There is a significant difference between male and female gametes for both the c-sh and the sh-gl_{15} regions. The difference is most pronounced in the c-sh region where recombination in the male gametes is nearly normal. For the sh-gl_{15} region the rate of recombination in the male gametes is more reduced relative to normal values (8 percent versus 25 percent), and less difference is observed between male and female gametes.

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1. Effect of diplontic selection on estimates of change in radiosensitivity during seed germination.

Some recent studies on responses of germinating seeds to x-rays have involved comparisons of temporal changes in (a) somatic mutations and (b) inhibition of seedling growth. Maize seeds heterozygous for "wd", a terminal deficiency of chromosome 9 that conditions an albino phenotype when homozygous, were irradiated on a rotating turntable with their roots shielded by a disc of lead. Sectors of albino tissue in embryonic leaves (nos. 1-6, those present as discrete primordia in the embryo) of plants grown from irradiated seeds were used as an index of chromosome breakage. Plant height after 3 weeks of post-treatment growth furnished estimates of growth inhibition.

Changes in these two variables produced by 800r of x-rays showed positive correlation through an initial period of low sensitivity, 0-15 hours, and an abrupt rise in x-ray-induced injuries from 15-32 hours (Table 1). However, somatic mutation frequencies were maximal at 32 hours, then declined to a low at 40 hours (Table 1, column 4). Growth inhibition showed a similar sequence of changes but was not maximal until 40 hours (Table 1, column 6).

To gain insight into this apparent discrepancy between two widely used criteria of radiosensitivity, samples of seed were irradiated with one of three doses of x-rays, 200, 500, or 800r, at four points in time (Table 2, column 1) including the interval where changes in growth inhibition and frequencies of albino sectors showed opposite trends.

Changes in growth inhibition were the same at all doses (Table 2). There was a progressive increase from 31-41 hours after which time growth inhibition decreased.

Though changes in somatic mutation frequencies were somewhat more complex some definite trends could be distinguished. Albino sectors induced by irradiation with 800r showed the characteristic decline in frequency from 37-41 hours (Table 3, column 5). Subsequently their

Table 1

Ontogenetic Changes in Somatic Mutations and Growth Inhibition Produced by 800r of X-Rays

Hours Germinated	Rep	No. Plants Treated	Average No. Sectors/Leaf Leaf 5	Average Seedling Height (cm.)	Reduction in Seedling Height— Percent of Control
0	1	28	0.00	45.5	+1.9
	2	28	0.04	33.1	0.0
15	1	28	0.07	44.8	1.7
	2	28	0.04	32.6	1.5
24	1	27	0.26	35.8	20.6
	2	27	0.22	28.0	15.4
28	1	26	0.62	37.6	16.6
	2	28	0.46	27.7	16.3
32	1	27	0.74	35.1	22.2
	2	27	0.37	25.9	21.8
36	1	28	0.41	27.9	38.1
	2	28	0.43	20.6	37.8
40	1	24	0.38	22.2	50.8
	2	28	0.28	18.5	44.1
44	1	26	0.56	29.5	34.5
	2	26	0.40	19.4	41.4
48	1	27	0.65	27.2	39.7
	2	24	0.38	20.4	36.9
48 (Control)	1	28	0.07	45.1	--
	2	28	0.00	33.1	--

frequency was equal to or less than that induced with 500r. This trend was largely absent from the 200 and 500 r series (Table 3, columns 3, 4). Instead, somatic mutation frequencies tended to increase from 31-46 hours and thereafter remained relatively constant. These data suggest that chromosome breakage, like growth inhibition, was maximal from 40-45 hours and that the decline in sector frequencies from 37-41 hours reflected an increase in x-ray-induced lethality and differential survival of damaged cells. This suggestion draws support from the fact that in the 31 and 37 hour series of irradiations somatic mutations showed a progressive increase with dose (kinetics of dose-response curves showed a 2-hit component), whereas in the 41 and 48 hour series dose-response curves showed a saturation effect, maximum response being reached with 500r.

