The maize material used in these experiments has the advantage for RBE studies of yielding a basically first order dose-response curve ($Y = \alpha + \beta D$) with low (X rays) as well as with high (fast neutron) LET radiations. The frequency of yellow-green (*yg*$_2$) sectors in leaves 3, 4 and 5 of young plants grown from irradiated *Yg*$_2$/*yg*$_2$ seeds served as a quantitative measure of response. The mutant sectors are believed to be due mostly to simple chromosome breakage and deletion. An exposure apparatus was used which produced essentially equal dose rates in five rings of seeds placed so as to intercept neutrons of 0.43, 0.65, 1.00, 1.50 and 1.80 MeV. Dose average LET values for these energies are 72, 67, 58, 57.5 and 42.5 kev/μ, respectively.

Two experiments were performed at dosages that gave responses which were linear, below saturation levels, and overlapping in range for X rays and neutrons. These ranges in dosages were 32.8 to 126.4 rads of neutrons and 1,500 to 15,600 rads of 250 kvp X rays.

RBE values, calculated from relative slopes (α) of linear regression lines for N and X, ranged from 42 to 135 (average 78) in Experiment 1 and from 48 to 106 (average 68) in Experiment 2. Monoenergetic fast neutrons of 0.43 MeV were the most efficient in producing *yg*$_2$ sectors as shown by the yield of sectors per krad and highest RBE values.

The RBE values obtained in these experiments are higher than commonly reported and in the neighborhood of those found by Neary *et al*. (Int. J. Rad. Biol. 6:127) for plant chromosomes when the dose-squared term of low LET radiation response is minimized. With regard to maximum permissible levels of radiation for man, these results suggest the alternatives that either chromosome breaks in plants have a much higher RBE than comparable reactions in man and need not be considered, or that the problem of chromosome damage *per se* in human tissues be reexamined after exposure to high LET radiations and/or low LET radiations at low doses or dose rates.

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7. Relative biological efficiency of muons and π^- mesons.

Until recently meson beams of sufficient intensity for cytogenetic studies have not been available. The Alternating Gradient Synchotron (AGS) at the Brookhaven National Laboratory now produces almost pure π^- meson and muon (μ^- particle) beams suitable for use in biological experiments. The mesons were generated in the AGS by bombarding a beryllium target with highly accelerated protons of about 28 BeV energy.

Dormant seeds of *Yg*$_2$/*yg*$_2$ maize were exposed in two experiments: (1) to 1,275 rads of nearly pure muons; and (2) to 3,360 rads, comprising about 2,060 rads of muons and about 1,300 rads of π^- mesons. To compare these effects with those of better known radiations, seeds of the same material were treated with 250 kVp X rays. The frequency of *yg*$_2$ sectors was scored in leaves, 3, 4, 5 and 6 of the seedlings.

The muons were found to have about the same mutational efficiency as the X rays (average RBE = 1.01). The calculated results for π^- mesons indicated a relative mutational efficiency of about 3 (average RBE = 3.16). The greater effectiveness of π^- mesons is considered to be due to the energy deposition through strong interactions of these particles with protons and neutrons of the atomic nuclei. These interactions result in nuclear disintegrations producing stars and showers of lightly ionizing and heavily ionizing secondary particles such as protons, alpha particles and heavier nuclei. Since these higher LET tracks are much more efficient than X ray or other low LET radiations (such as muons) in breaking maize chromosomes, π^- mesons would be expected to have the higher RBE observed.

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8. Effects of X-irradiation on intracistron recombination at the Wx/wx locus.

Research work by O. E. Nelson (Science 130:794) has demonstrated intracistron recombination at the waxy locus in maize. Also, Roman (CSHSQB, 1958) has demonstrated an increased rate of intragenic recombination in yeast by using ultraviolet irradiation. This research was conducted to determine if X-irradiation would influence the rate of intracistron recombination in the waxy locus in maize.

The present authors are grateful to Dr. Oliver E. Nelson for providing the seed stocks described in this research. The procedures used for the pollen assay are essentially those published by Nelson.

Waxy alleles, wx^{C}, wx^{90} and wx^{H21} were available in the homozygous condition and all possible combinations among the parents. The wx^{C} and wx^{H21} stocks had been backcrossed six times, and wx^{90} three times, to inbred M14.

An acute dose of 200 r of X-irradiation was applied to each maize plant during meiosis. The plants were irradiated in air with a G.E. Maxitron 250 X-ray machine (30 ma, 250 kv, 1 mm Al filter at 50 cm).

At the time of irradiation sporocytes were collected. These were later scored as to the stage of meiosis. The area of collection was marked with ink in an attempt to simulate a "synchronous" system and to determine the stage(s) of meiosis at which the tassel was irradiated. The marked tassel area was used as the center of the target area and pollen used in the assay was taken from this area. Tassels to be used in the pollen assay were collected before anthesis and stored in 70% alcohol.

Nelson (1959) states that if the frequency of black staining (Wx) pollen grains in the population from a cross between two mutants is significantly higher than the frequency in either parental stock, this would indicate that the two mutations occupy different sites within the region.