall within the first 8 hr of application, but results are generally satisfactory under a wide range of weather conditions. To be effective, the material must be delivered to the target area at the prescribed rate of application.

Application Cost

In the 1985 application on the 700-acre test area west of Indianapolis on I-70, costs averaged $27.14/acre; the total cost for application was $19,000. Of this total, $7,000 was for chemicals and $12,000 was for application. It should be noted that the major part of the application cost, with the exception of two 500-gal Swinglok® sprayers and operators, was for dump trucks with trailer-mounted arrow boards and operators that followed the spray trucks for safety. On outside shoulders one truck and arrow board followed, and on median shoulders two trucks with arrow boards followed each unit. These safety precautions are standard for four-lane divided highways in Indiana. Other states may have standards that may increase or decrease application costs.

Even with these safety precautions, and considering the relatively low traffic volume in April, there were several near misses involving commerical trucks running side by side, with both the trailing Indiana Department of Highways (IDOH) employee or a commercial driver using the median to avoid collision.

OBSERVATIONS

The first practical growth retardant mixture that was both effective and equivalent in cost to one-cycle mowing was one in which the herbicide Telar (chlorsulfuron) was included to reduce the amount of the primary retardant Embark (mefluidide) to an affordable application rate (Table 2). Results in 1983 demonstrated that the less expensive mixture of 0.25 lb/acre active ingredient (ai) mefluidide + 0.1875 oz/acre ai chlorsulfuron was as effective as 0.5 lb/acre ai of mefluidide alone in the mixture with 2,4-D and surfactant.

The early application on March 28 was not as effective as later applications. Both seedhead and weed control were near 90 percent with mid-season and late applications (see Figure 1). In 1984 the mixture was applied to a 67-mi, 700-acre segment of Interstate with satisfactory results (Figure 2). Seedhead control in both fescue and bluegrass was excellent (Table 3), and weed control also was

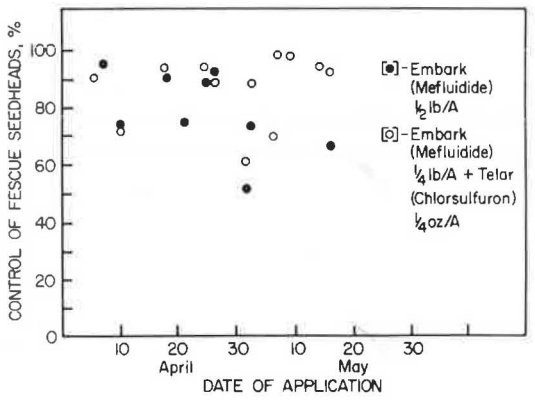

FIGURE 1 Percent control of fescue seedheads as a function of application date for Embark (·) and Embark + Telar (◦) in combination with 2,4-D and surfactant. Tall fescue seedheads emerge from about May 15 to May 25 in central Indiana.

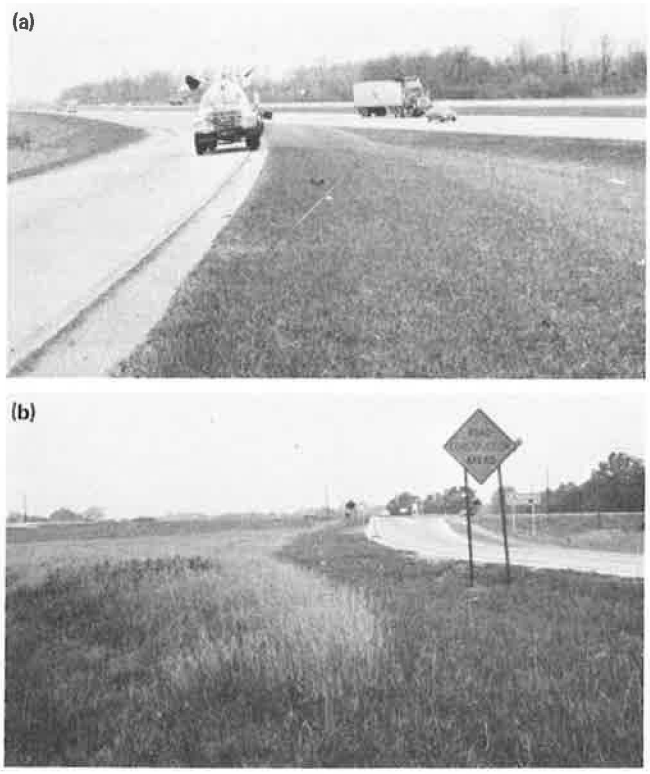

FIGURE (a) April 1984 application adjacent to an Interstate ramp section using Swinglok® sprayer. (b) Results on June 15, 1984, showing seedhead control in the strip next to the ramp using the standard chemical mowing mixture. The interior area of the interchange is untreated.

