

INDIAN AGRICULTURAL RESEARCH INSTITUTE  
New Delhi, India  
Division of Genetics

1. Cytoplasmic effects on quantitative characters in maize:

Reciprocal  $F_1$  and backcrosses were studied between SP2 and Llera III, Yellow Tuxpañ, Eto Amarillo, San Andres Tuxtla and Colorado, and Colorado and Pira Blanco, Pollo Segregaciones and Pollo Amarillo. Quantitative characters such as yield, days to 75 per cent silking, plant height, ear height and no. of ears per plant were studied in all the reciprocal crosses with a view to find out whether the cytoplasm showed any effect on these characters. Significant cytoplasmic effects were obtained with four of the five characters studied. The character, number of ears per plant, did not show any cytoplasmic effect.

B. K. Bhat\*  
N. L. Dhawan

\*Present address: The Birla Institute of Scientific Research, Rupar, Punjab, India.

2. Instability of cytoplasmic effects in different environments.

Reciprocal  $F_1$  crosses were studied between Indian, Mexican, and Colombian varieties of maize. Data were recorded during 1964 and 1965 growing seasons on quantitative characters such as yield, maturity, plant height and ear height. The reciprocal crosses studied and the characters showing significant reciprocal differences in the two years are given in the table.

Pedigree	1964	1965
SP2 X Yellow Tuxpan	-	Days to silk
Yellow Tuxpan X SP2		
SP2 X Eto Amarillo	-	Plant height
Eto Amarillo X SP2		Ear height
SP2 X San Andres Tuxtla	-	Days to silk
San Andres Tuxtla X SP2		
Pira Blanco X Colorado	Days to silk	Plant height
Colorado X Pira Blanco		Ear height
KT41 X San Andres Tuxtla	Plant height	Yield
San Andres Tuxtla X KT41		
Basi X Eto Amarillo	-	-
Eto Amarillo X Basi		

It will be noted from the table that cytoplasmic effects on a particular character in one year were not repeated in the other year of study. Reciprocal crosses of SP2 with Yellow Tuxpan, Eto Amarillo and San Andres Tuxtla did not give cytoplasmic effects on any of the four characters studied during 1964, whereas significant effects were obtained on days to silk, plant height and ear height in the 1965 study. Reciprocal crosses between Pira Blanco and Colorado gave a significant cytoplasmic effect on days to silk in 1964, whereas no cytoplasmic effect was obtained for this character in 1965; instead plant height and ear height were significantly affected. KT41 X San Andres Tuxtla and its reciprocal revealed a significant cytoplasmic effect on plant height in 1964 and on yield in 1965. Reciprocal crosses of Basi and Eto Amarillo did not show significant cytoplasmic effects on any of the four characters studied.

B. K. Bhat  
N. L. Dhawan

3. Threshold concentration of plasmon sensitive polygenes in the expression of quantitative characters.

During the course of studies of cytoplasmic effects on quantitative characters such as yield, maturity, plant height, ear height and number of ears per plant, it was observed that, if a character was under the dual control of nuclear genes and cytoplasm, cytoplasmic effects were expressed only up to a certain threshold concentration of the plasmon sensitive polygenes. Once the concentration of these genes crossed the threshold limit, they alone controlled the character and no cytoplasmic effects would be expressed.

This concept, to the knowledge of the authors, is a new one and has a direct bearing on the expression of cytoplasmic effects on quantitative characters.

If a cytoplasmic effect on a certain quantitative character is expressed in the  $F_1$  and disappears in backcross generations, it might be due to the increased number of genes of one parent introduced by backcrossing which now exceed the threshold limit and thus nullify the cytoplasmic effect. Such a phenomenon was seen to exist in nine of the eighteen cases showing significant cytoplasmic effects on yield, days to 75 per cent silking, plant height and ear height.

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N. L. Dhawan

4. Male sterility caused by nucleus-cytoplasm interaction.

Llera III, a derivative of the Tuxpeno race of maize from Mexico, was reciprocally crossed with SP2, a primitive variety of maize from Sikkim (MNL 38:70), and it was observed that male sterility was produced only when Llera III contributed the cytoplasm. The data are presented in the table.