POA ANNUA: STILL HOLDS SURPRISES

Factors influencing competition of annual bluegrass* Poa annua *L.) within established turfgrass communities and seedling stands. *J.E. Bogart. 1972. Michigan State University Master of Science Thesis. pp. 1-75. (from the Department of Crop and Soil Sciences, Michigan State University, East Lansing, Mich. 48823).*

The objective of this investigation was to study the influence of temperatures, cutting height and comparative rooting rate on the competitiveness of annual bluegrass in both seedling and established turfgrass stands of Merion Kentucky bluegrass and Penncross creeping bentgrass. Conclusions concerning temperature effects were obtained by a combination of (a) controlled climate growth chamber studies and (b) seasonal phenological observations made under typical turfgrass conditions in the field.

The controlled climate growth chamber studies involved an evaluation of the quantity of shoot and root growth produced by each of the three species, annual bluegrass, Merion Kentucky bluegrass and Penncross creeping bentgrass, when grown at eight temperature levels (10° F intervals) in the range from 40° to 110° F. The turfs grown in cups were retained in each of the individual temperature treatments for a period of 30 days before being removed and measurements taken of shoot density and total quantity of root and shoot growth produced. Clippings were also collected at five day intervals throughout the 30-day treatment period at each of the temperature treatments. The cutting height was 0.75 inch. In addition to the growth responses, observations were made of seed germination rates and seedling vigor at each of the temperature treatments.

The phenological observations involved seasonal determinations of growth over two growing seasons, from 1970 through 1972. Five representative turfgrass locations where annual bluegrass was a component of the turfgrass community were included. These were (a) a Toronto creeping bentgrass putting green, (b) an irrigated Kentucky bluegrass lawn turf mowed at 1.2 inches, (c) a putting green apron mowed at one inch, (d) a golf tee on a par-three hole, which was predominantly annual bluegrass and (e) an unirrigated sports turf composed of Kentucky bluegrass mowed at two inches. Frequent observations were made from early April through to growth stoppage in the fall. Soil temperature readings at a one-inch depth were made at each observation date. Data collected included the time of shoot growth initiation in the spring, plus the shoot length, color and seedhead production.

The author drew the following conclusions regarding temperature responses under both controlled climate chamber and field studies. Penncross creeping bentgrass and Merion Kentucky bluegrass initiated new shoot growth earlier in the spring than annual bluegrass. Penncross and Merion initiated shoot growth at soil temperatures between 50° and 55° F, whereas established plants of annual bluegrass did not initiate new growth until the soil temperatures exceeded 55° F.

In terms of optimum temperatures, Penncross creeping bent-

continued on page 21

BEARD *from page 18*

grass root growth was the greatest at 60° F, whereas Merion Kentucky bluegrass and annual bluegrass produced maximum root dry weights at 70° F. All three species produced maximum shoot growth at 60° F. Penncross creeping bentgrass was adapted to a wider range of temperatures. This was particularly true at the extreme temperatures of 40° F and 90° F.

Other temperature observations revealed that all three species matured more rapidly at and above 80° F. The root systems turned decidedly brown at 80° F temperatures. In terms of seedhead production, annual bluegrass plants grown at 80° F produced seedheads during the first 15 days of the temperature treatment. However, seedheads were not produced until after 15 days in the 60°, 70° and 90° F constant temperature treatments. Seedhead development was present on annual bluegrass plants throughout the rest of the growing season.

The quantity of seedheads produced was greatest on the sports turf maintained at a low cultural intensity and was the least on the golf tee maintained at a very high intensity. Examination of these areas revealed that the sports turf was composed primarily of annual bluegrass plants of the annual (subspecies *annua*) bunch type, whereas the golf tee maintained under a higher level of irrigation, nutrition and mowing was composed primarily of creeping, perennial types of the subspecies *reptans*. The percentage of annual bluegrass plants lost during the midsummer stress period was greater in the sports turf containing a predominance of annual types than in the golf tee containing predominantly perennial types.

Seed germination. Seed germination of annual bluegrass did not differ significantly at temperatures ranging from 40° to 70° F. Very substantial decreases in seed germination occurred at the 80° and 90° F treatments.

Cutting height. A second phase of the investigation involved comparisons of the competitive ability of annual bluegrass as influenced by cutting height. Individu-

continued on page 22

BEARD *from page 21*

al annual bluegrass plants were transplanted into established Merion Kentucky bluegrass plots and into monostand annual bluegrass communities. Measurements were made of shoot dry weight, root organic matter, tiller number and shoot density of the annual bluegrass plants. Results of this study revealed that the one-inch cutting height produced the highest tiller numbers, shoot dry weights, and shoot density counts for annual bluegrass growing in both the Merion Kentucky bluegrass polystand and the annual bluegrass monostand. Based on several different studies in which comparisons of this type were made, the author concluded that the optimum cutting height for annual bluegrass in terms of competitive ability was one inch.

