

and manifestation of quantitative differences for agronomic characters influenced by specific cytoplasmic effects in the crosses. Hence in a composite like  $J_1$  constituted of genetically diverse sources of germplasm from different geographical areas, the cytoplasmic differences offer great scope for selection and putting together cytoplasm and genotype which give the most desirable plant types in the derived population. The approach of selection between reciprocal biparents would combine the ease and rapidity of different mass selection procedures to exploit the additive gene effects in such populations and at the same time would insure selection for superior interacting cytoplasmic effects.

The observations in the present study also point out that in practical breeding programmes where such composites are being used, a larger population than generally used should be involved as female parent to represent the entire range of the variability of cytoplasm in the composite, and it may be desirable to get an idea about the extent of cytoplasmic variability and the combining ability for cytoplasmic effects in such composites, so that one may have a sound basis for determining which composite should be used as the female parent. The present findings also suggest that the maintenance of composites should be based on fairly large plant populations.

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1. Verification of  $R^{st}$  reconstitution in  $R^{sc}/r^g(I)^3$  heterozygotes.

A report in the 1966 MNL (pp. 135-137) described the recovery of four  $R^{st}$  mutants from heterozygous combinations between two  $R^{sc}$  and a near-colorless aleurone allele,  $r^g(I)^3$ , originally isolated from an  $R^R R^{st}$  plant. The male parent in these tests was  $r^g r^g, wx wx$ , and the four isolations of  $R^{st}$  segregated  $wx$ , as expected. However, there were several plantings in the field of an  $R^{st} R^{st}, wx wx$  stock culture, and the possibility existed that the  $R^{st}$  alleles isolated as mutants could have been pollen contaminants from this source. Conclusive verification required the identification of the  $r^g$  allele brought in from the male parent. A  $R^{st}, wx$  contaminant gamete would produce a  $R^{st}/r^g(I)^3, wx wx$  kernel, whereas a mutation would produce a  $R^{st} r^g, wx wx$  kernel. The  $r^g(I)^3$  and  $r^g$  alleles are identifiable by phenotype and paramutagenic action.

The four stippled kernels selected as possible mutants were self pollinated when grown out. The nonstippled kernels from each ear were planted, and plants were self pollinated and crossed to  $R^R R^R$ . Selfed ears from the four progenies were examined for a near-colorless aleurone phenotype but

all kernels were colorless; kernels homozygous for the  $\underline{r}^g(I)^3$  allele show some pigment on about 75% of the kernels.

Seed from two ears crossed to  $\underline{R}^r \underline{R}^r$  from each progeny was planted and 3-4 plants from each were used as males in testcrosses to  $\underline{r}^g \underline{r}^g$ . The testcross ears were examined for evidence of paramutagenic activity and none was found; the  $\underline{r}^g(I)^3$  allele is known to be as paramutagenic as  $\underline{R}^{st}$ .

The results from the above two tests exclude pollen contamination as a possible source for the four stippled alleles isolated and support a mutation origin.

Some additional data are now available on the characteristics of these four  $\underline{R}^{st}$  mutants. One of the four clearly has a phenotype different from that of the stippled allele maintained in our stock cultures; the pattern of spots is finer, frequent but small in size. The three other mutants have a phenotype similar to that of our stock allele, although one appears to be somewhat lighter (less frequent spots).

The two  $\underline{R}^{sc} / \underline{r}^g(I)^3$  heterozygous combinations from which  $\underline{R}^{st}$  mutants were recovered were also heterozygous for  $\underline{M}^{st}$ , a modifier of the stippled phenotype about six units distal to  $\underline{R}$ , with  $\underline{M}^{st}$  being carried on the  $\underline{r}^g(I)^3$  chromosome. The  $\underline{R}^{st}$  mutants were tested for the presence of  $\underline{M}^{st}$  by pollinating several  $\underline{R}^r \underline{R}^{st}$  plants representing each of the four mutants with  $\underline{r}$  pollen. The  $\underline{R}^r$  chromosome is known not to carry  $\underline{M}^{st}$ , and a lighter stippled phase of each mutant, indicating a loss of  $\underline{M}^{st}$ , occurred with a frequency of about 6%. These results show that the mutants carried  $\underline{M}^{st}$  and are responsive to its modifying effect.

Testcrosses of  $\underline{R}^r \underline{R}^{st}$  plants representing each mutant to  $\underline{r} \underline{r}$  ears have shown all four mutants to be paramutagenic. Detailed scorings have not been completed, and it is not known whether the level of paramutation is comparable to that of  $\underline{r}^g(I)^3$  and our stock  $\underline{R}^{st}$  allele.

The  $\underline{r}^g(I)^3$  allele is unstable for plant color and mutates to a form having red plant; these mutations often are somatic and evidenced as tassel sectors in which the anthers are red. About 60 plants homozygous for each of the four  $\underline{R}^{st}$  mutants were examined for such tassel sectors but none were found. Evidently, the unstable plant characteristic of  $\underline{r}^g(I)^3$  was not retained by the  $\underline{R}^{st}$  mutants even though all carried a distal genetic marker from the  $\underline{r}^g(I)^3$  chromosome.

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