Soil Moisture Extraction by Irrigated Pasture Mixtures as Influenced by Clipping Frequency

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Among the more important factors which affect the production of pastures are soil fertility, species, grazing management, and the maintenance of favorable soil moisture conditions within the root zone. The influence of clipping frequency upon yield, botanical composition, and feed quality has been reported by Peterson and Hagan (6). Clipping (or grazing) at frequent intervals was found to greatly reduce the amount of herbage produced per acre. This factor might be expected also to influence root growth and thus the soil depth from which moisture could be extracted by the plant.

Numerous investigators have considered the effect of clipping on root growth in turf and forage crops, but few have investigated its effect on root depth distribution of mature stands under field conditions. Many of the clipping studies are reviewed by Salmon et al. (7), Graber et al. (4), and Biswell and Weaver (1). There is general agreement among the workers cited that the more frequent and severe the clipping treatment, the lower is the production of shoots, rhizomes, and roots. Similar conclusions have been reached in more recent work by Harrison and Hodgson (5), Carter and Law (2), and Wagner (10) from greenhouse investigations using young plants in containers and by Comstock and Law (3) from a field study. The latter workers compared root production by pure stands of alfalfa and by alfalfa-wheatgrass mixtures under two clipping schedules. Some plots were cut once per season for hay while others were cut two or three times which allowed recovery periods between clippings of approximately four weeks. The more frequently clipped plots produced a lower dry weight of roots with a higher percentage of roots in the top foot of soil and a lower percentage in the second foot.

An exception to the general conclusion that frequent clipping reduces depth of rooting appears in the report by Salmon et al. Alfalfa growing in the field was cut for nine years at four stages of growth which permitted average recovery periods of 31, 35, 40, and 51 days between clippings. The roots were washed out to a depth of 4 feet at the end of the second year. Large, healthy roots were found in all plots, but some dead and decaying roots were found under the most frequently cut treatments. When the roots were excavated at the end of the ninth year, a water table at 18 feet was found to have prevented further downward growth. Roots were seen at this depth in all cases and were assumed, on the basis of their size (1 to 2 mm. in diameter), to have been capable of penetrating further had soil conditions been favorable. NO differences related to plot schedules. Some plots were cut once per season for hay while others were cut two or three times which clipping reduces depth of rooting appears in the report by Harrison and Biswell (5). There is general agreement that frequent clipping reduces depth of rooting in turf and forage crops, but few investigations have been reported of the long-term effect of clipping frequency on root distribution and depth of rooting under mature stands of irrigated pasture mixtures.

MATERIALS AND METHODS

The plots used for the clipping experiment reported here and Hagan were utilized in this study. Three of the mixtures were investigated, each containing a mixture of perennial ryegrass, orchardgrass, and tall fescue but differing in the legume component. The legume portions consisted of broadleaf trefoil and alfalfa each used alone. The plots were established in October, 1948, and for the next three years clipped at intervals of two, three, four, and five growing seasons. Further details are given in the paper cited (1).

The almost complete absence of rain throughout the summer months made possible an accurate control of soil moisture conditions by irrigation. Plots were flood irrigated approximately seven days during the warm part of the summer and in spring and fall.

The plots were located on a deep alluvial silt loam series. The texture varies with depth because of a clay loam or sandy loam below 8 feet. Below 8 feet, a clay stratum retards drainage and restricts the root development of deep-rooted plants such as alfalfa. Slow drainage through the clay layer makes it possible to evaluate accurately root activity in the lower profile during the first three weeks after irrigation. Difficulty, the soil was ideally suited to a detailed study of root extraction. The apparent (bulk) specific gravity of the soil was determined using a standard California soil tube, and the depth, but in 112 measurements individual values ranged from 1.59 to 1.11. The mean of 1.36 was used for all calculations of consumptive use.

The effect of clipping treatments on rooting depth periodic soil moisture determinations continued were badly wilted. The relative activity of roots can be inferred from the rate of soil moisture extraction. Water was made to wash out and weight the root system of roots is not a reliable measure of their ability to the plant.

Soil moisture records were obtained in the third months of July, August, and the first half of September of the mixtures at the four clipping intervals. After the clipping was resumed on March 19, 1951, and two or more weeks were usually required before irrigation, the soil moisture content in each mixture was determined using a standard California soil tube. Soil moisture records were obtained during the third and fourth growing seasons. Further details are given in the paper cited (1).

EXPERIMENTAL RESULTS AND DISCUSSION

Influence of Clipping Frequency

Soil-moisture extraction records at various periods of the lagin clover-grass series of four, and five week periods are given in figure 1. For the three-week period is very similar to the four-week period when the root depth is not a reliable measure of their ability to the plant.

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