Chemical Mowing

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INTRODUCTION

Chemical mowing is the outcome of a program of research in roadside vegetation management initiated in 1966 and structured to include four phases (Table 1).

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

The first research phase, from 1966 to 1970, was largely one of problem identification in which surveys were conducted to determine weed species and densities and to evaluate practices of vegetation management then current. Various herbicides were evaluated and a mode of action study was completed that eventually led to more efficient use and greater environmental safety.

The second phase, development of a herbicide program, was the first to be implemented. The program was begun in 1971 with full implementation in 1972-1973. A fall application of an environmentally safe amine formulation of 2,4-D is followed by a second application in early spring on a 3-year rotation.

Research on Phase III "Reduced Mechanical Mowing" was initiated in 1971 with the first implementation activities in 1974.

The project is now in Phase IV of the program, "Chemical Mowing." The objective is to develop and test materials or mixtures of materials that will eliminate or reduce the need for mechanical mowing and provide efficient total vegetation management at reduced cost.

THE CONCEPT OF CHEMICAL MOWING

As the name implies, chemical mowing is the use of chemicals to prevent grass growth so that the need for mechanical mowing is either eliminated or reduced. Some characteristics of the desired treatment are summarized in Table 2.

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 untoward injury to desirable species; repeated annual use possible
7. Healthy, lawn-type appearance
8. Low cost
9. Environmentally safe

Ideally, one would anticipate a single spray application that would maintain maximum grass height below acceptable mowing limits for the state of Indiana. It 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; a pre-emergence action that prevents the germination of seeds in the spring is one approach.

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 annual use. A healthy, lawn-type appearance to the turf would be ideal. 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 3-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 that of seed head suppression. Most roadsides require mowing to control seed heads, especially with fescue. If even a few seed heads form, the appearance is unsightly. For whatever treatment is finally selected, the elimination of seed heads is essential.

METHOD OF APPROACH

Independently and through the assistance of industrial cooperators,

a large number of commercially available and experimental materials were examined for growth retardant activity in a series of laboratory, greenhouse, and field studies. More than 500 materials were screened. From these, about 20 materials were selected for further study.

In subsequent investigations, a series of test plots were established under roadside conditions to begin the evaluation of about 20 growth retardant materials selected from preliminary laboratory and greenhouse testing. More than 2,000 test plots were 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 intervals 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 as well. Approximately 5 materials, effective on both bluegrass and fescue, were selected for detailed evaluation.

The 5 materials to be evaluated in more detail were tested in large plots along I-79 north of Lafayette for optimum rate of application at a fixed date and for optimum date of application at a fixed rate. Date studies were initiated about every two weeks from early March to mid-September in the first year and from early March to early June in two 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 two succeeding years.

RESEARCH FINDINGS

One of the five materials tested over the past 3 years consistently gave the desired results. This was actually a mixture of 3 different materials: Embark (1 lb/A) plus an experimental material, KG-1044 (1 lb/A) plus the Lithium salt of 2,4-D, Lithate (2.5 lb/A). A single application of this combination of materials in early spring (March 20 to May 1) gave complete suppression of seed heads with both fescue and bluegrass and the sprayed roadsides maintained a healthy lawn-type appearance, well within current mowing limits, for the entire growing season without the need for mechanical mowing. The inclusion of 2,4-D in the mixture gave control of broad-leaf weeds and most annual grasses. There was no weakening of the root system and no appreciable carry-over to the next season, and all materials have been judged environmentally safe.

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 re-

quired to control seed heads in fescue. These high rates may be injurious to native bluegrass.

The KG-1044 was developed to be added to the mixture as a means of decreasing the rate of Embark required for seed head suppression in fescue. This material has the additional potential of reducing phytotoxicity and improving grass color and appearance. It is ineffective as a single agent.

Neither Embark nor KG-1044 control broadleaf weeds so a third component, Lithium 2,4-D was added. Lithium 2,4-D was chosen on the basis that, at high rates of application, amine formulations sometimes showed an antagonistic reaction with low application rates of Embark. The Lithium 2,4-D was safe, effective, nonvolatile, and sold commercially as a water-soluble powder (Lithate). The main disadvantage of Lithium 2,4-D over 2,4-D amine was its greater cost. At current market prices, Lithate costs about 4 times that of 2,4-D amine per pound active material.

The importance of the results with the Embark/KG-1044/Lithium 2,4-D combination was that it establishes the feasibility of chemical mowing for Indiana. One chemical treatment, applied in the spring, has eliminated seed heads in all grass species, eliminated weeds, and reduced grass growth to the point where *no mowing* was required. The treated grass maintained a uniform height and had a healthy, lawn-type appearance. The appearance was judged to be superior to that of a mowed roadside. Results were consistent in three consecutive years.

IMPLEMENTATION ACTIVITIES AND FUTURE DIRECTIONS

The major disadvantage of the Embark/KG-1044/Lithium 2,4-D mixture was its cost. Based on results obtained during the 1980 growing season, a modified combination was developed for application on I-465 for the spring of 1981. This combination consisted of 1/2 lb Embark plus 1/16 lb KG-1044 plus 2.2 lb Lithium 2,4-D (Lithate). The material was to be applied by Clyde Mason of the Greenfield District at an estimated materials cost of $65 per acre. This cost was regarded as break even since the mowing costs on the roads to be treated were about $25 per cycle for three-cycle mowing. A major factor in the cost was the KG-1044.

In February 1981 we were informed that the estimates of the cost of KG-1044 has been revised upward an additional $62.50 per acre approximately doubling material costs from that originally estimated. Since there was no time to develop a suitable alternative to KG-1044 for the spring of 1981, the mixture was applied without the KG-1044.

Over the next two years, it is our goal to reduce material costs to approximately that of one mowing cycle. The minimum rate of Embark required must be carefully adjusted within the range of 3/8 to 1/2 lb

per acre. The need for the Lithium 2,4-D must be clearly established. It may be possible to adjust the mixture to accomodate the less expensive amine formulations. Finally, a less expensive alternative to KG-1044 must be developed and tested.

SUMMARY

The objective of this research project, full-season vegetation control through a single spray application and with no need for additional herbicide application or mechanical mowing, has been realized. The feasibility of chemical mowing for the state of Indiana has been demonstrated beyond reasonable doubt. The next objective is to make chemical mowing economically feasible. This is projected over the next two years with final implementation anticipated for spring of 1983.