The Effect of Gibberellin on Forage Crops
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GIBBERELLINS, a group of plant growth-promoting substances isolated from diseased rice plants by Japanese workers in 1932, have recently aroused interest as to their potential in crop production in the United States. The germination of creeping red fescue, domestic ryegrass, tall fescue, and Kentucky bluegrass was hastened in the laboratory when treated with gibberellic acid. Kentucky bluegrass produced significantly more dry weight when gibberellins were used in conjunction with fertilizer, and crab grass nearing the end of seasonal development was stimulated to new growth by a single application of gibberellic acid. Due to the interest aroused and its possible value in a pasture program, the studies reported here were initiated to determine the response of various forage plants to treatment with gibberellic acid.

EXPERIMENTAL PROCEDURE

Two studies were conducted for 3 years, 1957-1959, on 8 summer forage annuals and 1 summer perennial, Coastal bermudagrass. In the study on summer annuals, seeds of Jackson soybeans, S.J cattail millet, DeKalb No. 1 forage sorghum, browntop millet (Panicum virgatum L.), Tift sudangrass, VPI 802 corn, Martin combine milo, and Tracy sorghum were soaked for 5 minutes in a solution of 1 ppm of gibberellic acid and alcohol. They were then dried, weighed, packaged, and planted during May in a split plot design, the main split being between treated and untreated. At planting, 500 pounds of 4-5-10 fertilizer was applied in the row. An additional 48 pounds of nitrogen per acre was used during the growing season. Two 20-foot rows of each entry were replicated 4 times. Three weeks after emergence the plants were sprayed with gibberellins, the other half were sprayed with an equal amount of water. When the forage had attained a height of 10 to 12 inches, yields were determined by mowing a 36-inch swath through the plots, leaving a 3-inch stubble. After each clipping, 48 pounds of nitrogen per acre was applied. Dry weight determinations were made by drying the fresh plant material at 70° C. Leaf-to-stem ratio and the protein content were also determined.

RESULTS AND DISCUSSION

Gibberellins had several noticeable effects on forage plants. Plant height in every species tested was increased when the gibberellic acid was applied (Table 1). The length of the internodes was increased and the plants became stemmy. The protein content of the treated plants was reduced, primarily because of the higher ratio of stems to leaves.

Data collected for 3 years summarized in Table 1 shows that no significant increases in yields were obtained by treating the summer forage annuals with gibberellins although in some years there were significant varietal responses. The forage yield of corn, cattail millet, and the sorghum species was reduced during 1958 due to the use of xylene as the solvent for the potassium gibberellate. Xylene caused considerable killing of the leaf area. However, when the powder form of potassium gibberellate was dissolved in water with a soap emulsifier instead of xylene, this killing effect did not occur.

In all four species, spraying with gibberellins made the plants more stemmy. The greatest increase occurred in the first clipping, indicating that the maximum stimulation is obtained in the seedling stage. This same increase in stemminess is demonstrated in plant height measurements. Again in every species, plant height was greatest in the treated plots. These differences would have been greater had it not been for the killing of top growth caused by xylene during 1958. Recovery was slow and in most cases incomplete.

One of the simplest determinations for estimating forage quality is leaf-to-stem ratio. Good, high quality forage contains an abundance of succulent leaves and a minimum of flowering, plant height, internode length, leafiness, and maturity date. After clipping, the fresh plant material was dried at 70° C. for dry matter determinations. The leaf-to-stem ratio was determined by hand separating subsamples of fresh material and weighing the dried components.

In the study on Coastal bermudagrass, 6- X 20-foot plots were replicated 4 times on a well-established Coastal bermuda sod which had been fertilized with 500 pounds of 4-5-10 fertilizer. Half of the plots were sprayed 4 times during the season with a 1,000-ppm solution of gibberellins, the other half were sprayed with an equal amount of water. When the forage had attained a height of 10 to 12 inches, yields were determined by mowing a 36-inch swath through the plots, leaving a 3-inch stubble. After each clipping, 48 pounds of nitrogen per acre was applied. Dry weight determinations were made by drying the fresh plant material at 70° C. Leaf-to-stem ratio and the protein content were also determined.