

Varieties or lines which seemed to be most suitable for breeding materials could be selected by choosing the principal components which were important in connection with the breeding objectives. In this study the first and the second principal components were most important in connection with the objectives of breeding early and high yielding hybrids.

Thus, classification of maize lines and selection of breeding materials were achieved by the application of principal component analysis and distance method.

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1. X-ray induced mutations during pollen tube growth in maize.

X-ray induced mutations in maize pollen were first discovered by Stadler (1928). Recently, the 24-28 hours old developing embryos in maize have proved to be a suitable system for a study of radiation- and chemical-induced mutagenesis (Singleton, 1961; Verma et. al., 1962; Caspar, 1965; Chatterjee et. al., 1965). However, very little is known about the frequency of X-ray induced mutation during pollen tube growth or early stages of fertilization. In order to obtain some information in this respect, ears having the recessive gene (su) were pollinated with Su pollen and were irradiated by X-rays at different times after pollination ranging from 0 to 30 hours. Total dose was 1210r + 110r, with a dose rate of 96.1 r per min. (173 kVp, 25mA, 0.5<sup>mm</sup>Cu + 0.5<sup>mm</sup>Al filter, 45-50cm distance). Whole and chimeral endosperm mutations at the Su locus were scored in the kernels resulting from these pollinations and data thus obtained are shown in Figure 1.

The frequency of whole mutations increased rapidly (from 2.91% to 5.81%) when ears were irradiated 0 to 12 hours after pollination; the frequency decreased slightly (from 5.81% to 5.60%) when X-irradiation was given 12 to 18 hours after pollination; the frequency declined rapidly (from 5.60% to 3.41%) from 18 to 30 hours after pollination. On the other hand, the frequency of chimeral mutations increased gradually (from 0.83% to 1.39%) when treatment was in the interval from 0 to 12 hours after pollination; the frequency increased rapidly (from 1.39% to 3.94%) in the interval from 12 to 30 hours after pollination. The data for the per cent of chimeral mutations are summarized in the following table:

	Hours after pollination					
	0	6	12	18	24	30
% chimeral endosperm mutations	21.6	18.3	19.5	28.1	41.0	50.4

