Table XI. Actual frequency in the classes of the indicated kernel phenotype.

Number of examined ears	I Sh Bz Wx+ I Sh bz Wx	C Sh Bz Wx	C Sh bz Wx	I sh Bz Wx+ I sh bz Wx	C sh Bz Wx	C sh bz Wx	I Sh Bz wx+ I Sh bz wx	C Sh Bz wx	C Sh bz wx	I sh Bz wx+ I sh bz wx	C sh Bz wx	C sh bz wx
	F_1 X multiple recessive											
47	4456	268	30	25	132	1131	1287	20	48	311	4	4320
	Multiple recessive X F_1											
38	2793	148	15	13	101	582	831	7	12	188	3	2920

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1. Expanded glumes.

Previous tests for linkage using interchanges had indicated that this gene is in the long arm of chromosome 5 (M.N.L. 32:93). Tests in F_2 with bm ys yg and bm v_2 indicate about 32% recombination with v_2 and with yg. Limited data suggest the order is bm ys yg -- expanded. If true, crossing over must be high in the distal segment of 5. There was some variability of expression of the expanded character in F_2. Backcross tests are planned.

2. Linkage studies in multiple interchange heterozygotes.

Studies of the effect of a ⊙ 8 (1-5-6-7) and a ⊙ 10 (1-5-6-7-8) on crossing over in genetically marked chromosomes in the rings are in progress. In the regions measured thus far there is little if any difference between the two stocks. The use of genetic markers in chromosomes 5 and 7 should make it possible to check the products of crossing over in the differential segment in 5 and those from c.o. in the differential segment in 7. From the former, T1-5 and T5-6-7 are predicted; from the latter T6-7 and T1-5-7 (M.N.L. 27:64).

3. Progress in producing multiple interchange stocks.

A stock homozygous for 1-7-5-9 has been established (a combination of 1-7 (4405), 5-7 (5179), and 1-9b interchanges). This stock was isolated from the cross of 1-7-5 x 1-7-9 (2 rings of 4). Other combinations for rings of 8 made up in a similar manner are being tested. Various problems dealing with the use of multiple interchange stocks in studies of the inheritance of quantitative characters are being studied, e.g., frequencies of crossing over in differential segments, methods of making com-

parisons, types of crosses to use. It should be possible to compare the effects of various groupings of the multiple factors responsible for a given character, by using rings of 6 or rings of 8 made up in various chromosome combinations.

Crossovers were selected which should produce the following rings of 6: 2-9-10, 3-9-5, 3-9-10, 6-5-8 and 7-5-9, and 2-5-6.

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4. Studies of chromosome pairing in maize by using interchanges involving the same two chromosomes.

Interchanges between chomosome 2 and 6, 3 and 6, and 6 and 9 were used. Four intercrosses belonged to type 1a (breaks in both chromosomes in opposite arms), eight to type 1b (breaks in one chromosome in opposite arms and in the same arm in the other chromosome), and five to type 2 (the breaks in both chromosomes in the same arm).

At pachytene in type 1a and type 2 intercrosses, homologous end segments of the chromosomes usually showed complete homologous pairing whether in an association of four chromosomes or in "pairs." The intercalary segments showed extensive non-homologous association or asynapsis. Likewise in type 1b intercrosses, the ends were associated in the ⊙ 4 configurations. In none did the centromeres play a significant role in the initiation of pairing. Usually in these intercrosses pairing begins at the ends, although it may start occasionally at other points. Genetic linkage tests and microspore quartet analyses show reduced or no crossing over in regions showing asynapsis or non-homologous pairing. Unusually high frequencies of adjacent-2 segregation from the associations of four chromosomes were found in two type 1a intercrosses. It is difficult to account for these values. In type 1a intercrosses, a new viable set of chromosomes should arise by simultaneous crossing-over in the two 'between-breaks' segments in the complex of four chromosomes. In this set the centromere-bearing 'between breaks' segments of the two non-homologues would have exchanged positions.

The diakinesis configurations observed in the three types of intercrosses may be summarized as follows:

Type of intercross	No. of crosses	Av. % Assoc. of 4	% of "pairs"	Range in % of "pairs"
Type 1a (see paragraph 1)	3	32.6	67.4	55.9-75.9
Type 1a	1	100.0	0	
Type 1b (see paragraph 1)	5	98.3	1.7	0.0-6.6
Type 2 (see paragraph 1)	8	10.0	90.0	73.0-100.0