satisfactory (Table 4). A similar implementation trial was conducted in 1985 in comparison with lowered rates of mefluidide and chlorsulfuron (Table 5). As in 1983 and 1984 the mixture of 0.25 lb/acre ai mefluidide + 0.1875 oz/acre ai of chlorsulfuron provided excellent control of grass seedhead and weeds. The lower rate of application, 0.125 lb/acre ai mefluidide + 0.0937 oz/acre ai chlorsulfuron in combination with 2,4-D and detergent, also provided satisfactory results although suppression of seedhead formation under these conditions was incomplete.

The treatment of 0.25 lb/acre ai mefluidide + 0.1895 oz/acre ai chlorsulfuron in combination with detergent and 2 lb/acre ai 2,4-d did not significantly reduce root development in turf species and has shown no deleterious effects with annual applications to the same area (7 years with mefluidide alone, 3 years with mefluidide and chlorsulfuron). Some slight discoloration of grass blade may occur early but it soon disappears. In mid-summer and fall, the treated areas appear lush and green with a visual appearance equal or superior to comparable areas mowed once.

On secondary highways, where smooth brome is a dominant species, or where roadside infestations of tall, late-germinating annual weeds (giant foxtail, ragweed, and wild lettuce) are a problem, the mefluidide + chlorsulfuron + 2,4-D + surfactant mixture is not satisfactory. The treatment does not suppress formation of seedheads with smooth brome, and the tall, late-germinating annuals become unsightly late in the growing season. New combinations of materials are under development in the research phase of the project to overcome these problems to permit extension of chemical mowing to all secondary highways.

DISCUSSION OF IDOH PROGRAM

The main objective of any roadside maintenance supervisor must be to provide a zone of safety adjacent to the traveled way. This may involve good sight distance, a clear zone free of obstructions, and a clear path for water to follow in draining off of the pavement. Traditionally this was accomplished through mowing. The advent of improved herbicides has permitted the manager to reduce the amount of expensive mechanical mowing by reduction or elimination of weeds and brush (3). The more recent development of plant growth retardants adds another tool for the roadside manager to permit choices not previously available.

Perhaps the key words here are tool and choice. In the management of roadsides the roadside maintenance supervisor should never lose sight of the objectives noted earlier and therefore should not permit programs to be all mechanical mowing or all chemicals, or now all plant growth regulators. Each manager must assess the needs, budgets, abilities, and competencies of the parent organization and then apply the proper method of control to the determined need.

Obviously needs vary state by state and by other governmental agencies. Size of budget, adjacent land

TABLE 3 Evaluation of a Spring Application

	Fescue[a]			Bluegrass[a]		
	Seedheads			Seedheads		
	Number per ft^2	Height (in.)	Blade Height (in.)	Number per ft^2	Height (in.)	Blade Height (in.)
Median						
Unsprayed	17 ± 1	39 ± 2	15 ± 4	12 ± 4	21 ± 1	13 ± 2
Sprayed	2 ± 3	20 ± 5	14 ± 3	2 ± 1	13 ± 3	10 ± 2
Control, %	90			83		
Pavement to ditch						
Unsprayed	15 ± 3	37 ± 2	18 ± 3	7 ± 2	21 ± 1	14 ± 2
Sprayed	1.6 ± 1	24 ± 2	14 ± 2	0.7 ± 0.6	14 ± 2	11 ± 1
Control, %	90			90		

Note: Application consisted of 1/4 lb/A mefluidide + 1/4 oz/A chlorsulfuron + 2 lb/A 2,4-D amine + 0.25 percent X-77 surfactant (by volume of total spray mixture) (25 gpa Swinglok Sprayer®), Indiana Department of Highways on I-70 east of US 231. Application was on April 18, 1984. Evaluations were on August 24, 1984, 4 months after application.

