Copper Deficiency in Relation to the Nutrition of Oats

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For several years the Florida 167 variety of oats when grown on parts of the Experiment Station Farm at Gainesville, Fla., has exhibited unusual vegetative characteristics. A description of this abnormal condition already has been published (8). Fig. 1 indicates how affected plants appear.

In Australia (12, 13, 14, 15, 16) and in Europe (11), a similar abnormality has been attributed to a lack of copper in the soil. So far as the author is aware copper-deficiency symptoms on oats have not been reported in this country, although copper applications have increased the yields on peat and muck soils (1, 5).

The object of the experiments reported here was to determine the cause of this abnormal growth of oats.

EXPERIMENTAL

Two field experiments were conducted. Also, the effect of certain treatments in two other fertility experiments was measured.

EXPERIMENT I

The soil was an Arredondo loamy fine sand (pH 5.6) derived from a phosphatic limestone and is considerably fertile. Corn grown on it in 1945 appeared normal, but oats which followed the corn in the fall of 1945 and spring of 1946 exhibited severe deficiency symptoms (8).

The plots were 3 x 20 feet, or 7/20e acre. The one rows 18 inches apart and each plot contained two various plots were separated by two rows which served as treatments.

This experiment was a 2 factorial experiment with the fourth order interaction confounded with the blocks, as described by Yates (17). The treatment variables were the minor elements. There were two plots without any and two plots each of the 31 other possible combinations of the five elements. The following per acre rates of chemicals were applied where the element or elements occurred:

- Copper chloride, 10 pounds
- Boric acid, 2 pounds
- Manganese chloride, 10 pounds
- Zinc chloride, 10 pounds
- Molybdenum acid, 0.5 pound

The proper amount of each of these was mixed with a basic fertilizer mixture and put in the furrow under the oats before seeding.

The basic fertilizer which was applied to all plots and prepared by mixing the following acre rates: 125 pounds of treble superphosphate (48%), 111 pounds of c.p. sulfate, 93 pounds of calcium sulfate (98% CaSO4·2H2O), and 64 pounds of c.p. magnesium chloride. Nitrogen was applied as NaNO3 at 150 pounds per acre as a top dressing uniformly over the whole area on February 18, 1947.

The Florida 167 variety of oats was treated with New Improved Ceresan and planted on December 20, 1946, in a Cole planter in the furrows above the fertilizer and minor elements which had been applied before seeding.

EXPERIMENT II

In experiment II, the soil, methods, and planting were the same as for experiment I. The treatments, which were randomized in four blocks, were as follows:

1. No treatment.
2. Fertilizer (major elements as in experiment I, 150 pounds of NaNO3 per acre).
3. Fertilizer plus seed treatment (New Improved Ceresan).
4. Fertilizer plus seed treatment plus minor elements (all five at same rate as in experiment I).
5. Fertilizer plus minor elements.
6. Fertilizer plus high nitrogen (300 pounds NaNO3 per acre).
7. Fertilizer plus high nitrogen plus seed treatment.
8. Fertilizer plus high nitrogen plus seed treatment plus minor elements.

The nitrogen was applied as a top dressing on February 18, 1947.

EXPERIMENT III

Experiment III was concerned with the residual effect of certain treatments applied in 1942 to Sea Island cotton located on Arredondo loamy fine sand. Three treatments were selected for study. The nitrogen was applied as a top dressing on February 18, 1947.