Research Note

PRELIMINARY EVALUATION OF TWO NEW HIGH-QUALITY PROTEIN OPAQUE-2 CORN VARIETIES ON AN ACID AND RELATIVELY INFERTILE SOIL (ULTISOL) OF PUERTO RICO[1, 2]

Corn is the staple food for millions of people in the tropics, providing an important part of their daily protein requirements. It is well known that the protein quality of most corn, however, is inferior to that of animal protein. This may result in reduced body growth and other nutritional deficiencies and often leads to diseases such as the kwashiorkor syndrome.

Two essential amino acids are limiting: lysine (typically 2% of the protein) and tryptophan (typically 0.05% of the protein). For normal body growth and maintenance, 4% lysine and 1% tryptophan are required.[3] A type of corn was obtained a few years ago, with a mutant gene identified as opaque-2. It owes its name to the dull, opaque appearance of the kernel. Its lysine content is almost 4% while that of tryptophan is 1% which could help overcome malnutrition problems due to the inferior protein quality of common corn. This type of corn has, therefore, aroused interest among many governments and scientists in the developing countries. Several experiments have been conducted that indicate a high biological and feeding value of opaque-2 varieties. Nutritionists reported that its biological value is almost 90% that of milk, and significant increases in weight and health levels were obtained with children, pigs and rats when fed with opaque-2 corns as compared to ordinary corn.[4]

However, opaque-2 corns present certain limitations. The most important ones are: 1) Lower grain yield; 2) lack of resistance to various diseases and insects; and 3) low consumers' acceptance due to its dull, lustreless and chalk-like appearance. Facing these problems, corn breeders at CIMMYT (International Maize and Wheat Improvement Center) in Mexico have established an intensive research program in an effort to overcome these limitations and improve the agronomic charac-

[1] Manuscript submitted to the Editorial Board May 1, 1975.

[2] Joint contribution from the Department of Agronomy, Cornell University, Ithaca, New York, and the Agricultural Experiment Station, University of Puerto Rico, Mayagüez Campus, Río Piedras, Puerto Rico. This study was part of the investigations supported by the USAID under research contract tâ-c-1104 entitled: "Soil fertility in the Humid Tropics."

[3] CIMMYT Review 1974, Maize improvement (CIMMYT, Mexico), 1974.

[4] Bressani, R., La calidad proteica del maíz con gen opaco-2, Turrialba, 18(1): 8–13, 1968.

teristics of some of these varieties. Recently, they produced a new series of better varieties of the opaque-2 type that yield up to 5 tons/ha.[5] These have been sent to several tropical countries to be tested for adaptation and observation. Dr. Surinder Vasal, corn breeder at CIMMYT, kindly sent the authors seed of two new varieties: Tuxpeño × La Posta (O_2O_2) and Composite K Hard Endosperm, to be included in our fertilizer experiments in the acid, extensive, relatively infertile soils of the humid tropics (Ultisols and Oxisols). These soils are common in tropical regions and have a good productivity potential when properly managed.

A trial was conducted on Humatas clay (Ultisol) at the Corozal Substation. It was harvested 135 days after planting. This site is located at about 250 m (820 ft) above mean sea level and has a mean annual rainfall of 200 cm (78 in). The average summer maximum and minimum temperatures are almost 29° C and 21° C, respectively. In winter these are 3° C lower. Solar radiation ranges from an average of 300 langleys/day in the winter to 500 langleys/day in the summer. The evaporation from a class A pan is nearly 5 mm/day in summer and 3 mm/day in winter.

Each variety was planted in an area of 90 m^2 with a distance of 76 cm between rows and 30 cm between plants within the row. The seeds of variety Tuxpeño × La Posta (0_20_2) were sown at the beginning of September 1974 and those of Composite K Hard Endosperm at the beginning of October 1974.

The technological agronomic practice package used was identical to that used with tropical hybrid Pioneer X-306-B in a previous experiment at this site. A blanket fertilizer application of 100 kg/ha each of P, K, and N (urea) and 50 kg/ha of Mg was applied in bands one month after emergence of the plants. The pH of the soil was 5.2. Weed control was carried out by the use of Lasso (Alachlor),[6] a preemergent herbicide, at the rate of 4 kg/ha of active ingredient. Weekly sprayings of a mixture of Lannate (0.5 kg/ha of active ingredient) and Dithane M45 (2.5 kg/ha of active ingredient) until the silking stage satisfactorily controlled insects and diseases. Corn ears were obtained from 15 m of the two center rows of each plot. Grain samples were taken for measuring yield and protein content. The growth of both varieties was reasonably good. However, Tuxpeño × La Posta (0_20_2) appeared greener and more vigorous than Composite K Hard Endosperm. Ear leaf samples taken at silking stage showed a slight N deficiency in the latter. This seemed to indicate

[5] Vasal, S., CIMMYT, Personal communication, 1974.

[6] Trade names are used in this publication solely for the purpose of providing specific information. Mention of trade names does not constitute a guarantee or warranty of the product by the Agricultural Experiment Station of the University of Puerto Rico or an endorsement over other products not mentioned.

TABLE 1. *Yield and protein content of two opaque-2 corn varieties and hybrid Pioneer X-306-B*

Type of corn	Grain yield (15% H_2O)	Grain protein	Grain protein
	Kg/ha	%	*Kg/ha*
Opaque-2 var. Tuxpeño × La Posta (O_2O_2)	5188 (46 cwt/acre)	11.2	494 (440 lb/acre)
Opaque-2 var. Composite K Hard Endosperm	5150 (45.8 cwt/acre)	10.1	442 (393 lb/acre)
Common corn hybrid Pioneer X-306-B	6274 (56 cwt/acre)	11.5	613 (546 lb/acre)

that for maximum yield at that site more than 100 kg N/ha was needed. No lodging was observed despite abundant rainfall and strong wind during the growth cycle. The plants showed little insect and disease damage. In table 1 the yield and protein content of these two varieties are reported as compared to those of the new superior tropical hybrid Pioneer X-306-B which was growing in a nearby area in the Corozal Substation at the same time, and to which the same management was applied.

These yields could be higher in summer according to previous observations in plantings with other corn varieties. Furthermore, opaque-2 variety yields might have been better with higher levels of N fertilizer. Although the overall yield and protein content of Pioneer X-306-B are higher than those of opaque-2, the protein quality of the latter is normally superior. For Puerto Rico, which uses large amounts of corn for animal feeding, these and other opaque-2 varieties may eventually have an impact in terms of better nutrition at less cost.

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