

5. A classical test for allelism of id (indeterminant growth habit = photoperiodic) in teosinte and maize.

Three hybrids between maize which is homozygous id and teosinte were found to be indeterminant. They flower, however, in response to a photoinductive regime of 9 hrs. of light and 15 hrs. of dark.

This finding is a successful partial repetition of the work of Langham (Genetics 25:88-107, 1940), and is a partial reconfirmation of his contention that the inheritance of this difference between maize and teosinte is simple (monogenic).

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1. Growth effects of gibberellic acid on dwarf-1 and normal maize seedlings.

One approach to the basic problem of the role of hormones in normal plant growth is to use artificial applications of hormones to plants in which the usual amount of native hormones is assumed to be reduced by mutant gene action. In maize a "growth series" can be set up using the mutant, d_1 , and artificial applications of the hormone, gibberellic acid (GA_3), which has been demonstrated to normalize expression of this gene (Phinney, 1956, Nat. Acad. Sci. 42:185-189). The series is:

1. Normal phenotype (D_1D_1 and D_1d_1) untreated, assumed to be within the normal range of native hormone content.
2. Dwarf phenotype (d_1d_1) untreated, has shown evidence of reduced native hormones (Van Overbeek 1938 Plant Physiol. 13:587-598; Phinney 1961 Iowa State U. Press, pp. 489-501).
3. Normal treated with GA_3 -- normal native hormones and added GA_3 .
4. Dwarf treated with GA_3 -- reduced native hormones plus added GA_3 .

The maize kernels used in the present study were from the maize breeding program of Dr. E. C. Abbe of the Department of Botany, University of Minnesota. These kernels, segregating for d_1 , were produced by backcrossing the mutant gene for several generations to University of Minnesota Station Inbred A188 to achieve a homogeneous background for the mutant gene. In the experiment daily applications of a 0.01% solution of GA_3 were applied to half the normals and dwarfs as soon as the dwarfs could be identified. Measurements of the first five leaves (which is about the life span of the treated plants) in maximum length and width of the leaf blade were made every other day until maturity of the leaves.

Three distinct patterns of growth could be detected from this growth series:

1. Normal growth as exemplified by the untreated normals.
2. Dwarf growth as produced by the untreated homozygous recessive mutants.
3. Extended growth resulting from additions of GA₃ to either the dwarf or normal phenotype.

Daily treatment with GA₃, then, changes both normal and dwarf growth. Early after treatment the dwarfs phenocopy the untreated normals, but soon the treated dwarfs copy the extended growth pattern such that the two phenotypes are indistinguishable. In terms of leaf form the three growth types are:

1. Normal growth characterized by long and narrow leaves.
2. Dwarf growth much shorter and wider leaves than type 1.
3. Extended growth much longer and narrower leaves than those of type 1.

Further experiments of this same nature will be made with larger populations and more frequent and complete measurements of leaf form than those used in this study.

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1. A sterile plant with S cytoplasm and S restorer genes.

In our 1961 MNL report (p. 20) on the genetic characterization of various sources of sterile cytoplasm it was pointed out that a single sterile plant appeared in the family from the cross A158H1[♀] x (A158HxNY16)[♂]. By all tests source H is S type cytoplasm; NY16 contains S (and T) restorer genes. Thus, the heterozygous restored sterile A158H x NY16 would be expected to produce only fertile offspring when crossed as a male parent to the A158H sterile female, since in the presence of S cytoplasm pollen grains containing the nonrestoring allele abort and only the restorer allele is transmitted. It was suggested in the previous report that the exceptional sterile plant in the above test cross did have the major S restorer gene from NY16, but was not expressed in the residual genotype of the cross (which also contained 5 partially fertile plants). The single sterile plant, which was completely sterile and exerted no anthers, was pollinated by normal A158 (i.e. A158H1 (A158HxNY16) sterile plant x A158). In 1961 the progeny from this cross segregated 8 fertile and 9 sterile. Since A158 is free of S restorer genes, it is likely that the sterile female parent did in fact contain the S restorer genes.

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2. Segregation of T restorer genes in "reciprocal crosses."

In a previous MNL (1959, pp. 9-12) Jones reported that the heterozygous (Rf₁rf₁) restored sterile inbreds C103TF, HyTF and KrTF (TF = restored sterile) each produced a significant excess of fertile plants when crossed as pollen parents to T sterile single crosses. Genotypically all crosses were presumably T rf₁rf₁Rf₂Rf₂[♀] x T Rf₁rf₁Rf₂Rf₂[♂], and thus expected to segregate 1 fertile:1 sterile. The excess of fertile plants in these segregating progenies was attributed either to the presence of fertility modifier genes in the seed parent single crosses and in the pollinator inbreds, or to a selective mechanism favoring the Rf allele in the pollen. To obtain further information on the transmission and segregation of restorer genes, progenies from "reciprocal crosses" involving individual heterozygous restored sterile