

quence of the relative numbers of "good" or "bad" cytoplasmic elements in the zygote, which could be distributed randomly during somatic development.

The result reported here of apparent cytoplasmically inherited constituents which affect chlorophyll and vigor are generally similar to the examples cited by Brown and Duvick (MNL 32: 120). The relationship between the chlorophyll aberration and the change from male sterility to fertility remains obscure. The two in fact may not be causally related.

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6. Male gametophytic selection as the mechanism for non-segregation in the restoration of cytoplasmic male sterility.

In the 1958 issue of Maize News Letter a non-segregation of restorer genes for cytoplasmic male sterility was reported. A further investigation has revealed the mechanism of this phenomenon. For brevity only a summary of part of the data will be presented here.

The following symbols will be used:

S = a male-sterile plant with the "S" type cytoplasmic factor

SF(Het) = a fertile plant with S type cytoplasm and heterozygous for the restorer from Ky21.

SF(Hom) = same as above but homozygous for the restorer.

<u>Type of cross</u>	<u>No. of crosses made</u>	<u>Residual genotype</u>	<u>No. of plts. per progeny</u>	<u>Results</u>
SxSF(Het)	15	A158	10 - 48	all fertile
SF(Het) selfed	4	"	20 - 80	" "
SF(Het)xSF(Het)	3	"	19 - 47	" "
SF(Het)x Inbred	23	"	41 - 80	1 fertile:1 sterile

Thus, in the above data, whenever an SF(Het) plant was used as a male no segregation occurred; while, when one of these was not used as a male, segregation always resulted.

Microscopic observation of the pollen from SF(Het) plants revealed that about one half of the pollen in each anther was aborted. Since there is a correlation between the percentage of pollen grains carrying the restoring gene and the percentage of apparently viable pollen, and since all the pollen grains effecting fertilization have the restorer, the inheritance pattern can be explained by assuming that only the pollen grains with the restorer live, while those with the alternate allele abort.

This hypothesis has been tested in the following manner: (1) If an SF(Het) plant were self-pollinated half the progeny would be expected to have about 90% normal pollen (normal for the A158 inbred) and half the plants to have slightly more than half of the pollen aborted. Pollen from

plants in two such "F2" cultures was examined. In one family eight plants had about 90% normal pollen, while eleven plants had about half the pollen aborted. With the other progeny eight were about 90% and fifteen were about 45%. The progeny of a selfed SF(Hom) plant was also checked. Also as expected, all eleven checked were about 90%. (2) If these "F2" plants with about 90% normal pollen were pollinated by the inbred (A158) only fertile offspring would be expected; while, from a similar pollination of the 45% segregates, a 1:1 fertile-to-sterile ratio should ensue. A total of twelve 90% plants from the three progenies were pollinated by A158 and each gave rise to an all-fertile progeny. Thirteen plants of the 45% type from among the two "F2" cultures were crossed with the inbred in the same manner; each segregated 1:1.

This selection phenomenon is not limited to material with the A158 residual genotype. The following is a summary of all S-sterile material observed:

<u>Source of Restorer</u>	<u>Background genotype</u>	<u>No. of progeny observed</u>	<u>Observation on basis of:</u>	
			<u>Pollen %</u>	<u>Progeny Test</u>
Ky21	A158	45	selection	selection
"	ML4	20	"	"
"	P39	12	"	"
"	WF9 x Ky21	2	-----	"
A206	A158 x A206	1	selection	"
"	(ML4xWF9)(A158xA206)	1	"	-----
Q703	ML4 x Q703	1	"	
W22	W22 x A158	1	no selection	-----
S.P.R.*	S.P.R.	1	-----	intermediate
"	(WF9x38-11)S.P.R.	1	intermediate	

\* Southern Prolific Restorer, a closed pedigree single cross produced by McCurdy.

It can be seen that this type of selection is wide-spread, though not universal in S material and therefore is not a necessary consequence of the S cytoplasm. There are indications that this inheritance pattern can be modified by both the restorer and the residual genotype; however, until the evidence is complete it will not be presented or discussed.

Preliminary observation suggests that this same type of phenomenon can occur with T cytoplasm and that it is dependent upon the residual genotype.

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7. The location and critical time of primary gene action as a mechanism of male gametophytic selection.

Since 50% of the pollen grains of the SF(Het) plants described in