Chemical Mowing Becomes Reality

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INTRODUCTION

Chemical mowing is the most recent development from a program of research in roadside vegetation management initiated in 1966 (Table 1). The first phase from 1966 to 1970, was largely one of problem identification. Surveys were conducted to determine weed species and densities and to evaluate practices of vegetation management then current. Herbicides were evaluated and mode of action studies were completed. These led eventually to more efficient herbicide use and greater environmental safety. This second phase was implemented in the form of a herbicide program beginning in 1971 with full implementation in 1972-73. A fall application of an environmentally safe amine formulation of 2,4-D was followed by a second application in early spring on a three-year rotation. Research on Phase III "Reduced Mechanical Mowing" was initiated in 1971 and implemented in 1974. The project is now in implementation of Phase IV "Chemical Mowing." The objective of Phase IV is to eliminate or reduce the need for mechanical mowing and provide efficient total vegetation management at a substantially reduced cost.

CHEMICAL MOWING

Chemical mowing is the use of chemicals to reduce or prevent growth of grass and weeds so that the need for mechanical mowing is eliminated or reduced. Characteristics of the program desired are summarized in Table 2.

Ideally, the treatment should consist of a single spray application. Maximum grass height should never exceed acceptable mowing limits over entire growing season. The treatment must be effective against both fescue and bluegrass, the dominant turf species in the State, as well as give control of broad-leaf weeds and brush. Tall annual grasses such as giant foxtail also must be controlled so that a pre-emergence action to prevent the germination of weed seeds in the spring is an important aspect.

In addition to the above criteria, it is important that the treatment be environmentally safe. There should be no weakening of the root system of the grass, no injury to desirable species and no carry-over that would limit repeated use on an annual basis. A healthy, lawn-type appearance to the turn would be nice but not essential. Finally, the treatment must be practical from an economic standpoint. The total cost of a single spray application must not exceed the current maintenance costs of the fall-spring spraying rotation and limited two-cycle mowing. If possible, the treatment should be designed to be not only cost effective but to provide substantial cost savings to the State.

The most important criterion, however, is the requirement to prevent seed heads of fescue. Most roadsides require mowing primarily to control these seed heads. If even a few seed heads form, the appearance is unsightly. For any treatment, elimination of seed heads is essential.

METHOD OF APPROACH

Independently and through the assistance of industrial cooperators, more than 500 commercially available and experimental materials were examined for growth retardant activity in laboratory, greenhouse and field studies. From these, about 20 materials were selected for further study in test plots under roadside conditions.

More than 5,000 test plots have been evaluated. Included in the evaluations were degree of growth retardation, effects on seed head suppression, color, vigor, and growth of underground parts and mode of action. Measurements of individual plant parts were taken at weekly or biweekly interals to help understand exactly how grass growth was being affected. Emphasis was on evaluating how growth was retarded, for how long, and to what extent. Any material showing promise on one species was tested on other species.

Approximately five materials, effective on both bluegrass and fescue, were selected for detailed evaluation in large plots to establish optimum rate of application at a fixed date and optimum dates of application at a fixed rate. Date studies were initiated approximately every two weeks from early March to mid-September in the first year and from early March to early June in succeeding years. Rate studies were conducted in early, mid and late spring, mid summer and early fall in the first year and in early, mid and late spring in succeeding years.

From these various materials, Embark (mefluidide), was selected as the primary growth retardant for a vegetation management mixture to enter the implementation phase in 1983. In cooperation with John Burkhardt and Kenneth Mellinger, IDOH, this mixture was evaluated in Miami County in 1983 with more extensive evaluations scheduled for 1984.

RESEARCH FINDINGS

One of the combinations tested over the past five years, is a mixture of four different materials: Embark (½ lb/A, as mefluidide + the an experimental additive and/or a surfactant + the amine salt of 2,4-D (2 lb/A as 2,4-D acid equivalent (Table 3). A single application consistently gave the desired results. This combination of materials in early spring (March 20 to May 1) gave greater than 85% suppression of seed heads with both fescue and bluegrass and the sprayed roadsides were maintained with a healthy lawn-type appearance. Grass hegights remained within the current mowing limits for the entire growing season and without the need for mechanical mowing. The inclusion of 2,4-D in the mixture controlled broad-leaf weeds and some annual grasses. There was no weakening of the root system and no appreciable carry-over to the next season. All materials have been judged to be safe in the environment.

Embark is the primary retardant material in the mixture. Its advantages are effectiveness, safety, and no appreciable inhibition of root growth. Some disadvantages are that a high rate of application is required to control seed heads in fescue. These high rates may be injurious to native bluegrass.

