PREDICTING THE ONSET OF ANNUAL BLUEGRASS SEEDHEAD PRODUCTION FROM DEGREE-DAYS

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Annual bluegrass is the predominant turfgrass species on most golf course fairways and greens in northern and Pacific-northwestern United States. Under high maintenance (close cut, high nitrogen, frequent irrigation), annual bluegrass is capable of forming a dense, uniform turf (3). However, seedhead production of annual bluegrass in the spring disrupts aesthetic qualities of the turf and is associated with undesirable plant responses such as a reduction of the root system. An accurate prediction of the onset to maximum production of seedheads would allow maintenance practices (i.e. irrigation, vertical mowing, and core cultivation) to be adjusted for best turf growth.

Heat accumulation models, sometimes referred to as growing degree day models, are useful in determining phenological stages in plant growth. Several models have been proposed for corn (7), sweet corn (1), leaf emergence of sour cherry (6) and peach bloom (9). For annual bluegrass no heat accumulation model has been proposed. The purpose of this study was to determine the base temperature for annual bluegrass growth and to develop a heat accumulation model for predicting seedhead formation.

Methods and Materials

Base temperature determination was made on annual bluegrass growth under growth chamber conditions. The four temperatures were 5, 10, 12, and 15C. One month old annual bluegrass plants growing in 700 cm^3 clay pots cut to a height of 1/2 inch were placed randomly in each growth chamber. Seven days later the plants were cut to 1/2 inch and clippings were weighed on an air dry basis (60 C).

Field data was collected on annual bluegrass (Poa annua var. reptans) seedhead emergence and number at 3 locations (Robert Hancock Turfgrass Center, East Lansing, Michigan; Michigan State Soils Research Barn, East Lansing; and Meadowbrook Country Club, Livonia, Michigan) for the year 1982. Maximum, minimum and hourly temperature readings were taken from hygrothermographs (Belfort Leaf Wetness Recorder, Belfort Instrument Co., Baltimore, Maryland 21224) at all locations. The hygrothermographs were set 2 cm above the soil surface. Seedheads were counted every 1 to 4 days from 4 plots measuring 20 cm by 20 cm at all locations.

A FORTRAN V program was used to calculate and accumulate degree-days according to the Baskerville and Emin method (2), which assumes the sine curve as an approximation of the diurnal temperature curve. A Control Data Corp. 750 computer and the Statistical Package for the Social Sciences Regression subprogram (8) were used to analyze the data and develop a model for seedhead emergence to maximum seedhead production based on degree-day accumulation.

Results

Growth chamber studies established that annual bluegrass initiated growth at 10C. This result was 2 degrees lower than the reported soil temperature needs for initiating growth in the field (4).

The number of seedheads counted at the three annual bluegrass field

locations increased with time through the month of May peaking at May 21 (Figure 1). For all three locations the general shape of the curve was in the form of a sine curve. Maximum seedhead number (>120/20 cm^2) occurred for a period of 14-17 days at the three locations.

Using 10C as the base temperature, based on growth chamber results, a regression model, was developed for initiation of seedhead formation to maximum seedhead production for the three locations. The model was linear and had a coefficient of determination equal to 0.94.

Discussion

The seedhead model is based on 1 year of data and needs further testing which we hope to do during 1983. We are excited about future use of the model because it can be used to study the effect of rate and timing of application of certain growth regulators that suppress annual bluegrass seedhead formation, as well as an aid in defining annual bluegrass stage of growth related to disease susceptibility.

Certain growth regulators inhibit seedhead formation of certain turfgrasses (5,10). These growth regulators could be used for seedhead inhibition of annual bluegrass. The rate and timing of applications could be based on plant growth using the model and not on some set calender dates.

An important part in disease development is the presence of susceptible tissue. The degree of susceptibility is often related to the stage of growth of the plant. Eisensmith and co-workers (6) proposed that a degree-day model for leaf emergence of cherry could be incorporated into disease models for cherry leaf spot to study host-pathogen interactions. Our seedhead model may serve the same way as a means of defining the phenological stage of annual bluegrass related to disease susceptibility and in any future disease models of annual bluegrass. For example, the initiation of the Anthracnose Severity Index model (see Forecasting Anthracnose Development on Annual Bluegrass from Weather Data" in these proceedings) starts with maximum seedhead production in the spring.

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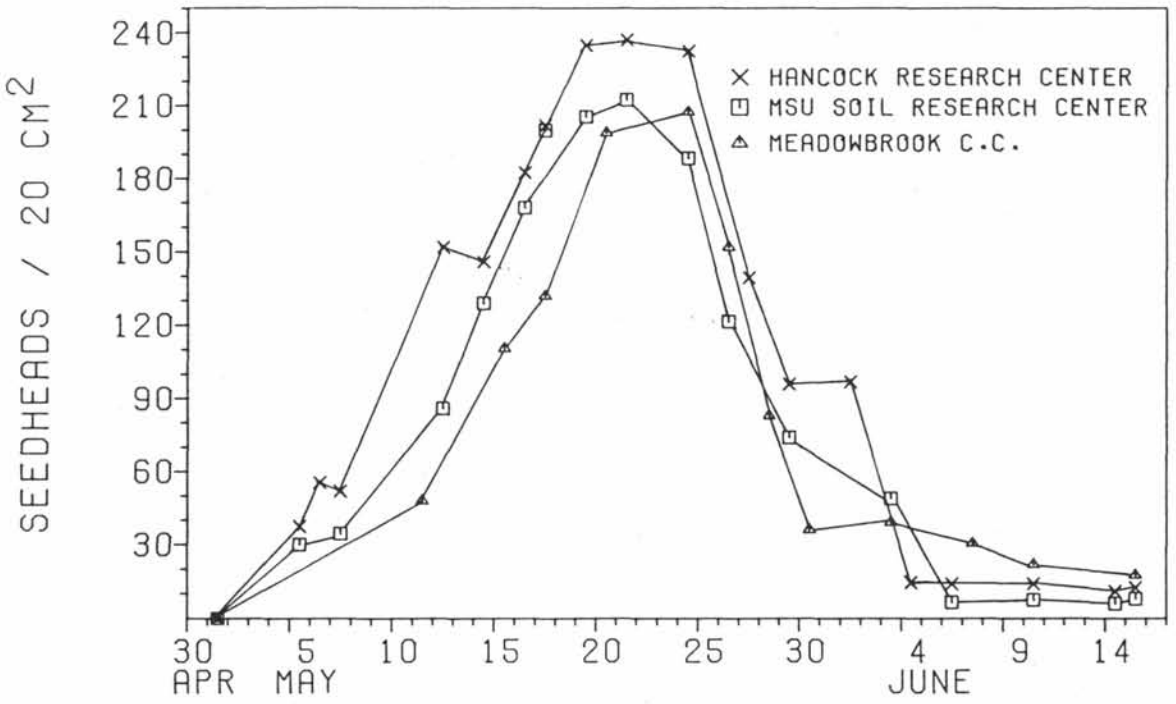

Figure 1. Annual bluegrass seehead number versus time (days) for 1982.