Table 2

Effect of X-Ray Dose on Seedling Growth

Hours Pregerminated	rep	Growth Inhibition (Per cent of Control)		
		200r	500r	800r
31	1	-1.0	8.4	23.8
	2	2.3	8.4	22.4
37	1	2.4	12.6	27.5
	2	-2.3	14.0	37.3
41	1	6.5	26.2	49.7
	2	7.8	25.3	41.9
46 (48)	1	6.5	23.6	47.1
51	2	2.6	14.0	29.9

Table 3

Effect of X-Ray Dose on Changes in Somatic Mutation Frequencies

Hours Pregerminated	rep	Average Number of Sectors/Plant					
		Leaves 5 & 6			Leaves 7-9		
		200r	500r	800r	200r	500r	800r
31	1	0.07	0.39	0.61	0.04	0.11	0.21
	2	0.04	0.25	0.58	0.00	0.11	0.43
37	1	0.11	0.14	0.64	0.07	0.14	0.43
	2	0.04	0.22	0.71	0.04	0.21	0.32
41	1	0.32	0.32	0.43	0.00	0.18	0.25
	2	0.15	0.32	0.44	0.11	0.25	0.15
46 (48)	1	0.25	0.39	0.36	0.00	0.32	0.50
51	2	0.25	0.40	0.38	0.07	0.19	0.30
48 (Control)	1	0.00	0.00	0.07	0.00	0.00	0.00
	2	0.00	0.04	0.00	0.04	0.00	0.04

Similar observations were recorded for albino sectors in leaves 7-9 (Table 3, columns 6-8), those derived from apical initial cells which do not initiate mitosis until after 72 hours germination. However, only the 41 hour series of treatments showed the saturation effect.

Dose-response curves for the 48 hour series (46 and 51 hour irradiations), like those for the 31 and 37 hour series, increased at a power of the dose greater than one. Hence, though onset of mitosis at ca. 38 hours in cells comprising embryonic leaf primordia undoubtedly influenced their capacity to recover from radiation injuries, the principal determinant of radiosensitivity was apparently some change in physiologic state that affected the entire shoot system.

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1. The effects of progressive alterations in chromosome constitution on pachytene and metaphase trivalent frequencies in 21 chromosome plants carrying maize-Tripsacum interchange chromosomes.

Three secondary exchange products have been recovered from a 21 chromosome stock carrying a pair of maize-Tripsacum interchange chromosomes. In effect, the secondary exchanges approximately halved the extent of the Tripsacum segment (in the 2^T chromosome), leaving either its distal region (carrying a terminal knob), or its intercalary region, as a substitution in chromosome 2, or returning its distal half to the T^2 chromosome. These secondary exchange products were identified both by means of genetic markers and by cytological morphology and synaptic behavior.

Plants carrying the secondary exchange products were then crossed in a variety of combinations to give (so far) an array of eleven constitutions differing in duplication or triplication of corresponding chromosome regions, extent and position of segments of maize chromosome 2 in the T^2 chromosome and also extent and position of segments of the Tripsacum chromosome in the 2^T chromosomes. Trivalent frequencies at pachytene and metaphase I have been studied in all of the available constitutions.

Estimates of these frequencies at pachytene were remarkably similar to metaphase estimates throughout the entire array of constitutions. Furthermore in the case of one plant with exceptionally clear pachytene cells, where it was possible to classify 90 percent of 116 cells for presence of a trivalent or univalent, 52/104 (or 50 percent) contained a trivalent. In the unlikely event that all 12 of the unclassified cells actually contained a trivalent, the pachytene trivalent frequency was 55 percent. Of 221 metaphase cells from this plant, 96, or 43 percent, contained a trivalent from which the minimum frequency of cells with at least one chiasma (in the appropriate arm) per pachytene trivalent is inferred to have been about 43/55 or 78 percent. If the trivalent frequency in the 12 unclassified cells did not differ greatly from the