Trend of Carbohydrate Reserves in Alfalfa, Smooth Bromegrass, and Timothy Grown Under Various Cutting Schedules

John H. Reynolds and Dale Smith

ALFALFA, one of the most important forages grown in the northern United States, is sown usually with a grass, principally bromegrass or timothy. Therefore, when managing an alfalfa-grass mixture, one must consider the growth characteristics of both the legume and the grass in order to maintain a desired proportion of each species in the mixture.

A close relationship of herbage production and persistence with the level of organic food reserves has been demonstrated in alfalfa by Graber et al. (1), Grandfield (2), Graumann et al. (5), Nielsen and Lysgaard (7), Smith (8), and others. Studies of the trend of food reserves in the storage organs of bromegrass and timothy are few. Teel (9) has indicated that available fructose in the shoot bases of bromegrass was at a low level when internode elongation began in the spring, increased during internode elongation until heading, decreased during flowering, and then increased to the ripe seed stage. Kust (3) found that carbohydrate reserves in bromegrass rose somewhat in the early spring, decreased until emergence of the heads, and then increased to anthesis. Carbohydrates usually decreased following cutting.

Harper and Phillips (4) and Kust (3) found that carbohydrate reserves in timothy decreased in the spring and then increased to a peak near full bloom. Harper and Phillips (4) also found that the carbohydrate reserves in timothy decreased very little following cutting at near full bloom, but Kust found some decrease. Troughton (9) and May (6) have thoroughly reviewed the work on carbohydrate reserves in forage plants.

The current study was initiated to obtain information on the trend of carbohydrate reserves in the storage organs of bromegrass and timothy as compared with that of alfalfa. The species were studied under schedules of no cutting, two cuttings, and three cuttings during the 1960 growing season at Madison, Wisconsin.

MATERIALS AND METHODS

A clonal line of bromegrass (Bromus inermis Leyss.) and of timothy (Phleum pratense L.) from northern stocks was established as individual plants in rows 18 inches apart in mid-June 1959. Plants were spaced one foot apart in a row. Each of the grass clones was selected for average maturity and for disease resistance. Vernal alfalfa (Medicago sativa L.) was established in broadcast rows 18 inches apart. The species were established in separate but adjacent blocks.

The forages were established on peat soil at Madison, Wis. The soil had been adequately limed and fertilized prior to planting. To prevent volunteer seedlings from shattered seed, grass inflorescences were removed during the summer of 1959 just below the head before seed was formed. Weeds were controlled by hoeing and insects by spraying.

Three cutting treatments were imposed on each species during 1960: 3 cuttings—June 3, July 18, and August 29; 2 cuttings—June 27 and August 29; and no cutting. The uncut treatment was included to study the species as they might occur under native conditions. The herbage was cut each time at a height of two inches above the soil surface with a National mower and was removed from the area. Plants were trimmed to the correct height with hand clippers.

Weather during the 1960 growing season was characterized by well-distributed rainfall with no periods of moisture deficiency. Rainfall from April to October, inclusive, was 8.7 inches above the recorded mean. Temperatures averaged slightly below the recorded mean.

Sampling for chemical analysis was begun on March 31, 1960, and repeated at intervals until November 11, 1960. At each sampling date, two plants of each grass species were trimmed evenly to 2 inches above the soil surface, dug, placed in wet cloth bags, taken to the laboratory, and washed free of soil. All roots and dead stem and leaf tissue were removed and discarded. The final bromegrass samples consisted of the rhizomes and about three inches of the shoot bases above the proaxis. Timothy samples consisted of about two inches of the shoot bases above the proaxis. At each sampling, 20 to 30 alfalfa plants were dug. The tissue retained for analysis consisted of 2 inches of the stem tissue.