THE RESPONSE OF SOYBEANS TO SOURCES OF NITROGEN IN THE FIELD

W. B. ANDREWS

In inoculation tests with legumes in the field and in the greenhouse it is often desirable to compare yields with those obtained with combined nitrogen. Data on the response of soybeans to different sources of nitrogen will, therefore, be valuable in setting up tests of this kind. In a previous paper (2) data were reported which show that 600 pounds of ammonium sulfate per acre did not reduce the amount of nitrogen fixed by soybean nodule bacteria.

Caldwell and Richardson (5) found that ammonium sulfate is not toxic to red clover when high quantities are added to the soil. The fact that legumes in mixtures containing grasses often do not do as well when combined nitrogen is applied has been interpreted differently by different investigators (2). Emphasis is placed upon the preference of legumes for nitrogen obtained through nodule bacteria on the one hand and the competition induced by the increased growth of grasses where combined nitrogen is applied, on the other hand.

Umbreit and Pred (14) concluded that, "Under conditions which result in a balanced carbohydrate-nitrogen relation in the soybean plant free nitrogen is the preferred form of nitrogen". A balanced carbohydrate-nitrogen relation "normally occurs under adequate sunlight of moderate intensity and in the presence of sufficient moisture and carbon dioxide". They concluded that, "If an excessive carbohydrate-nitrogen relation develops in the plants, the growth is favored by the presence of combined nitrogen".

Nitrate nitrogen has usually reduced the number of nodules and nitrogen fixation by legumes (6, 7, 8, 11, 12, 13), while small amounts of nitrates and ammonium sulfate have been reported to stimulate nodule production.

Allison and Ludwig (1) reviewed the literature on nodule reduction and decreased nitrogen fixation due to the application of high quantities of nitrogen, and from the data presented concluded that nitrogen reduced the root and nodule development through a reduction in the carbohydrate supply; whereas, Hopkins and Fred (8) and other workers from Wisconsin (6, 10, 14) placed emphasis on the relation between the carbohydrate supply and the functioning of the nodule bacteria. Andrews and Gieger (3) reported data on greenhouse work which show that nitrate of soda reduced the yield and nitrogen fixation by Austrian winter peas in the greenhouse.

Most of the work reported on the effect of nitrogenous fertilizers on legumes has been conducted in the greenhouse. The data reported in this paper were obtained in the field under natural growing conditions, and as a result, should be valuable in a study of the response of soybeans to combined nitrogen.

EXPERIMENTAL

Four sources of nitrogen were applied to soybeans in the field on Lufkin clay soil of pH 4.6 to 4.9. Three hundred pounds per acre of

1Contribution from the Department of Agronomy, Mississippi Agricultural Experiment Station, State College, Miss. Received for publication June 13, 1938.

2Associate Agronomist.

3Figures in parenthesis refer to "Literature Cited," p. 786.

779