Effect of Nitrogen Fertilization on Yield, Culm Number and Protein Content of Certain Spring Wheat Varieties

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Nitrogen fertilizer must provide increased returns, either in bushels per acre or in protein premiums, if it is to be used profitably by the wheat producer. Most investigations indicate that it may do both, which justifies the interest in nitrogen fertilization among farmers in recent years.

Yield increases are the result of increasing: (1) number of heads per unit area, (2) number of kernels per head, or (3) kernel weight.

Protein content has long been used as a criterion in establishing local market prices for spring wheat. If such protein premiums are to be continued, a knowledge of the influence of soil and crop management on the protein content of different varieties will be helpful. The protein variability within varieties also is important.

The experiment reported here was designed to measure the above-mentioned factors in certain spring wheat varieties.

Review of Literature

Quisenberry (6) concluded that number of heads per unit area was one of the most important factors in determining yield. He proposed that number of kernels per head was next in importance while kernel weight was least important of the three.

Locke, et al. (4) showed that at Woodward, Okla., kernel weight was not a determining factor in wheat yields but that there was a high correlation between yield and number of kernels per unit area. When the number of kernels is not known, he proposes that the number of heads per unit area and plant height will provide a useful estimate of yield. Laude (2) showed a close relation between yield and number of heads per unit area and also between yield and kernel weight in Kansas.

Hobbs (1) found that test weight and kernel weight were not significantly affected by nitrogen applications at Manhattan, Kans. He found that yield increased in both treated and untreated plots with an increase in stubble count (number of heads per unit area). The average increase in stubble count and yield was 14 and 20%, respectively, indicating that tillering was not the only factor contributing to the increased yield. Luginbill and McNeal (5) obtained an increase in culm number at Chouteau, Mont., from applications of nitrogen fertilizer on winter wheat.

Levi and Anderson (3) in Canada found that protein content between individual kernels on the same plant and among the mean protein content of closely adjacent plants of a single variety.

Materials and Methods

Nine varieties of spring wheat were sown in a split-rate experiment under irrigation at Bozeman, Mont. A plot of ground known to be low in available nitrogen was used. A uniform application of phosphate was made the day before seeding, using a fertilizer drill. Nitrogen as ammonium nitrate was applied on the same day. One inch of water was made early in July.

A split-split plot design was employed with 0, 50, 100 pounds of nitrogen per acre as main plots and varieties as subplots. The experiment was designed to place major emphasis on the fertilizer interaction. Three replications of 12 rows spaced 12 inches apart were used. Two center rows were harvested for yield.

Culm counts were made on 2 feet of each center row. Only those culms producing heads were counted and recorded as headed when 50% of the heads were free of the boot. Test weights were recorded for the composite of heads and maturity was determined from combining the grain from the three replications.

At harvesttime about 25 main heads and about 25 tiller heads were selected at random from the border rows of each plot. Low heads were taken to represent tiller heads only and taller heads were taken to represent the main heads.

The following protein percentage comparisons were made: (a) central and lateral kernels, (b) middle and top spikelet kernels, and (c) grain from main, tiller, and composite heads.

The composite sample was from grain harvested from the two center rows for yield determination.

Results and Discussion

Heading date was hastened by 1 to 4 days in plots receiving nitrogen applications (table 1). No yield data are included in this paper. All data in this paper are for 1953. Data were also not recorded, it was observed that the heading date was hastened in these plots. Under the conditions of this experiment, nitrogen was so limiting that maturity was delayed in the untreated plots.

The variety and fertilizer mean squares were highly significant, indicating real differences in the number of culms produced. Ceres showed the greatest increase in culms over the check treatment of 31.8% for the 50 and 100 pound rates of nitrogen. Lee showed an increase over the check treatment of 20% and 105.7% for the same rates. The variety effect was also highly significant and the variety and fertilizer interaction was significant.

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