The Effect of Grasses on Yield of Forage and Production of Roots by Alfalfa-Grass Mixtures with Special Reference to Soil Conservation

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Mixtures of grass with alfalfa are preferred to alfalfa grown alone for soil and water conservation. In the Pacific Northwest, such mixtures are grown in rotation with grain crops, wheat, barley, or peas. The relative number of years that the alfalfa-grass mixtures remain on the land as compared with the grain crops depends on the land capability class and the type of farming enterprise. The mixtures remain on the land from three to five years in each rotation cycle (11).

Mixtures of grass with alfalfa have been used to protect the surface soil against water erosion (5). Mixtures have been observed to give greater protection against erosion than alfalfa alone. Mixtures are preferred by livestock producers because the danger of blowing is reduced by the grass (2). Alfalfa-grass hay was equal to alfalfa in feeding value when the mixture contained 33% grass (6). Cultivated grasses when grown with alfalfa have materially reduced the invasion of cheatgrass, Bromus tectorum, which is a penalty mixture in alfalfa hay.

Preliminary trials showed that mixtures produced more roots than alfalfa. Grass roots have been shown to increase organic matter, improve tilth, and decrease the density of soils that have grown only grain crops for many years (13). Grass roots increase the aggregation of soils and this favors permeability, but there is a difference among species both as to amount of roots produced and their effect on structure (7, 8, 9, 12, 15).

Many grasses had been grown with alfalfa in preliminary trials in the Soil Conservation Service Nursery at Pullman, Wash. They were planted in several different ways and the mixtures were grown under different seasonal conditions. Twenty grasses were selected on the basis of performance in these preliminary trials to evaluate their adaptability for use in mixtures with alfalfa for forage production, erosion control, and root production.

PROCEDURE

The grasses were seeded in alternate 12-inch drill rows with Idaho alfalfa. Seeding were made in April 1945, in plots 8 by 22 feet, and replications were randomized in three blocks. Seedings of alfalfa alone in 12-inch rows were made for comparison with the mixtures.

The soil was Palouse silt loam with a slope of 11% and a south exposure. An average of 50 to 75% of the topsoil had been removed by erosion, and the land fell in capability Class IIe (4). It was cropped to wheat in 1944.

The rate of seeding the alfalfa and the grasses in alternate drill rows was that recommended for mixtures (3). Adequate stands of both the grasses and the alfalfa were obtained and remained until the fall of 1949, the end of the test. Gypsum was applied at a rate of 75 pounds per acre in the fall of 1945 and 1947 at the rate of 200 pounds per acre.

All plots were harvested as hay when the alfalfa was in the 1/10- to ½-bloom stage. Observational notes were taken on stage of maturity, and percentage stands at each harvest. All grass and alfalfa were weighed separately. All hay production was reported on an air-dry basis (approximately 10% moisture). Sufficient growth was made in the year of establishment to warrant harvesting for hay yields.

Root production was taken in the fall of 1949 for each of the two seasons. The samples, one per plot, were taken from 24 x 9 inches and to a depth of 8 inches. Preliminary work at this location showed that almost all the roots occur in the upper 8 inches or plow layer of soil (5). Observational notes on the form and number of roots in the soil are available with the work of others (1). The quadrat was parallel to the rows and included one row of alfalfa. The roots were washed free from the soil, all legume materials were separated and oven dried. The production of both the alfalfa and the grass were separated from the soil and analyzed separately.

RESULTS AND DISCUSSION

The data for the average production of forage as hay by 20 alfalfa-grass mixtures in each of four years are given in table 1. Total production and yield of the alfalfa and grass portions are shown. The production of alfalfa grown alone is given for comparison with the mixtures. The average production for mixtures is arranged according to the use group to which the grasses are assigned (3). This grouping facilitated comparisons.

Analysis of the detailed data showed that there were differences in average production and in average yield of forage in different seasons. The differences were highly significant. There was no significant interaction between the use groups and mixtures. The average yield of alfalfa in the mixtures was significantly higher than that of grass in each of the four seasons. There were significant differences among mixtures and with respect to the production of grass and alfalfa. The relationship was not affected by seasons. There was a significant difference between the average production of alfalfa by the mixtures and by alfalfa grown alone. These results, the data from table 1 were further analyzed in table 2 to show the salient features brought out by the analyses.

The differences among mixtures in average production of the yield of the alfalfa and the grass portion were easily seen by expressing the relationship as a percentage of the total yield that was grass. An average of 20% of the total yield of all mixtures was grass. The consistent relationship between total yield of mixtures and percentage of grass. Preliminary trials not reported on an air-dry basis (approximately 10% moisture). Sufficient growth was made in the year of establishment to warrant harvesting for hay yields.