Table 4

Correlation coefficients of different pairs of earliness traits of the three way crosses produced from WF 9 x N 6 by C 5 sublines

Pair of earliness traits	Correlation coefficients
Total leaf number per plant Days to 50% male flowering time	r = 0.4794*
Total leaf number per plant Grain moisture content at harvest time	r = 0.5063*
Days to 50% male flowering time Grain moisture content at harvest time	r = 0.7508**

**Significant at 1 per cent level

*Significant at 5 per cent level

The results may be summarized as follows:

1) Among the single, three way and double-cross maize hybrids produced from non selected inbred lines, the correlation between pairs of earliness traits were mostly significant at the 0.1 and 1 per cent level.

2) The correlation between earliness properties can also be observed in three way crosses produced from WF 9 x N 6 by C 5 related sublines. The correlations between pairs of earliness properties were significant at the 1 and 5 per cent levels.

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1. Influence of sex on crossing over in chromosome 5.

Rhoades (J. Amer. Soc. Agron. 33:603-615, 1941) found recombination in the proximal regions of chromosome 5 to be higher in male than in female meiocytes. Two explanations have been proposed to account for the lower female values, viz. (1) there is a basic difference in the rates of crossing over in mega- and microsporocytes (Rhoades 1941), or (2) selective orientation of the chromosome 5 bivalent on the meiotic spindle leads to the preferential segregation of noncrossover chromatids to the basal megaspore (Rhoades, in Corn and Corn Improvement, pp. 123-219, 1955). If the metaphase I orientation is maintained at metaphase II in megasporogenesis, preferential recovery of noncrossover strands in the basal megaspore would result. Since all four spores arising from a microsporocyte produce viable gametes while the egg develops from the basal megaspore only, the observed amount of recombination would be less in the female gametes, even if the frequencies of crossing over in male and female flowers were identical.

These alternatives were tested by making use of one of the properties of the elongate mutant, namely the production of unreduced eggs. These diploid eggs originate by omission of one of the meiotic divisions (Rhoades and Dempsey, Genetics 54: 502-522, 1966), so half the products of meiosis can be recovered within individual cells. El el and el el sibs heterozygous for A_2 and Bt were backcrossed as males and as females to a_2 bt testers. The silks of the elongate plants were pollinated with diploid pollen so as to obtain plump, viable 4n kernels from unreduced eggs. With the exception of the double recessive individuals, the tetraploid offspring from the first testcross were grown and pollinated again by tetraploid a_2 bt testers. The genotypes of the original diploid eggs were deduced from the progeny phenotypes. A second cross was unnecessary for backcross progeny showing only recessive phenotypes. Corrections were made to the diploid egg frequencies to allow for incomplete germination of certain classes of kernels among the backcross progeny. Crossover values calculated from both the uncorrected and corrected genotypic analyses of 425 diploid eggs appear in the table below, together with data from haploid el el sperm and from haploid eggs and sperm of El el sibs.

El el			*el el*			
Plant No.	No. of progeny strands	Percent recombination	Plant No.	No. of progeny strands	Percent recombination: *A*-*Bt*	
					Uncorrected	Corrected
F_1 used as female parents						
453-91	387	13.2	453-77	180	7.8	9.6
453-113	185	7.0	453-96	250	10.4	10.7
453-123	315	12.7	453-103	208	11.1	12.8
453-132	581	5.9	453-138	212	20.8	21.4
453-140	284	8.1				
453-142	389	14.1				
Pooled value:	2141	10.1**		850	12.6**	13.4**
F_1 used as male parents						
453-91	109	15.6	453-77	71	18.3	
453-113	361	15.2	453-88	484	32.0	
453-123	352	24.4	453-96	267	28.5	
453-132	531	17.3	453-121	270	35.9	
453-140	434	23.5				
453-142	334	22.2				
Pooled value:	2121	20.1		1092	31.2	

**Significantly lower at the 1% level, using a one-tailed test, than the corresponding male value.

The reciprocal testcrosses of *El el* plants show a significant difference in *A_2*-*Bt* recombination in the haploid gametes from female and male inflorescences. According to the second hypothesis, the percent of recombinant strands found in the diploid eggs of *el el* plants should be similar to that in the haploid male gametes of *El el* sibs, because in both cases a representative sample of the meiotic products is recovered and these should include the crossover strands presumed to be preferentially lost in the *El el* megaspores.

Another consequence of the "orientation hypothesis" is that no difference should be found in crossing over in the male and female gametes of elongate plants. The female values are based on diploid eggs while the male values come from haploid gametes. It might be argued that comparisons should not be made between two populations originating by different meiotic mechanisms. However, Rhoades and Dempsey (1966) found no difference in Lg-A_1 or Sh-Wx crossover frequencies in the haploid and diploid eggs from the same ear. Thus, a comparison of recombination in diploid eggs and haploid sperm of the same plant should also be legitimate.

The data show that neither of the above expectations is fulfilled. Recombination in elongate megasporocytes is not significantly higher than that found in haploid eggs from El el megasporocytes and is markedly lower than the value observed in El el microsporocytes. Moreover, the amount of recombination in diploid eggs from el el plants is much less than the value obtained from haploid male elongate gametes.

The significant differences between male and female recombination values in both El el and el el plants eliminate the hypothesis involving selective orientation. It may be concluded that the amount of recombination in the A_2-Bt region of chromosome 5 is intrinsically higher in male than in female meiocytes.

It may be noted that recombination in the haploid gametes of elongate microsporocytes is higher than in those of El el sibs. This is in agreement with the report last year (MNL 44:61-65) that crossing over is increased in elongate homozygotes.

P. M. Nel

2. Mechanism of diploid egg formation in elongate homozygotes.

Rhoades and Dempsey (Genetics 54: 502-522, 1966) were able to rule out somatic doubling of the genome in sporogenous cells and doubling in the gametophytic generation as mechanisms by which the unreduced eggs of elongate plants could arise. The remaining alternatives were: (1) suppression of the first meiotic division followed by a normal second division, (2) a normal first division with omission of the second, and (3) a normal first division with chromosomal replication occurring