PLANT GROWTH REGULATOR EFFICACY ON UTILITY TURFS

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Michigan State University has been involved in Plant Growth Regulator (PGR) research on turfgrasses since the early nineteen sixties. Dr. James Beard studied several "first generation" turfgrass PGRs which are no longer used but were chemically similar to the PGR compounds we use today. However, there have been very significant refinements in these twenty years. Dr. John Kaufmann continued with turfgrass PGR research in the late seventies, using improved PGR compounds. Responses were still inconsistent, but sufficient to encourage researchers to continue their study of the complex activity of these PGR compounds.

Today, PGRs offer greatly improved reliability in their response although there is still much to learn about their use. Our current PGR research is in cooperation with the Michigan Department of Transportation, emphasizing development of a PGR management system for roadside grasses. Michigan State University will be investigating several parameters in pursuit of a feasible PGR system. We have designed six studies to help develop practical recommendations. Four studies will be located at highway roadside sites and two others located at university research facilities on campus.

For specific PGRs we will be determining 1) effective and economical rates of application; 2) the "window of activity" which is the time span in calendar weeks during which any particular PGR compound must be applied for maximum effectiveness; 3) There are differential response characteristics among the common roadside grass species with each PGR compound. We will evaluate PGR mixtures on several grasses; 4) We will evaluate seeding combinations designed to yield a plant community which is responsive to an integrated PGR management program; 5) Methods to control the volunteer grasses and broadleaf weeds which typically give irregular response to PGRs; 6) and, programs to reduce the mowing energy input.

Our ultimate goal is to be able to make practical recommendations and give sound counsel to those interested in PGR application regardless of their management emphasis. In addition to uses on roadside and utility turfs, there is potential for effective application on higher quality turfs.

Research Results to Date

DOT 1 - PGR Application Timing Study Sp82

Embark was applied at 0.19 kg ai/ha on four dates - 4/27/82, 5/10/82, 5/25/82 and 6/17/82. This study is located at highway site 1 which is predominantly Kentucky Bluegrass and fine fescue.

Vertical vegetative growth, seedhead height, seedhead density and visual color response were evaluated on several dates.

The 5/25/82 application gave the best vertical vegetative control. A growth reduction of 3 cm (1 1/4 inches) was statistically significant by our tests. It should be understood that most fine grass species fall horizontally once they have reached 10 to 13 cm (4 to 5 inches in height), therefore this response is actually insignificant in a roadside situtation.

Seedhead height and density are a primary concern in a roadside situation due to their more upright growth habit. We found fewer and shorter seedheads on the plots treated 4/27/82 and 5/10/82. Practical significance is found with these parameters on fine grasses because it is the seedheads and seedstalks which give an unkempt appearance.

Color enhancement was seen on plots treated 4/27/82 and 5/10/82. The mechanism of this response is unknown and will be discussed further in another section of this paper. We consider this a positive response, because from a manager's perspective, greener grass is desirable in most situations.

DOT 2 - Roadside PGR Compound Evaluation Study Sp82

Chemicals applied were: Embark (0.14 kg ai/ha), Eptam (6.7 kg ai/ha), PP-333 (1.7 kg ai/ha), EL-500 (1.7 kg ai/ha), Glean (0.14 kg ai/ha), and Experimental #1. All compounds were applied 5/8/82. This study is located at highway site 2 which is primarily Kentucky bluegrass and fine fescue with some coarser grasses (i.e. orchard grass, redtop, tall fescue and quackgrass) randomly mixed throughout.

Vertical vegetative growth, seedhead height, seedhead density and visual color response were evaluated on several dates.

Nearly all compounds on each evaluation date showed statistically significant vegetative growth inhibition with 5 to 10 cm (2 to 4 inches) less growth than the control. Again, a growth reduction of this magnitude is not practical under highway conditions.

As in DOT I, seedhead height and density are the most important factors to be considered. Embark application reduced seedhead density by 33 percent, Eptam gave a 75 percent density reduction. PP-333 actually increased seedhead density. Fine grass (i.e. bluegrasses and fescues) seedhead height reduction ranged from 10 to 26 cm (4 to 10 inches) with Embark, Eptam, PP-333 and EL-500. Coarser grass responses were much more varied and therefore, statistically insignificant. These initial seedhead repression responses are strong evidence for the potential development of PGR management systems. Vegetative color enhancement was also seen in this study. Embark, Eptam and Experimental #1 gave improved green color.

