Effects of the Gene \( ae \) on Seed Quality in Maize

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A VERY limited amount of work has been done on the influence of single gene endosperm characters on seed quality of \( Zea mays \) L. As greater use is made of such genes to modify the chemical make up of maize this will be of greater importance. Senn (4) studied the effect of the sugary gene on resistance to seedling blight caused by \( Gibberella zeae \). By using seed from ears segregating for \( su_1 \), he avoided confounding ear to ear variation with the effect of the gene. He found that in every group of segregating ears the higher index of resistance to seedling blight was shown by the non-sugary kernels and concluded that the sugary gene itself lowers resistance to seedling blight. Haskell and Singleton (3) used similar techniques but did not seed the soil with a specific fungus organism. They found no difference in the ability of \( Su^2 \) and \( su_1 \) kernels to withstand cold treatment. Haskell (2) concluded that genetic factors for cold resistance are more important than whether the endosperm is starchy or sugary.

The purpose of research reported here was to evaluate the effect of the \( ae \) gene on germination and rate of seedling growth in warm sand, on resistance to seedling blight and rate of seedling growth in cold muck soil and to determine in new lines homozygous for \( ae \) the interrelationship between amylose level and (1) kernel collapse or shrinkage during maturation, (2) kernel shape, and (3) kernel weight.

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**MATERIALS AND METHODS**

The 4 widely used dent corn inbreds C103, Oh43, H49 and B14 were converted to amylose lines by outcrossing each to an \( ae \) stock and backcrossing 5 times to the recurrent inbred parent. Five of the 6 possible single crosses among these lines were made and grown in paired rows with their normal dent single cross counterparts in 1960 at the Purdue Agronomy Farm. These were self-pollinated and the F, seed used in the following tests: The cold muck stand or seedling blight resistance test was conducted by planting 50 kernels from each ear in each of 2 replicates in flats of muck soil. They were watered to near field capacity and held at 50° F. for 10 days, then transferred to the greenhouse. For the warm sand germination, 50-kernel samples were planted in flats of sand and taken directly to the greenhouse. Readings were taken when the plants were about 15 cm. in height. Vigorous seedlings were scored as 1.0 and stunted or diseased seedlings scored 0.5, failure to emerge was scored 0. Amylose content, total water soluble compounds, total sugars, and reducing sugars were determined.

Ears segregating for \( ae \) from the lines W64A, C103, and K55, backcrossed 7, 6, and 3 times, respectively, were used for paired comparisons of germination and seedling height both in warm sand and cold muck. Procedure was the same as the previous experiment except that 25-kernel samples were used. Seed of 143 ears of new lines homozygous for \( ae \), a random sample relative to any effects of \( ae \), were independently rated for kernel collapse or shrinkage during maturation on a 1 to 5 basis by 4 people. The same seed was rated for kernel shape (long and slender versus cylindrical), the weight per hundred kernels measured and the amylose percentage determined.

**RESULTS AND DISCUSSION**

Seedling emergence of the five single crosses are presented in Table 1. In warm sand, two pedigrees showed reduction (nonsignificant) of stand by the \( ae \) gene. However, in cold muck soil, all \( ae \) pedigrees except one were...