THE ABSORPTION AND UTILIZATION OF NITRATE NITROGEN DURING VEGETATIVE GROWTH BY ILLINOIS HIGH PROTEIN AND ILLINOIS LOW PROTEIN CORN

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In 1896 the Illinois Agricultural Experiment Station began a series of experiments to determine whether the chemical composition of corn could be altered by selection (20). A variety known as Burr's White was used as the foundation stock and selections were made, based upon chemical analysis, for high protein and low protein content of the grain at maturity. These two strains have since been termed Illinois High Protein and Illinois Low Protein. They have undergone 40 generations of continuous selection.

Beginning with a mean protein content in the grain of 10.92% in 1896, a comparatively wide spread has been attained between them. For instance, the mean values for the high protein strain the past 3 years were, respectively, 23.79, 17.71, and 21.63%, and for the low protein strain, 10.75, 5.90, and 8.01%. Fig. 1 shows the mean protein content of the grain year by year and also the highest and lowest variant among the individual ears analyzed of each line. Every year since 1921 the lowest high-protein variant has been higher than the highest low-protein variant, that is, they have never crossed.

The purpose of the investigation reported in this paper was to determine the effect of the nitrate nitrogen concentration in the culture medium upon nitrogen absorption and assimilation during vegetative growth of plants of the high- and low-protein strains, separating the total nitrogen of these plants into the various groups of compounds which are concerned in nitrogen metabolism.

The literature contains accounts of many studies which relate, to some extent, to the object of this investigation. The effectiveness of a breeding program to modify the chemical composition of corn has been demonstrated (14, 18, 19, 35, 36). Many studies (1, 2, 4, 5, 8, 11, 15, 23, 32, 33) have furnished interesting observations on the nitrogen metabolism of plants. Several workers (3, 6, 16, 21, 22, 26, 27, 31) have demonstrated the effect of environment on composition as well as on growth, and some recent papers (9, 10, 28) report on conditions which affect the assimilation of ammonium and nitrate ions. In none of the investigations referred to was there available plant material with a definite hereditary difference in nitrogen content among plants within the same species. An opportunity to observe differences in

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4. The term "protein" in this instance refers to the total nitrogen multiplied by the conventional factor 6.25.
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