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1. Equation of heredity to include cytoplasmic effects.

Results from our experiments on female and male cytoplasmic effects in the  $F_1$  and  $F_2$  generations of double-cross maize hybrids suggest that we alter the common equation of heredity,  $P = G + E$ , to include cytoplasmic effects.

The final expression of the phenotype ( $P$ ) is the manifestation of the genotype (nuclear genes), the cumulative effect of the cytoplasms, and the environment. Thus, the new equation which we suggest to include cytoplasmic effects is  $P = G + (C_f + C_m) + E$ .

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2. Does the male contribute cytoplasm?

"Yes," is our answer to this question. Our affirmative answer is given on the basis of the effects of the male cytoplasm on the zygote.

It was once thought that no cytoplasm is contributed to the offspring by the male parent. We have obtained data from several experiments which reveal differential male cytoplasmic effects and differential female cytoplasmic effects on the expression of various agronomic characters.

In our most recent  $F_1$  experiments, significant effects of the male cytoplasm were obtained for time of silking, ear height, leaves below top ear, leaves above top ear, total leaves, number of shoots, and number of green ears. We also found significant effects of the female cytoplasm for time of silking, stalk diameter, leaves below top ear, leaves above top ear, number of green ears, number of shoots, and ear number at harvest.

Data for plant height, ear number, and yield approached the .05 level of significance in the  $F_1$  experiments on male cytoplasm. Characters approaching the .05 level for the female cytoplasm were total leaves, erect plants, and yield.

F<sub>2</sub> data show that the male cytoplasms produced significant differences in time of silking, erect plants, and yield. The F<sub>2</sub> female cytoplasmic data indicate a significant effect on time of silking and erect plants.

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### 3. Female vs. male cytoplasm.

The effects of these two kinds of cytoplasm on the offspring may not necessarily be in direct proportion to the amount of cytoplasm that is contributed to the zygote by each parent. Significant effects may be obtained from apparently small amounts or large amounts of contributed cytoplasm in certain genotypic-cytoplasmic combinations. This statement is made on the assumption that only a small amount of cytoplasm is obtained through the male.

In addition, as reported in Maize Genetics Cooperation News Letter 41: p. 39, 1967, by Fleming and Campbell, the expression of the male cytoplasm can be influenced by the female cytoplasm.

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### 4. New character affects hybrid performance.

Six stocks of the long-time white inbred, Tx61M, were crossed to a single-cross tester, T105 x K64. The Texas stock has the greatest amount of brachyism, a character previously reported (Fleming and Kozelnicky, 1964, Maize Genetics Cooperation News Letter 38:47). The short internodes above the top ear cause a bunching effect of the upper leaves.

In the three-way testcrosses, the Texas stock caused significantly more brachyism in the hybrid than the five Tx61M stocks from Alabama, Georgia, Kentucky, North Carolina, and Tennessee.

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