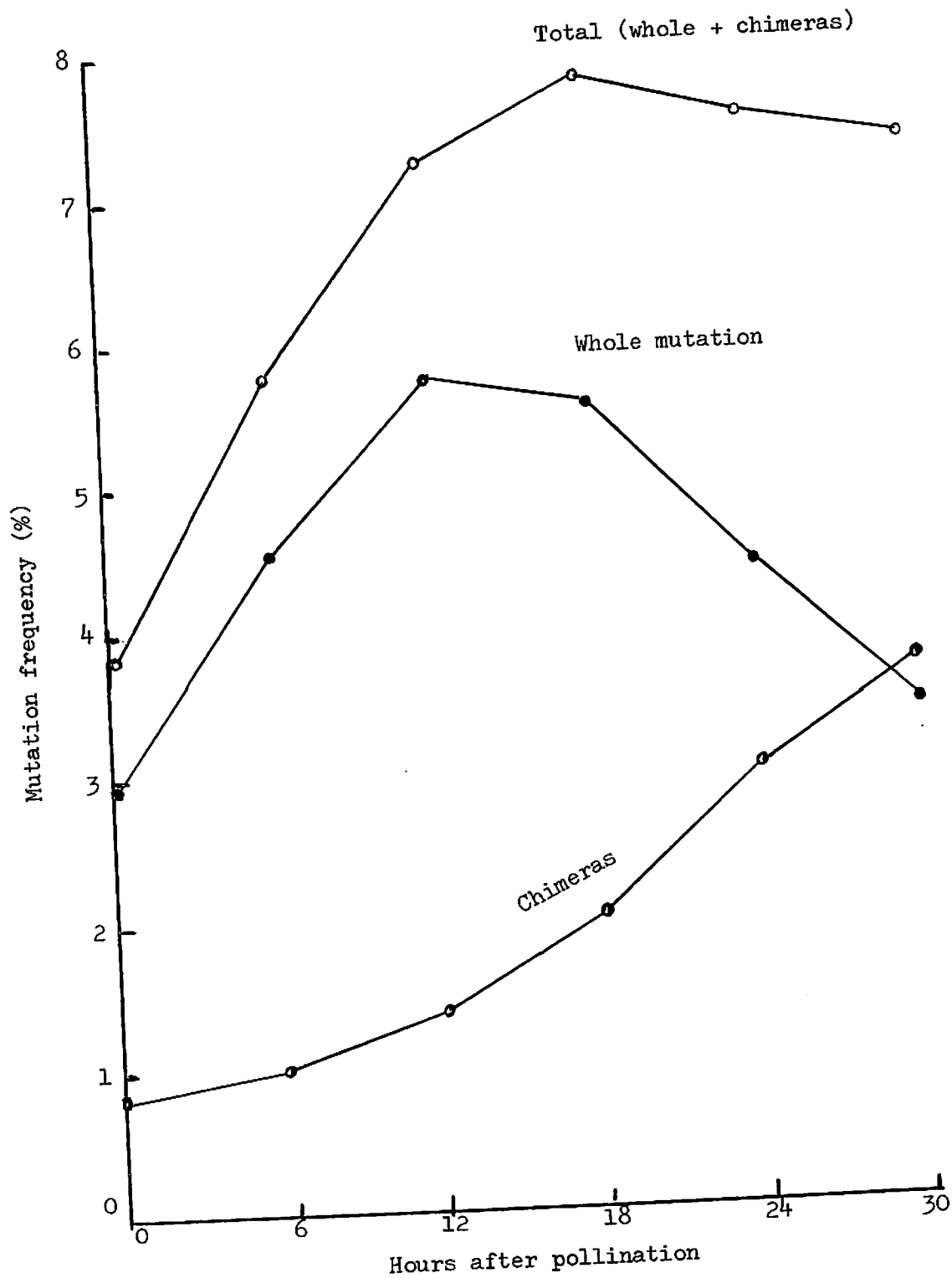


Figure 1. Mutation frequency resulting from X-irradiations during pollen tube growth in maize.

It is significant to note that total mutation frequency when ears were irradiated 12 hours after pollination increased two-fold over the frequency found with ears irradiated immediately after pollination.

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1. The genetics and environmental interaction of a new pale midrib mutant.

A new chlorophyll mutant, tentatively designated pale midrib-2, was found in 1965 at The Pennsylvania State University in a line of "supersweet" corn. The leaves of the affected plants are green at the margins, with the midrib and adjacent tissue chlorotic from the base of the leaf to the tip. In the region near the margin the chlorosis is in the form of a fine stripe so that there is a gradation of yellowing from the completely green tissue to the completely yellow chlorotic tissue. In the field-grown plants the trait did not appear until about a month after planting. However, plants germinated in a growth chamber segregated for the chlorosis at the time of germination. The expression of the trait by the plants grown under artificial light closely resembled that of field-grown plants.

The two original mutant plants were selfed and outcrossed to inbred W153R. The following summer seeds from these pollinations were planted and both were found to segregate for the pale midrib character. The selfs resulted in 11 green and 24 pale midrib plants while the outcrosses resulted in 46 green and 31 pale midrib plants. Furthermore, among the chlorotic plants in the population resulting from selfing, six plants appeared to be more severely affected than the others. These data suggest that the expression of this character is controlled by a single incompletely dominant gene and that the severely affected plants were perhaps homozygous for the pale midrib gene. Because of the inbred background of the shrunken-2 line from which this mutant was obtained, the progeny from the selfing lacked vigor. The chlorotic plants were even less vigorous and the severely affected plants were extremely stunted and did not set seed. However, the mutant plants which resulted from the outcrosses were quite vigorous, with excellent seed set.

Seeds from the above selfs and outcrosses were grown in a growth chamber on a 16-hour photoperiod and on several temperature regimes. When the night temperature was 15°C and the day temperature was maintained either at 21°C or 26°C, 1:3 and 1:1 segregations, similar to those observed in the field, were obtained. It was also possible under these conditions to distinguish mildly and severely affected plants. However, when the day and night temperatures were held at 29°C, the progeny of the self