The additives are employed as a means to decrease the rate of Embark required for suppression of seed heads in fescue through a synergistic interaction. One of the most effective additives to date is Glean Herbicide. Active at very low rates, the standard treatment of ½ lb/A Embark + Surfactant + 2 lb/A, 2,4-D amine (Schedule A, Table 4) can be duplicated or exceed by ¼ lb/A Embark + Surfactant + ¼ oz/A Glean + 2 lb/A, 2,4-D amine (Schedule B, Table 4). Glean is expected to be marketed for roadside use under the trade name *TELAR*. Since neither Embark nor Glean gives satisfactory control of broadleaf weeds, 2,4-D amine is added. At high rates of application, 2,4-D amine formulations sometimes showed an antagonistic reaction with low application rates of Embark. However, the antagonism is overcome by the surfactant X-77 in the mixture (Table 5). 2,4-D amine is safe, effective, non-volatile and sold commercially.

IMPLEMENTATION ACTIVITIES

Large scale tests of ½ lb/A of Embark (as mefluidide) plus surfactant and 2,4-D amine (Schedule A, Table 4) were applied in Miami County, Indiana on April 4, 1983 and for evaluation of varying rates of materials in Tippecanoe County, Indiana to US 52 north of Lafayette at several dates in the spring of 1982. Both years, scheudule A was effective in controlling seed heads in fescue (Table 6).

Schedule B, with the addition of Glean Herbicide (Telar) as an additive, is even more effective. When applied in early May, complete control of fescue seed heads was obtained. Schedule B has been recommended for limited implementation on the Interstate System in the spring of 1984. Schedule B is also very effective in the control of broadleaf weeds. It is comparable to schedule A for most species (better than 90% control) and Schedule B is more effective than Schedule A against wild carrot.

The most cost effective mixture so far is Schedule C. When applied late in the 1983 season, it was nearly as effective as Schedule B and more effective than Schedule A (Comparable Tables 7 and 8). This material, however, has not been tested in early applications and a decision on implementation will probably be based on test results from the 1984 trials.

With any of the schedules, spring applications only are recommended. The materials can be applied in the fall but much higher rates are required and the fall applications do not appear economical. For Schedules A and B, the materials are applied from green-up until the seed heads just emerge from the boot (Table 9). With Schedule A, the seed heads will sometimes elongate beyond the point where they are at the time of application. This, however, does not seem to happen with Schedule B. With Schedule B, the seed heads and grass remain nearly at the stage they are at time the application is made. For Schedule C, applications should be restricted to the last week of April and the first week of May until more information is obtained concerning the suitability of earlier applications.

None of the present schedules is recommended for use on secondary roads in agricultural areas. The problem comes from late germinating foxtails and other crop-land weeds that are inadequately controlled. It will probably be necessary to mix the materials with a crop-type preemergence herbicide for use in such situations. At present, a suitable cost-effective material for this purpose has not been identified.

The relative costs of the three schedules is summarized in Table 10 based on current prices of materials and mowing and application estimates. Both schedules A and B are competitive with one-cycle mowing ($20 + per acre) and Schedule C is decidedly less expensive to apply than it is to mow once.

FUTURE DIRECTIONS

In the coming years, we expect to explore ways to reduce even further the costs of the chemical mowing program and to make it more effective. Among the priority objectives for 1984 are to test Schedule C further and determine its place in the Indiana Program. Also, we will begin studies to adapt one or more of the Interstate Schedules for use along secondary roads.

SUMMARY

The objective of this research project, full-season vegetation

management through a single spray application and with no need for additional herbicide application or mechanical mowing, has been realized. In 1984, we expect to deliver full season vegetation management for the Interstate System for about the same cost or a few dollars less per acre than the cost to mow once.

Table 1

Indiana Program of Roadside Vegetation Management

Phase	Designation	Begin	End	Total Study Costs	First Year Cost Savings
I	Problem Identification	1966	1970	$ 25,000	none
II	Herbicide Program	1971	1973	$ 30,000	$ 300,000
III	Reduced Mechanical Mowing	1974	1976	$ 45,000	$1,100,000
IV	Chemical Mowing	1977	1983	$125,000	$2,000,000*

*Projected

Table 2

Desired Characteristics of a Chemical Mowing Program

1. Single spray application
2. Control of broadleaf weeds/brush/annual grasses
3. No seed heads formed in turf species
4. Maximum grass height below acceptable mowing limits
5. No mechanical mowing necessary
6. No weakening of root system; no outward injury to desirable species; repeated annual use possible
7. Healthy, lawn-type appearance
8. Low cost
9. Environmentally safe