Rooting. The final factor evaluated was the comparative root growth and development of annual bluegrass in relation to Penncross creeping bentgrass and Merion Kentucky bluegrass. These investigations utilized special glass-faced root observation boxes. Root growth on the glass face was observed over 15- and 30-day periods after individual plants were transplanted into the root observation boxes. One set of plants was clipped three times weekly at one inch; the second set was not mowed.

Results after 30 days of growth revealed no significant difference in the rooting depth and root dry matter production of the three species. The annual bluegrass root system was more extensive and branched than for Merion Kentucky bluegrass. Visual observations during the initial 10-day period following transplanting indicated that annual bluegrass root growth was more rapid during the seedling stage. The root organic matter production after 15 days supported this observation. Cutting the plants at one inch reduced the rooting depth of all three species with Penncross creeping bentgrass being more severely effected. The author concluded that the initial superiority in rooting capability of annual bluegrass could play an important role in its competition within a bentgrass or Kentucky bluegrass turfgrass community.

Comments: The above research was part of a three-year study of annual bluegrass supported by the United States Golf Assn. Green Section. The over-all objectives of this and several other investigations were to better describe the annual bluegrass plant so that those attempting to maintain it as a component of the turfgrass community, rather than controlling it, would have a better basis for decision making in terms of turfgrass cultural practices.

There are a number of observations from this study which apply to the maintenance of golf course fairways and tees containing a predominance of annual bluegrass. First of all, it might surprise many readers that both Penncross creeping bentgrass and Merion Kentucky bluegrass are able to ini-

continued on page 25

BEARD *from page 22*

tiate shoot growth earlier in the spring than annual bluegrass. Keep in mind that this is growth from plants which have survived the winter period as perennials and that a predominance of the annual bluegrass in irrigated, close cut fairways and tees is of the creeping, perennial type. Many individuals feel that annual bluegrass initiates growth earlier in the spring than the other two species. This impression probably results from the very early spring germination and seedling growth of annual bluegrass in bare areas that are warmed by direct radiation from the sun. In most golf course fairways and tees we are concerned primarily with the plants that survive the winter rather than the germination and growth of new annual bluegrass seedlings.

In this regard, it it important to ensure adequate nutritional levels early in the spring in order to stimulate the growth of bentgrass and Kentucky bluegrass at a time when annual bluegrass is less competitive because of the lack of favorable growing temperatures. Withholding fertilizations until later in the spring will stimulate the growth of annual bluegrass, making it more competitive. Early spring stimulation of bentgrass and Kentucky bluegrass growth can be achieved by an early spring fertilization, by a late fall fertilization or by dormant fertilization, depending on the situation and climatic conditions.

The ability of Penncross creeping bentgrass to grow at a wider range of temperatures no doubt reflects its superior hardiness to both heat and drought stress compared to annual bluegrass.

Observations on seedhead production are of particular interest with 80° F soil temperatures producing the most rapid seedhead development and temperatures below 60° F impairing seedhead development. These data more specifically characterize the environmental conditions under which the greatest seedhead development can be anticipated. Keep in mind that seedhead development is usually greatest on turfs maintained at a low nitrogen fertility level and can be reduced by nitrogen fertilization.

Observations on seed germination reveal that little germination of annual bluegrass seed will occur at soil temperatures above 75° F. Here again these data identify the specific periods during the growing season when the seed germination, establishment and encroachment potential of annual bluegrass in the turfgrass community will most likely occur.

The second study regarding cutting height effects on annual bluegrass competition may also surprise a number of individuals. Many writers have suggested that annual bluegrass is most favored by cutting heights of 0.5 inch or less. Certainly annual bluegrass is adapted to these cutting heights and perhaps is better adapted than many of the turfgrass species we use. In terms of over-all competitive ability and potential for encroachment into other turfgrass

continued on page 70

communities, however, the one-inch cutting height is most favorable. Many golf course fairways in the United States are maintained at this height. This is one of the key contributing factors to the presence of annual bluegrass in these fairways along with the high quantities of irrigation water being applied.

The final observation supports two earlier pieces of research that have shown, contrary to the popular concept, that annual bluegrass root growth and development is just as good as for Kentucky bluegrass and creeping bentgrass. The general concept that annual bluegrass is a shallow rooted species has probably arisen from the conditions under which it is frequently found. That is, it grows and can survive better than the other two species in compacted, poorly drained soils. These conditions result in a shallow root system. However, if the three species are grown under comparable soil, environmental and cultural conditions, there is no significant difference in long term rooting. This piece of research goes one step further and shows that during the initial establishment period annual bluegrass actually has a better rooting capability than Kentucky bluegrass or creeping bentgrass. This factor may be quite important in contributing to the capability of annual bluegrass to encroach into Kentucky bluegrass and creeping bentgrass communities. □

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