Nitrogen Fractions of the Component Parts of the Corn Kernel as Affected by Selection and Soil Nitrogen

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IN THE summer of 1944 an extensive research program was started by the Division of Soil Fertility on several phases of nitrogen metabolism of the corn plant. The program included field experiments to determine the interaction of hybrid, rate of planting, level of nitrogen fertility, and location on yield and protein content of grain; a study of the weekly absorption of soil nitrogen by the corn plant and the rate and forms of nitrogen compounds translocated into the developing grain; and a comparative study of various plant compounds and enzyme systems of corn lines differing widely in protein content of the grain.

The first object of this research program was to determine the principal factors responsible for the reported decline in the protein content of hybrid corn grain. The second object, though equally as important as the first, was to study in detail a few of the metabolic processes of the corn plant known to be associated with protein synthesis.

As a fundamental supplement to these investigations, a quantitative study was made of the various classes of protein in the germ and endosperm of six strains of corn which differed widely in total nitrogen. The results of this study are reported in this paper.

REVIEW OF LITERATURE

The only work found in the literature on the fractionation of the various proteins in different parts of the corn kernel is that of Osborne and Mendel (7). They used only one variety of corn which contained 2.33% total nitrogen. Total nitrogen and other elements have been determined on the various parts of the corn kernel by Hopkins, Smith, and East (5), Osborne and Mendel (7), and Earle, Curtis, and Hubbard (3).

SOURCE OF MATERIALS

Illinois High Protein, Illinois Low Protein, Illinois Low Oil, and Funk’s G-80 corn were used. All strains except G-80, a commercial hybrid, had been selected for their respective chemical characteristics since nitrogen and oil analyses for these strains of corn and data from the literature are given in table 1, but other data will be considered in this paper.

The grain from Illinois High and Low Protein, High and Low Oil corn was produced in 1945 on the south farm at Urbana, Ill. Funk’s G-80 was produced the same year near Urbana, Ill., on two plots with different levels of nitrogen. One plot received no nitrogen fertilizer; this plot is referred to as high-soil-nitrogen corn. The other plot received 2,400 pounds per acre of 21% ammonium nitrate and 21% potassium chloride applied on the surface and plowed under. Corn from this plot is referred to as low-soil-nitrogen corn. G-80 was drilled at the rate of three kernels per hill checked in 40-inch rows, other strains were drilled at the rate of one kernel every 12 inches in rows 40 inches apart.

DISSECTION OF KERNEL

A known number of air-dried kernels were completely dissected at one time so that the water used for softening them would not have time to dissolve the water-soluble nitrogen. The kernels were placed in distilled water at room temperature for approximately 10 minutes, or until the tip cap was easily removed with a knife. First the tip cap was removed; the hull was pulled down to the dent end in strips pulled off so as to remove as little aleurone layer as possible. These strips served as a means of removing the cap and the dent.

The germ and endosperm remained intact. The germ was removed most satisfactorily by starting at the tip end and slowly prying the turgid germ from the endosperm. This process was continued down along the sides of the endosperm. This process was continued down along the sides of the endosperm. The portion of the germ that filled the small groove in the endosperm was removed fairly satisfactorily in this manner. A much cleaner separation was made if the germ remained intact throughout the entire operation. Extreme caution was used to prevent the germ from being damaged by the knife.

The moist tip cap, hull, germ, and endosperm were dried overnight in a forced-draft oven at 40° C and then dried in a vacuum oven at 76° C for 1 hour in the Graduate College. This investigation was made possible by a cooperative gift fund from Funk Bros. Seed Co. of Bloomington, Ill., courtesy of Dr. C. M. Woodworth.

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