Table 3

Materials Used as a Tank Mix to Formulate the Chemical Mowing Combinations

Embark (mefluidide) Plant Growth Regulator (3M)
  2 lb active mefluidide per gallon

Glean Concentrate (DuPont)
  75% active material

X-77 (Ortho) Concentrate = Surfactant

2,4-D Amine
  4 lb 2,4-D acid equivalent per gallon

Table 4

Mixing and Application Schedules for Embark-Glean-Surfactant-2,4-D Combinations

SCHEDULE A

½ lb/A Embark (mefluidide) + 0.5% X-77 + 2 lb/A 2,4-D Amine

2/3 gal Embark
1 gal X-77
1 ¼ gal 2,4-D amine
100 gal water

The mixture is applied at the rate of 40 gal/A

Note: This is the same recommendation as for 1983 and has proved satisfactory for dual lane highways and should be acceptable anywhere in the Interstate System. No mowing should be required.

SCHEDULE B

¼ lb/A Embark (mefluidide) + 0.5% X-77 + ¼ oz/A Glean + 2 lb/A 2,4-D Amine

1/3 gal Embark
1 gal X-77
5/8 oz Glean
1 ¼ gal 2,4-D amine
100 gal water

The mixture is applied at the rate of 40 gal/A

Note: This is an experimental mixture expected to replace Schedule A after 1984.

SCHEDULE C

1/8 lb/A Embark (mefluidide) + 0.5% X-77 + 1/8 oz/A Glean + 2 lb/A 2,4-D Amine

1/6 gal Embark
1 gal X-77
5/16 oz Glean
1 ¼ gal 2,4-D amine
100 gal water

The mixture is applied at the rate of 40 gal/A per acre.

Note: This experimental mixture has been proven effective in late applications and may replace Schedule B depending on 1984 test results.

Table 5

Fescue Seed Head Suppression from Embark and Embark plus Surfactant With and Without 2,4-D amine

Treatment/Rate per Acre	Seed Heads per sq. ft.	% Suppression
None (Check)	18	0
Embark (½ lb/A)	9	50
Embark (½ lb/A) + Surfactant (1%)	4	75
Embark (½ lb/A) + 2,4-D amine (2 lb/A)	13	28
Embark (½ lb/A) + Surfactant (1%) + 2,4-D amine (2 lb/A)	2	89

Table 6

Tests Under Roadside Use Conditions of Embark (½ lb/A) + Surfactant (0.5%) + 2,4-D Amine (2 lb/A)

		Fescue Seed Head Suppression	
Year	Location	Range	Average
1982	Tippecanoe Co.	68-93%	83%
1983	Miami Co.	64-94%	81%

Table 7

Combinations of Embark and Glean with Surfactant and 2,4-D. IN-126, Lafayette, IN Applied May 9, 1983, Evaluated June 15, 1983.

	Material: lb Per A				Fescue Seed Heads	
Schedule	Embark	Sufactant	Glean	2,4-D	Per sq ft	Height (in.)
None					17	46
A	½ lb	0.5%		2 lb	7	24
B	¼ lb	0.5%	¼ oz	2 lb	0	14

Table 8

Combinations of Embark and Glean with Surfactant and 2,4-D. IN-126, Lafayette, IN. Applied May 8, 1983. Evaluated June 18, 1983.

					Fescue Seed Heads	
Schedule	Embark	Surfactant	Glean	2,4-D	Per sq ft	Height (in.)
None					4.5	43
C	1/8 lb	0.5%	1/8 oz	2 lb	0.1(98%)	14

Table 9

Schedule of Applications

Recommended for application in the spring only

Schedules A and B, apply as the grass begins to green until just before emergence of seedheads from the boot
(End of March to the first week of May)

With Schedule B what you see at the time of application is the way it will stay

Schedule C, apply the last week of April and the first week of May

Table 10

Cost of Materials Comparison

Based on Glean (Telar) $12/oz; Embark $35/lb; 2,4-D $1.60/lb and Surfactant $10 gal

	Material costs per acre				
Schedule	Embark	Surfactant	Glean	2,4-D Amine	Total
A	17.50	4.00	0	3.20	24.70
B	8.75	4:00	3.00	3.20	18.95
C	4.35	4:00	1.50	3.20	13.05

The addition of Glean (Telar) to the schedule may permit a 50% reduction in costs of materials where Schedule C can be followed.

The comparable cost of one-cycle mowing is about $20/acre.

Add $2-4/acre for cost of the application.