**The Inheritance of Protein and Certain of Its Components in Maize**

KENNETH J. FREY

PROTEIN is a class of organic compounds essential to all life, plant or animal. Animal requirements of protein and plant content of protein have been studied quite extensively, but very little is known about the amino acid structure of plant proteins or how they are inherited. Therefore, it is the purpose of this paper to present data pertinent to the inheritance of proteins and amino acids in corn.

**Literature Review**

The first attempt to modify the protein content of corn was begun at Illinois in 1896 with the hope of producing high- and low-protein strains through the use of ear-to-row breeding. The high and low strains contained 17.2 and 7.2% protein, respectively, in 1946 in contrast to the original selections which contained 10.9%. East and Jones (10) started a similar program except that they used straight selfing as a means for isolating high-protein strains. They made as much progress in six generations of selection as the workers at Illinois did in 15.

East and Jones (10) presented further data on the inheritance of protein percentage in a series of F1 hybrids from which they concluded, first, that low-protein percentage was partially dominant, and second, that a great number of genes determined this character. Later, Lindstrom and Gerhardt (17) reported on a cross of high oil × Evergreen sweet corn in which low-protein percentage was dominant.

Inheritance of protein percentage in wheat was studied by Clark (6), Clark and Quisenberry (8), and Clark and Hooker (7) in the F3's and F4's of several crosses. Low protein percentage tended to be dominant.

Doty, et al. (9) studied the inheritance of protein, tryptophan, tyrosine, histidine, cystine, and arginine in 28 single crosses grown in 1939 and 1940, and despite large fluctuations, their data showed that protein character was controlled somewhat by heredity. They also obtained an index of the protein-producing ability of the genotype of the F1 plant is being measured.

Histidine percentage did noticeably. L317 and 38-11 in crosses were high in cystine content, and K4 was outstanding in arginine percentage. These results showed that amino acids in corn were under genetic control and therefore protein quality could be improved.

Studies upon the nature of the interaction of genetic factors influencing yield have been made in *Zea mays* and *Lycopersicum* species. MacArthur and Butler (19) and Powers (22) presented data on the fruit size in tomato crosses which conformed to the expected values based upon the hypothesis of geometric gene interaction. In corn, Kinman and Sprague (15) found that expected values based upon the hypothesis of arithmetic gene interaction was more closely approximated by arithmetic than by geometric gene interaction. Manglesdorf and Fraps (20) and Fraps (11) studied the inheritance of protein, tryptophan, valine, leucine, and isoleucine percentages. Data obtained on the corn endosperm genes in corn act in an arithmetic manner with each gene adding 5 units of vitamin A per gram of the yellow endosperm genes.

**Materials and Methods**

**MATERIALS**

The corn samples analyzed in the present study were obtained from two sources. Group I includes:

1. **P1**, Illinois high-protein corn
2. **P2**, Illinois low-protein corn
3. **P1**, Illinois high-protein by Illinois low-protein
5. **Bc1**, backcross to Illinois high-protein
6. **Bc2**, backcross to Illinois low-protein

These two parents were selected because of extreme differences in protein percentage. Group II includes:

1. **P1**, 1198
2. **P2**, Hy
3. **P1**, 1198 × Hy
4. **P2**, 1198 × Hy
5. **Bc1**, backcross to 1198
6. **Bc2**, backcross to Hy

**Group II** includes:

Hy and 1198 are Corn Belt inbreds. Group II, 1945. Throughout the remainder of this paper the symbols “P1”, “P2”, etc., as given above, will be used.

Twenty-five kernels of each of the P1, P2, P1 × P2 and P2 × P1 inbred and crosses were planted in 25-plant rows. The plants were selfed to eliminate foreign pollen. After accidental losses about 800 ears were harvested.

**2** Contribution from the Farm Crops Subsection and Chemistry Section, Iowa Agricultural Experiment Station, Ames, Iowa, and the Division of Cereal Crops and Diseases, Bureau of Plant Industry, Soils, and Agricultural Engineering, Agricultural Research Administration, U. S. Dept. of Agriculture, cooperating. Journal Paper No. J-1596 of the Iowa Agricultural Experiment Station, Ames, Iowa. Project 616. Part of a thesis submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy at Iowa State College. Received for publication October, 1948.