

hypothesis is supported by the close correlation between the observed distribution of A_2 genotypes within the $Bt Bt$, $bt bt$, and $Bt bt$ classes and that expected on the basis of the known amount of recombination between A_2 and Bt . For example, if there is no crossing over between Bt and the centromere and if the $Bt bt$ eggs come from first division elimination, the proportion expected to be homozygous at the A_2 locus is 13.4% on the basis of recombination between A_2 and Bt (corrected data) and 12.6% on the basis of the uncorrected crossover value. These percentages are in fair agreement with the frequencies of 16.6% and 14.9% derived from the corrected and uncorrected arrays of diploid eggs, respectively.

Similarly, if the $Bt Bt$ and $bt bt$ eggs arise through the omission of the second meiotic division, the expected proportions of homozygotes ($A_2 A_2 + a_2 a_2$) are 73.2% and 74.8%, depending on whether the corrected or uncorrected recombination values are used. The actual frequencies are in close agreement, namely 71.2% for the corrected and 73.4% for the uncorrected data. The small discrepancies can be attributed to a low frequency of crossing over between Bt and the centromere, and to sampling errors.

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1. Studies of inbreeding in autotetraploid maize.

The inbreeding influence on depression characteristics was studied for the five characters: yield (in centner per hectare), plant height, number of tassel branches, leaf area of an ear and ear length in progenies from successive selfing based on the diploid synthetic population Krasnodarskaya 1/49 and the tetraploid population Synthetic B developed by D. Alexander.

The seeds from each selfed ear were sown in 5 m² one-row plots in four replications: P; I₁; I₂; I₃; I₄; I₄; I₃; I₂; I₁; P and so on.

For every inbred population 18-20 progenies were present. Measurements were made on 20 plants in every progeny.

The complete correlation analysis showed that there was a direct linear correlation between the level of heterozygosity and the characteristics of the depression curve for all five factors. But for tetraploids, there was a curvilinear correlation for plant height and yield.

In calculating the theoretically expected decrease in the heterozygosity level, it was assumed that chromosome segregation occurred and that every locus had two alleles (O. Kempthorne, 1957, An Introduction to Genetic Statistics, New York).

A comparison of depression characteristics for the populations permits certain conclusions: autotetraploidy affects the slope of the curve making it smoother; the depression characteristics depend on the nature of the character. For example, such complex characters as yield and plant height conditioned by many genes have a steeper depression slope which differs a little from that in diploids.

In the report of Dudley and Alexander (Crop Science 9 (5) 1969) it was assumed that in the process of autotetraploid inbreeding a relatively great number of aneuploids of little value would appear. These aneuploids have a low yield.

Table 1 gives the results of studies proving these suppositions.

Table 1
Correlation of aneuploids in populations at various levels
of inbreeding in Synthetic B

Inbred population	Number of examined plants		
	Total	Aneuploids	$P \pm m_p$
Synthetic B P	169	61	0.36 ± 0.037
I ₁	100	37	0.37 ± 0.048
I ₂	100	39	0.39 ± 0.049
I ₃	100	42	0.42 ± 0.05
I ₄	100	49	0.49 ± 0.05

Thus, the increase in number of aneuploids in the population on inbreeding probably has a somewhat negative effect, but its influence is not great enough to be responsible for a yield decrease of 45% in a selfed generation.

We may suppose that the main reasons conditioning a considerable reduction of yield and plant height in inbreeding of autotetraploid maize are likely genes with a series of multiple alleles involved in the expression of these characters and genes with a similar additive effect.

Probably various types of heterozygotes (simplex Aaaa, duplex - AAaa, triplex - AAAa) are not of the same value from the point of view of the maximum expression of heterosis. All these suppositions are to be checked.

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2. Meiosis in amphidiploid maize and teosinte.

Diploid hybrids of maize and teosinte developed by Emerson and Beadle usually showed a normal process of crossing over for marker genes (Emerson, R. A. and Beadle, G. W. Zeitschrift für Inductive Abstammungs- und Vererbungslehre 62:291-304, 1932).

Cytological studies showed normal chromosome pairing in these hybrids and only negligible variations in their length were determined (Longley, A. E., Bot. Rev. 7:263-289, 1941). The minor deviations in the process of meiosis manifested in some diploid hybrids are explained by the presence of small inverted segments of chromosomes in some teosinte forms.

The next logically based step in determination of the level of chromosome relationship and chromosome interaction is a hybrid tetraploid test.

To determine the level of homology of maize and teosinte chromosomes we crossed maize with the annual teosinte, E. Mexicana, from Chalco.

The 2-3 leaf seedlings were treated with colchicine by the method of 0.2% colchicine solution and 0.5% water soluble methylcellulose injection into the hollow formed by the leaves above the shoot apex.