Establishment of Legumes as Influenced by the Rate of Sowing the Oat Companion Crop


A LARGE proportion of the stands of small-seeded legumes in the North Central Region of the United States is established with a companion crop of spring grain. This spring grain is principally oats. In Wisconsin, over 90% of the legume seedings are made in this manner.

A companion crop such as oats competes with the legume seedlings in varying degrees for light and moisture, and for mineral nutrients if soil fertility has not been properly adjusted. Limitations of light may become the dominant factor in competition on the heavy, fertile soils while on the lighter or sandy soils, competition for moisture may limit or eliminate the growth of the small-seeded legume seedlings.

The study reported here deals primarily with the influence of spring oats sown at different rates on the establishment of stands of alfalfa and medium red clover. The observations were made over a 4-year period, 1947–1950, at four Experiment Stations in Wisconsin.

REVIEW OF LITERATURE

Investigators are not in agreement as to whether the legume seeding is favored by sowing oats at reduced rates either with normal or wide drill rows. They do seem to agree, however, that managerial practices which reduce the competition for light and for moisture favor the establishment of legume seedings. In trials conducted during the period of 1953 to 57, Dungan et al. (3) in Illinois found that the stands and growth of red clover were poorer as the sowing rate of Grapher oats was increased. Thatcher et al. (13) report that a thin sowing rate of oats may result in a better stand of legumes in Ohio in dry seasons but that in most seasons no significant difference in the stands of legumes occurs at different rates of sowing oats unless heavier rates cause lodging.

Several workers have compared different row spacings in sowing oats (3, 6, 10) and have noted a greater population and growth of legumes in oats spaced in rows wider than the normal. However, in an experiment conducted for three seasons (1950 to 52), Pendleton and Dungan (9) found no significant differences in 1951 or 1952 in the stands of red clover that could be attributed to differences in row spacings of the oats. These 2 years had normal or above normal rainfall in May and June. The 1950 season had an abnormally dry month of May, and the stands and growth of clover, and the hay yields in the subsequent year, were better as the width of the rows of oats was increased.

Collister and Kramer (2) have reported a reduction in the stands and development of red clover plants under certain spring oat varieties in a 1-year study in Indiana. Also, Flanagan and Washko (4) have shown a highly significant difference in the degree of light exclusion by several varieties of spring oats and a variety of spring barley in a one-year trial in Pennsylvania. High light readings were correlated with larger red clover populations and with smaller losses of both alfalfa and red clover seedlings. Bula et al. (1) have reported higher light readings under Clinton oats sown at thin rates as compared with heavy rates during the early stages of growth in a 2-year study in Wisconsin. Differences in light were then virtually eliminated in these trials during the latter stages of growth of the oats because weeds increased in height and amount in the plots sown at thin rates. The canopy of oats and weeds eventually became nearly alike for all rates of sowing. Significant differences in legume stands were not obtained among the rates of sowing and varieties of oats used. Other investigators (5, 7, 8) have found also that thick stands of small grains are effective in reducing weeds. Stahler (12) and Pritchett and Nelson (11) have concluded from their investigations that light is the principal competitive factor of companion crops when soil moisture and fertility are not limiting.

METHODS AND RESULTS

Four varieties of oats, Clinton, Bonda, Forvie, and Viecland, were used at each station. The oat varieties were sown at 1/2, 1, 1 1/2, 2, 3/4, and 3 bushels per acre in a split plot design with 4 replications and with the oat variety as the whole plot. A mixture of 6 pounds of Certified Grimm alfalfa and 6 pounds of Wisconsin-grown medium red clover was seeded uniformly over the entire experimental area with a roller seeder after the oats were sown.

The oats were removed each year at the grain harvest stage and all excess straw was cleared from the plots. During the fall months, plant counts were made to measure the stands of seedling legumes under the oat varieties at each rate of sowing. A quadran with an inside area of 2.18 square feet (20,000 acre) was thrown at random in each plot. Five counts were usually made in each plot. The average legume population for each oat sowing rate was obtained from these legume plant counts over the 4 oat varieties used.

The study was carried on during the entire 4-year period of 1947 to 1950 at Madison on Miami silt loam soil and at Ashland on Berglund red clay soil. A 4-year summarization of the data for Madison is given in table 1 and for Ashland in table 2.

The trial was also carried on at Spooner and at Hancock on sandy soils. However, legume plant counts were made only in 1947 and 1948 at Spooner and only in 1949 at Hancock. Since these stations are both on sandy soils, Spooner on Chippewa loamy sand and Hancock on Plainfield sand, the data have been summarized together in table 3 for the 3-year period of 1947 to 1949.

DISCUSSION

The 4-year average results at Madison (table 1) and at Ashland (table 2), and the 3-year average results of the combined data from Spooner and Hancock (table 3), show...