[a]Based on measurements from four different locations selected at random. Heights are average maximum heights in inches from 10 to 20 plants per location ± standard deviation among different locations. Rates are of active ingredients. Initial height of bluegrass is 3.5-4 in. Initial height of fescue 6 to 7 in. Blade height is measured in inches for fully extended leaf blades.

TABLE 4 Control of Weeds by a Spring Application

	Weed/1,000 ft^2											
	Ragweed	White Top	Wild Carrot	Lespedeza	Common Spurge	Milkweed	Wild Lettuce	Clover Sweet	Red	Black Medic	Aster	Total[a]
Median												
Unsprayed	43	67	0	204	30	18	0	27	0	0	2	391
Sprayed	11	0	0	12	0	1	0	0	5	1	0	30
Control, %												92
Pavement to ditch												
Unsprayed	63	9	0	182	54	87[b]	4	57	0	0	12	468
Sprayed	21	0	2	18	11	0	1	3	0	6	0	62
Control, %												87

Note: Application consisted of 1/4 lb/A mefluidide + 1/4 oz/A chlorsulfuron + 2 lb/A 2,4-D amine + 0.25 percent X-77 surfactant (by volume of total spray mixture) (25 gpa Swinglok Sprayer®), Indiana Department of Highways on I-70 east of US 231. Applied April 18, 1984. Evaluations were on August 24, 1984.

[a]Sum of all weeds counted in three different locations. The area was not especially weedy, averaging 18,600 weeds per acre. The treatment reduced the weed population to about 2,000 weeds per acre equivalent to 90 percent control of all species.

[b]Includes 85 whorled milkweed.

TABLE 5 Evaluation of a Spring Application

	Fescue[a]			Bluegrass[a]		
	Seedheads			Seedheads		
	Number per ft^2	Height (in.)	Blade Height (in.)	Number per ft^2	Height (in.)	Blade Height (in.)
Median						
Unsprayed	13 ± 1	33 ± 3	13 ± 1	10 ± 4	14 ± 2	9 ± 2
Sprayed						
Schedule B	1 ± 1	10 ± 5	11 ± 2	1 ± 1	8 ± 3	10 ± 1
Control, %	92			90		
Schedule C	1 ± 1	11 ± 1	11 ± 2	4 ± 3	7 ± 2	11 ± 2
Control, %	92			60		
Pavement to dtich						
Unsprayed	11 ± 2	35 ± 2	18 ± 2	12 ± 3	18 ± 3	15 ± 1
Sprayed						
Schedule B	1 ± 1	10 ± 2	10 ± 2	1 ± 1	8 ± 2	10 ± 2
Control, %	91			92		
Schedule C	1 ± 0	11 ± 1	10 ± 2	3 ± 2	6 ± 2	10 ± 1
Control, %	91			75		

Note: Application consisted of 1/4 lb/A mefluidide + 1/4 oz/A chlorsulfuron + 2 lb/A 2,4-D amine + 0.25 percent (by volume of total spray mixture) = Schedule B with 1/8 lb/A mefluidide + 1/8 oz/A chlorsulfuron + 2 lb/A 2,4-D amine + 0.25 percent X-77 surfactant (by volume of total spray mixture) = Schedule C. Application was in late April 1985, evaluation was on July 26, 1985.

[a]Method of measurement same as in Table 3. Heights are average maximum heights in inches ± standard deviation among different locations. Rates are of active ingredient. Weed control was estimated at 93 percent based on actual counts.

uses, and environmental regulations all have an effect in the determination of a program. The program of the Indiana Department of Highways should apply to any roadside vegetation management program so long as the predominant roadside grasses are tall fescue and bluegrass.

The application of this information may be from full elimination of mowing to spot treatment in order to eliminate expensive hand trimming of sign-posts and guardrails. Perhaps the most promising use, from the standpoint of safety, may be the elimination of seedheads in areas where sight distance is critical such as at-grade intersections, crossovers, and gore areas at interchanges.

The reader is invited to find new ways of applying the methods and procedures presented here to provide yet another effective tool, to help solve the many complex maintenance problems found on roadsides.

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