PREDICTING ANNUAL BLUEGRASS SEEDHEAD EMERGENCE USING GROWING DEGREE-DAYS AND POSSBILE MODELING APPLICATIONS

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A major phenological event in the life of annual bluegrass is the production of seedheads. The emergence of seedheads in Michigan occurs sometime between the end of April and the middle of May, with seedhead production continuing through late June. Although profuse seedhead production may only last a couple of weeks, disruption of the esthetic and playing qualities of the turf occur. Another detrimental effect of seedhead production is the energy imbalance that occurs in the plant. During seedhead production energy in the form of carbohydrates is spent in seedhead formation with little used for root production. The result is little or no root growth with the possibility of actual root reduction, under the right conditions. Knowing when seedheads emerge would allow for better timing of cultural practices and applications of seedhead suppressive compounds.

Temperature greatly affects the rate of most biological processes. Growth and development of not only turfgrass but most agricultural plants show a temperature response. Mathematical models in the form of heat accumulation models, have been used to explain temperature effects in growth.

Heat accumulation models, sometimes referred to as growing degree-day models have been proposed for a wide range of agricultural crops. The classical method for calculating growing degree days is:

$$GDD = \frac{max + min}{2} - base$$

where GDD = growing degree days; max = maximum temperature for a day; min = minimum temperature for the same day; and base = base temperature needed for growth of the turfgrass species. GDD for each day are accumulated over a given period of time and then related to phenological events in the life of a plant.

From the data collected in 1982 and 1983 we developed a model of predicting when seedheads emerge through maximum production and finally, to the point where seedhead production declined, then leveled off. We related seedhead emergence to GDD however; to calculate GDD we used the equation:

$$GDD = [1/\pi] - [w\,\theta\,\frac{\pi}{2}\sin t\,dt - \theta\,\frac{\pi}{2}\,(K1 - m)\,dt]$$

where w = maximum temperature (celcius) - minimum temperature divided by 2; K1 = base temperature (celcius); m = maximum temperature + minimum temperature divided by 2; and t = 24 hour period beginning at midnight. The temperature of 10C was used as the base temperature for initiating annual bluegrass growth. The reason 10C was used instead of 13C as reported by Bogart (1), was 10C gave a statistically better fit. GDD were accumulated starting 1 April.

In Michigan, initial seedhead formation occurred around 60 GDD using 10C as the base temperature.

Mefluidide Experiment

Mefluidide (Embark) is a plant growth regulator that also suppresses seedhead formation of annual bluegrass. A critical factor in the use of this compound is proper application timing. Applying mefluidide too early may

result in inadequate control, as would a late application.

An experiment was conducted during 1982 using GDD as a basis for applying mefluidide. Mefluidide was applied at 1/2 pint/acre at three different times; 25, 50, and 75 GDD. The GDD were based on centigrade with seedhead counts being made on 1 June.

Mefluidide applied at 50 GDD resulted in excellent seedhead suppression (Table 1). The 25 GDD treatment resulted in adequate suppression with the 75 GDD treatment resulting in poor seedhead suppression. This poor result was probably due to the treatment (75 GDD) being applied after seedhead emergence had occurred. We observed a deeper root system in the 50 GDD treatment compared to that of the control.

Mefluidide shows great promise as an agent for suppressing seedhead formation. However, caution in the application of mefluidide should be practiced. We observed some phytotoxicity in the plots. Further research is needed on rate and timing of mefluidide applications.

Table 1. Number of annual bluegrass seedheads in a 20 by 20 cm area plot on June 1, 1983.

Treatment	Rate of mefluidide application application	No. of seedheads
Check	-	172
25 GDD	1/2 pint/acre	42
50 GDD	1/2 pint/acre	9
75 GDD	1/2 pint/acre	93

GDD - Growing degree-days with base temperature of 10C.

References

1. Bogart, J.E. 1972. Factors influencing competition of annual bluegrass (Poa annua L.) within established turfgrass communities and seedling stands. M.S. Thesis. Michigan State University. East Lansing, Michigan.