EFFECTS OF PASTURE PRACTICES ON ROOT DISTRIBUTION

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IN CARRYING out pasture management studies for soil erosion control, an apparent increase in roots near the soil surface that seemed to be related to the practices involved was observed. The character of changes in root growth and distribution in the soil horizon may affect plant survival, compatibility of species in mixtures, response to surface fertility treatments, soil moisture relationships, and erodibility of the soil. It seemed desirable, therefore, to ascertain whether the apparent differences were real; and, if so, to attempt identification of their causes.

Measurements of root growth in turf studies have shown effects of varying degrees of clipping and interaction effects, of closeness of clipping and fertility treatments. In general, the results of these studies (1, 2, 3, 4, 7) show reductions in root growth when continued severe clipping is practiced. Where there was no interaction between fertility treatment and closeness of clipping, the reductions measured appeared to be a result of reduced metabolism caused by continued removal of the synthesizing members of the plant. In the interest of brevity, the term "root density" will be used in this paper to designate quantity of roots per unit volume of soil.

Measurements have also shown marked reductions on root density of turf grasses due to interactions of severe foliage denudation and nitrogen applications (2, 3, 4). This interaction is generally explained upon the basis of an unbalanced nitrogen metabolism. Unlike "luxury" consumption of potash and phosphate, an excess of available nitrogen appears to affect the nature of the end-products of photosynthesis. In this interpretation, carbohydrates are utilized principally in protein synthesis until excess amino acids are exhausted. Due to severe reduction of the photosynthetic area, the plant is unable to synthesize carbohydrates in excess of those used in the nitrogen metabolism; and, hence, carbohydrates for storage and root tissues are sharply limited. The products of photosynthesis are thus utilized principally in parenchymatous tissues, such as leaves, rather than in the relatively woody root tissues. When the plant has photosynthetic area sufficient for carbohydrate synthesis in amounts above those utilized in nitrogen metabolism, nitrogen fertilizer applications result in an increase of root growth (1, 2, 7).

Fertility treatment may also directly affect the character of root growth by chemotropism. Like many other tropisms, the physiology of chemotropism of roots is not clearly understood. However, it is known that positive and negative reactions of roots occur in response to certain salts within limited concentrations of the salts (6). Positive responses are commonly expressed by branching and development of...