Growth and Flowering of Zoysia Species in Response to Temperatures, Photoperiods, and Light Intensities

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THREE Zoysia species, japonica steud., matrella (L.) Merr., and tenuifolia Willd., have been introduced to the United States from Asia (4, 8). The japonica and matrella species have been used extensively for turf in the warmer regions of the United States.

Forbes (2) considered the Zoysia species to be short-day plants as they flowered in the greenhouse from mid-winter until mid-spring. Flowering was observed only at high temperatures (85°F. min.). Plants flowering at 85°F. ceased flowering when placed in a 75°F. F. min. greenhouse and flowered again when returned to 86°F. Z. tenuifolia flowered approximately two months later than japonica and matrella at the same temperature. The chromosome number was found to be n = 20 for the three species. Hybridization in all possible combinations among the species was easily accomplished.

Mechanical hulling of Z. matrella and Z. japonica seeds was found to increase total seed germination and speed of germination by Forbes and Ferguson (3).

Juska (5) observed that best growth of the Meyer strain of Z. japonica was at a soil pH of 6 to 7. Greatest response to nitrogen, phosphorus, and potash was in this pH range.

Youngner (9) showed that Cynodon dactylon, another warm season grass species, had a minimum temperature for growth of approximately 50°F. Discoloration at temperatures above freezing was shown to be caused by the interaction of high intensity light, 7000 foot-candles or more, and temperatures below 50°F.

The objectives of the studies reported here were to obtain more specific information on growth of the various vegetative organs, inflorescence initiation, flower development, and fruiting of Zoysia japonica and Zoysia matrella as affected by temperature and light.

MATERIALS AND METHODS

Meyer strain of Z. japonica and a clonal selection of Z. matrella were used throughout the investigation.

Plants were started by either of two methods. For studies on shoot growth under various temperatures, cuttings (sprigs) of uniform length consisting of two nodes were planted in pots of a prepared soil mixture and allowed to become established in a 27°C greenhouse. Plants uniform in growth were then selected for the experimental treatments. Where larger quantities of plant material were required, 4-inch cores of established turf were planted in 5-inch pots of sand after washing all soil from the roots. These also were started in the 27°C greenhouse before the experimental treatments were begun.

Shoot growth was measured at intervals of 10 days in the greenhouse. Shoots were cut to 1 inch above the soil, and measurements extended to 50 inches. All growth was measured to the nearest 0.1 cm. Caliper measurements of leaves were made to nearest 0.1 mm. Ten measurements were made per plant. Tops, rhizomes, and roots were dried at 75°C and weighed to determine dry matter. Discoloration at temperatures considerably higher than 15°C for Z. japonica, and slight growth only on Z. matrella, was observed in the field during cool weather, developed on growing temperature of approximately 15°C for Z. japonica. Since growth was still quite slow, maximum growth temperatures for Z. japonica was nearly identical, differing only in amounts of tissues produced, and are therefore not shown.

To determine minimum temperatures for growth, shoot growth measurements were made on plants grown at a series of constant and alternating day and night temperatures ranging from 5°C to 21°C. Artificially lighted glass-walled naturally lighted growing chambers were used. Day length was 16 hours. No growth could be measured on Z. japonica at 15°C and slightly on Z. matrella. Both species grew moderately at 21°C and 25°C days. No differences could be observed in the growth of plants in the artificially lighted and naturally lighted chambers at these low temperatures.

Zoysia thus appears to have the unusually high minimum growing temperature of approximately 15°C and slightly higher for Z. japonica. Since growth was still quite slow, maximum growth temperatures for Z. japonica are considerably higher.

Discoloration, (chlorophyll destruction), as observed in the field during cool weather, was in the glass chamber. Red pigmentation developed on Z. japonica in the 10°C. artificially lighted night temperatures; they otherwise remained green. Maximum light intensity in the glass boxes at this time was between 4000 and 5000 foot-candles. In the artificially lighted chamber the plant height was only 1500 foot-candles. Dicoulorations are in keeping with those previously reported for Cynodon dactylon (9) that discoloration develops at temperatures below the minimum for growth at light of sufficient intensity. However, it is not know if the discoloration in the field is due to temperature or to a lack of light intensity.