IDW - Supplementary Bluegrass PGR Study Su82

Embark, EL-500 and PP-333 were each applied at two rates, combinations of EL-500 x Embark and PP-333x Embark were also applied. All treatments were applied 7/15/82. This study was located at the Hancock Turfgrass Research Center on 'Enmundi' Kentucky bluegrass with regular automatic irrigation.

Clippings were collected and weighed on 8/12/82, twenty-eight days after treatment. All compounds, rates and mixtures gave statistically significant response with 40 to 70 percent lower yield by clipping weight.

Relative regrowth ratings, 12 days after mowing, showed that all compounds and mixtures were still actively inhibiting plant growth. The PP-333 x Embark combination showed the least regrowth on this date.

On 9/16/82, thirty-six days after the first mowing, two months after treatment, final clipping weights were taken from both uncut and previously cut plot areas. Total growth inhibition and regrowth inhibition was evaluated by this method. All but one of the previously uncut plots were exhibiting statistically significant growth reduction. Clipping weights from the PP-333 x Embark plots showed very significant growth reduction on uncut plot areas for both dates. The final clipping weights taken from the previously cut plots showed that several PGR compounds had affected regrowth but only the two rates of PP-333 had given statistically significant growth inhibition. The PP-333 x Embark treatments were not significantly different from our check.

Color response was observed but was not significant for all compounds when compared to the control. The PP-333 x Embark combination gave the highest and most consistent color enhancement response.

Data analysis from the Kentucky bluegrass study (IDW) has led us to propose one theory to explain the color responses seen in all of the studies. Briefly stated, the observed response is the result of continued production and storage of photosynthates within the artificially regulated plant. It is thought that these PGRs work in a way which inhibits cell elongation and/or meristematic activity (growth). However, these chemicals do not appear to affect the photsynthetic process, therefore, the photsynthetic products are stored by the turfgrass plant, thus the color enhancement response.

It appears that as a result of the first mowing the plant was taken out of its chemically dormant state and resumed active growth. Upon resumption of growth, a rate increase was observed, theoretically resulting from the plants use of the stored photosynthates. This response is very interesting and will be further investigated next season.

Conclusions

1. There are species specific effects with some of the PGR compounds. We need to categorize these differences, then propose solutions.

2. Timing of application is critical. PGR compounds have a "window of activity" which is the time span in calendar weeks during which the compound must be applied for maximum effectiveness. Clearly, a wider "window of activity" would be an advantage for the persons in charge of PGR application.

3. Soil active PGRs have a broader "window of activity" for plant uptake, and more predictable response. Soil variability may alter efficacy.

4. Foliar active PGRs are less consistent in response. Varying weather conditions alter efficacy.

5. It must be realized that although statistically significant vegetative growth reduction was found, leaf blade growth of most highway grass species commonly exceeds the plants ability to support itself vertically. Evaluation of vertical vegetative growth is much less important when the primary grasses (bluegrasses and fine fescues) have fallen into a horizontal orientation.

6. Seedhead height and density become the largest concern for roadside managers due to their upright growth habit. We found excellent response for both parameters with some of the PGR compounds.

7. Color enhancment is considered a positive response. Greener color is sought after by most turfgrass managers. It is thought that the plant has continued its photosynthetic activity and that color enhancement is indicative of storage within the plant of the photosynthates.

Factors to consider

1. The site must be an area where traffic and wear are minimal.

2. Is control of vegetative growth or seedhead development more important in your management program?

3. Continued PGR application may result in an accumulation of senescing plant tissue, reduced turf density, discoloration, weed encroachment and increased disease susceptibility. These parameters are affected by the timing of PGR application, the initial vigor of the grass plants themselves, and a variety of soil and moisture factors under which the grasses are surviving. Damage symptoms will not be masked by continued plant growth. Would this be acceptable?

4. If increased weed or disease problems result, are you willing to consider additional chemical controls? Will the efficacy of pest control chemicals be changed when PGRs are used?

5. Will a PGR program be cost effective? How could this affect your management options? (see Table 1)

6. What grass species would you like to control through the use of PGRs?

7. Is the critical timing of application feasible in your situation?

Table 1. Cost per hectare of PGRs as applied in our studies.

PGR	Formulation	Rate of Application	Cost/hectare as applied
Embark	2 lb ai/gal[1]	0.14 Kg ai/ha[2]	$9.26
Eptam	10G	6.7 Kg ai/ha	$59.28
EL-500	50WP	1.7 Kg ai/ha	N/A
PP-333	50WP	1.7 Kg ai/ha	N/A
Glean	75DF	0.14 Kg ai/ha	$76.57

[1]ai/gal: active ingredient per gallon

[2]ai/ha: active ingredient per hectare