OIL CONTENT AS A MEASURE OF SEED QUALITY IN CORN1 (Zea mays L.)

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VARIATION of growth from plant to plant in corn is fairly obvious even in genetically homogeneous hybrids, i.e., single crosses. Part of this variation may be the result of differences in early seedling vigor which in turn may be due to variations in seed quality. The purpose of this study was to determine if oil content of individual kernels of the same genotype can be used as a measure of seed quality. Since it has been found that the germ contains most of the oil in corn kernels, seed selection for oil content should result in seed with increased embryo size. Unfortunately, owing to the variation in the shape of germs and the size of kernels, it is difficult to estimate germ size accurately by inspection of the whole kernels. However, development of a new technique using nuclear magnetic resonance spectroscopy,3 enables the planting of individual kernels analyzed for oil content and the observation of the resulting plants.

Two hundred and eighty corn kernels of nearly the same size of the single cross WF9 (female) × B37 were dried at 60 C for 96 hours to about 5% moisture and weighed individually. These individual kernels were then analyzed for oil content using nuclear magnetic resonance spectroscopy.4 The oil content of individual kernels ranged from 2.77 to 5.55% and was negatively correlated (r = -0.23*) with seed weight. This indicates that light kernels tend to contain more oil than the heavy ones. However, the correlation is quite low and not of great biological significance.

The analyzed kernels were grouped into high and low oil samples of 84 kernels each with mean oil contents of 4.88 and 3.95%, respectively. The respective mean kernel weights were 263 and 254 grams. “Dried” seed (dried in the same manner as the analyzed kernels) and “Normal” seed (approximately 12% moisture) of similar size as analyzed kernels from WF9 × B37 were used as checks. A latin square design containing four treatments and four replications was used. The test was planted on May 28, 1964 and there were 21 plants per plot of each treatment.

Germination, number of leaves, plant height, ear height, silking date, and yield were studied and the data presented in Tables 1 and 2. High oil kernels germinated earlier than low oil kernels. Plants from high oil kernels also developed more rapidly than those from low oil kernels in the early stages of development, as measured by number of leaves, plant height, and silking date. There were no significant differences in final germination, total leaf number, final plant height, and yield. Surprisingly, plants from high oil kernels had lower ear height than those plants from low oil kernels.

Since the plants from high oil kernels began growth earlier and developed more rapidly than those plants from low oil kernels, a yield difference might have been expected. However, plant yield can be influenced by many environmental factors. If the two groups of plants were grown in a larger population and in adverse conditions such as in cool wet weather shortly after planting, the superiority of high oil kernels might be sufficient to give a yield advantage over plants from low oil kernels.

Based on early germination and early growth, results from this study suggest that percent oil, as an indirect measure of germ size, may be used as a measure of seed quality of individual corn kernels. The technique of measuring oil content with nuclear magnetic resonance is not at present a practical means of grading seed corn. However, the procedure may be useful in studies on seed quality and theoretical problems.

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