TABLE I

$\left(\frac{hm_1}{hm_1}; \frac{Sh\ Wx\ Hm_2}{sh\ wx\ hm_2}\right)$ ⊗ Bulked Seed

Kernels Planted	Disease Reaction: Resistant ($Hm_2/?$)	Disease Reaction: Susceptible (hm_2/hm_2)
sh wx	33	49
sh Wx	39	4
Sh wx	30	33
Sh Wx	122	24

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4. Production of diploid eggs by normal diploid maize.

The presence of triploid plants in diploid maize populations has frequently been observed, especially in experimental hybrid tests. It seems logical to theorize that these resulted from diploid (2N) eggs fertilized with normal (1N) pollen. If this is true then pollination of normal 2N plants with 2N pollen from established tetraploids should give rise to a low frequency of plump tetraploid kernels; the other kernels, of course, will be defective triploids. This method would provide an easy, large scale screening technique for detection of 2N eggs and recovery of tetraploid strains for breeding purposes.

In 1958 the above hypothesis was tested on a very small scale and several tetraploids were obtained.

In 1959 ten inbreds and fourteen single crosses were hand pollinated in an isolated field with 2N pollen from tetraploids. Delaying pollination by 4, 7, and 10 days after silking was tried to determine if this would increase the frequency of 2N eggs. The resulting plump kernels from these crosses were unfortunately planted in a Florida winter nursery where poor growing conditions and frost prevented the classification of a majority of the plants. Nevertheless, at least 56 tetraploid plants were obtained among 22 of the 24 crosses.

Classification of only part of the suspect plants prevented an accurate determination of the frequency of 2N eggs. From these limited

data delayed pollination did not appear to increase the frequency of 2N eggs. It was evident, however, based on the number of plump kernels and recovery of tetraploid plants, that the various inbreds and hybrids did differ in frequency of 2N eggs.

In the 1959-60 winter nursery seven single crosses were pollinated with 2N pollen. The plants grown from the plump kernels were classified for ploidy level by selfing and outcrossing them to a diploid tester (See Table below).

Pedigree	Number of gametes tested	Number of plants from plump kernels classified as			Frequency of normal 3N kernels per 1000 gametes	Frequency of 2N eggs per 1000 gametes tested
		2N	3N*	4N		
(H49 x C103) x 4N	2676	6	1	14	.37	5.23
(WF9 x 38-11) x 4N	2593	3	4	9	1.54	3.47
(W22 x Oh28) x 4N	4611	2	8	13	1.73	2.82
(38-11 x Oh43) x 4N	3492	6	3	9	.86	2.58
(Oh51A x Oh28) x 4N	7407	9	18	10	2.43	1.35
(Oh28 x M14) x 4N	3086	6	22	2	7.13	.65
(W22 x Oh51A) x 4N	5152	11	7	3	1.36	.58

* Triploid plants arising only from normal plump kernels.

The crosses ranged in frequency of 2N eggs per 1000 gametes from a low of .58 for Oh28 x M14 to a high of 5.23 for H49 x C103. The possibility of cool weather and poor growing conditions in the winter nursery abnormally increasing these rates will be checked in further tests.

Another interesting result was that some of the plump or normal kernels produced triploid plants. The rate varied, depending on the diploid female, from a low of .37 to a high of 7.13 normal triploid kernels per 1000 gametes. This normal development of some triploid kernels probably explains the occurrence of triploid plants in diploid yield tests. Defective triploid seeds would normally be discarded in cleaning and hand counting of the seed, but these normal triploid seeds would not be detectable. Whether these kernels have a different endosperm constitution to account for their normal development is not known, but will be investigated in future tests.

The production of 2N eggs, even though at a low frequency, by diploid types of maize provides a rapid and efficient method for developing tetraploid populations for breeding purposes. The procedure may be outlined as follows:

1st year: Pollinate diploid types (singles, doubles, synthetics, etc.) with 2N pollen from established tetraploids. Save the plump or normal kernels.

2nd year: Identify the tetraploid plants arising from the plump kernels by selfing and outcrossing to diploid tester (giving 3N defective seeds) or to tetraploid tester (giving 4N kernels).

3rd year: Make backcross with recovered 4N strain onto recurrent diploid parent.

Etc.

A backcross may be completed in two generations, with isolation of tetraploids in each successive backcross. Recovery of tetraploid versions of the diploid recurrent parent should be obtained in successive backcrosses in a manner similar to the expectation in the normal diploid backcrossing procedure, i.e. 75% and 87.5% recovery after the 1st and 2nd backcrosses, respectively.

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5. Frequency of mutations of R^{st} to R^{sc} (self-colored aleurone) in $R^{r}R^{st}$ and $R^{st}r^{g}$ heterozygotes.

It has been observed that R^{st} mutates to full self-color (R^{sc}), and that such mutations are more frequent in R^{st} homozygotes (17.0×10^{-4}) than in $R^{st}r^{r}$ heterozygotes (4.9×10^{-4}), (Genetics 45:19-34). Since the rate of mutation of R^{st} to R^{sc} in $R^{st}r^{r}$ heterozygotes reported in the paper cited above was based on a very small population, the test was repeated on a larger scale. In the second test the stability of R^{st} was tested in $R^{st}r^{g}$ heterozygotes with the following result: 14 mutations to R^{sc} were recovered from a population of 19,239 R^{st} gametes, a rate of 7.3×10^{-4}. The difference between this rate and the one first reported (4.9×10^{-4}) is most likely due to the large error involved in the first test because of the small population; however, the possibility of a different effect of r^{r} and r^{g} on R^{st} stability cannot be discounted.

To obtain additional information on the effect of homozygosity and heterozygosity on R^{st} stability a test was made of the frequency of R^{st} to R^{sc} mutations in R^{r} R^{st} heterozygotes. $R^{r}R^{st}$ plants were pollinated with $r^{g}r^{g}$ pollen; the self-colored kernels from this mating were planted in sand in a greenhouse bench and the resulting seedlings scored for plant color. Seedlings from non-mutant self-colored kernels ($R^{r}r^{g}$) had red plant color; seedlings with no plant color (green), presumed mutants, were transplanted into pots in the greenhouse and the resulting plants selfed.