2. The effect of X-ray and UV on mutation in a doubled haploid line.

In an effort to determine whether X-rays can produce desirable genetic variability, plants of a supposedly homozygous (doubled haploid) line were self-pollinated with treated (1200 r) pollen and the resulting seeds were grown to observe the types of mutants produced. A small population from pollen subjected to UV as well as an adequate control were also included.

The kernels from 41 control, 77 X-ray and 14 UV-treated ears were planted and the resulting seedlings were noted at several stages of maturity.

Mutant types that appeared in the first generation are summarized in Table 1.

Table 1. Types and frequencies of mutants in S_1.

	No. of kernels planted	No. seedlings	Mutant types			
			chloro-phyll	Male sterile	dwarf	narrow leaf
Control	5632	4493 (79.7%)	12 (0.26%)	37 (0.83%)	92 (2.04%)	0
X-Ray 1200r	10813	5205 (48.1%)	46 (0.88%)*	319 (6.12%)	247 (4.74%)	14 (0.26%)
UV	706	410 (58.0%)	0	29 (7.07%)	16 (3.92%)	0

*Four yellow striped plants from one ear are included.

The effect of the treatments in producing types lethal under field conditions (column 3, Table 1) is quite striking and demonstrates the effectiveness of the treatment. The treatments were moderately efficient in producing other types listed in the table. No vigorous or more desirable types were found. All the mutant cases, except the male sterile plants, and about 1/3 of the normal plants were self-pollinated.

At least 40 kernels of each self-pollinated ear of the normal plants of the control and treated families were planted in a sand bench in the greenhouse. The seedlings from these (450 control, 202 X-ray and 160 UV treated) F_2 ears were checked for segregating mutant types. These are listed in Table 2.

Table 2. Types and frequencies of mutants in the seedling stage of S_2.

	No. of ears tested	No. of ears producing mutant seedlings			
		poor germination*	chlorophyll type**	narrow leaf	dwarf
Control	450	12 (2.66%)	10 (2.22%)	3 (0.66%)	1 (0.22%)
X-Ray	232	15 (6.46%)	21 (9.05%)	4 (1.72%)	3 (1.29%)
UV	160	9 (5.62%)	15 (9.37%)	3 (1.87%)	1 (0.62%)

*Germination below 50%. Normal is 83%.
**Both white and virescent seedlings are included.

Most of the mutants found did not give a clear 3:1 ratio, but instead had a deficiency of the recessive class. Again, in the F_2 there was a complete lack of vigorous seedling or desirable mutant types. It should be pointed out, however, that recognition of desirable types is a quite arbitrary choice.

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3. The effect of EDTA on the frequency of crossing over.

It is thought that the failure to obtain an increase in crossing over in corn that has been grown on calcium-deficient soil comparable to that obtained in Drosophila and other organisms that were treated with EDTA is due to the fact that corn has a very critical calcium requirement for growth, and therefore does not survive at a level low enough to affect crossing over. To overcome this a special treatment was devised to provide a very low concentration of metallic ions in the flowering parts of the plant during a short period of time just prior to meiosis.

Vigorous F_1 plants of the constitution $\underline{a}$ $\underline{a}$ $\underline{sh}/\underline{a}^m$ $\underline{Sh}$, $\underline{dt}$, no $\underline{Ac}$ were treated with a .001 molar solution of chelating compound, (ethylene dinitrilo tetracetic acid). The method of treatment consisted of feeding through the cut end of the sixth or the seventh leaf. The leaf was cut about four inches from the auricle and the cut end was placed in a vial containing the above solution for a period of twelve to twenty-four hours. The treatment was applied when the most advanced region of a tassel was just premeiotic. The plants were pollinated by $\underline{a}^s$ $\underline{sh}$, $\underline{Dt}$ and the ears were examined for crossovers between $\underline{a}$ and $\underline{sh}$. The results shown in the following table, though of a preliminary nature, clearly show significant increase in cross-over types in the treated material.