The last two columns in the table show the results of the crosses sterile x NY16, and sterile x Ky21. The degree of restoration was estimated on the basis of pollen examinations in the field with a pocket magnifier, and on microscopic examinations of pollen stained with IKI. Exact counts of normal and aborted pollen grains were not made, but the difference between approximately 50 per cent and approximately 100 per cent normal pollen grains is readily apparent. The nine sources A through I were 50 per cent restored by NY16 and Ky21 in both the A158 and WF9 series of steriles. This indicates that all nine sources of cytoplasm are S type.

One cannot, of course, be certain that the restoration in all cases is effected by the conventional S restorer genes known to be present in NY16 and Ky21, since these inbreds could possess other restorer genes. It is apparent, nevertheless, that the restoration of cytoplasms A - I is similar to that characteristic of S type restoration. If the A - I restored sterile plants do have S type cytoplasm and typical S restorer genes, these plants should give all fertile offspring when crossed as pollen parents to S steriles. These crosses plus additional tests involving known S and T restorer lines have been made with all sources of sterile cytoplasm, and the results should provide more critical evidence on the nature of these cytoplasms.

Cytoplasmic Designation	Origin of cytoplasm	Source of Seed	Restoration (100% or 50%) NY16	Ky21
T			100%	100%
S			50%	50%
A	Turkish Flint	PI 171 892	"	"
B	Brazilian Flint	F. G. Brieger	"	"
C	segregating progeny of Vg, sy, j, v_{16}	G. F. Sprague	"	"
D	B9 Vg su stock	W. C. Galinat	"	"
E	Coop 49-40: seg. Vg	J. E. Wright	"	"
F	iojap induced	M. M. Rhoades	"	"
G	3 way cross (Q63M^{x}C115)F5E	C. C. Wernham	"	"
H	Ind. 33-16	L. M. Josephson	"	"
I	New England Flint (Vt.)	R. M. Bailey	"	"
J	Bolivian variety	P. C. Mangelsdorf	-	-
K	Turkish Flint	PI 204 830 B	-	-
L	Turkish Flint	PI 204 830 A	-	-

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2. Comments on the comparison of sources of sterile cytoplasm.

If, as the evidence above indicates, all nine sources of sterile cytoplasm are S type, there are several interesting implications. First, this would mean that the sterile cytoplasms in our collection so far fall into either the S or T classification on the basis of the restorer tests. However, as reported in the 1959 MNL (p. 22), chromatographic analyses of mature anthers of nine sources of sterile cytoplasm (in various stages of backcrossing by WF9) revealed differences among them, especially in the presence of UV light fluorescent spots. On this basis of classification the nine sources of cytoplasm were tentatively put into 5 groups, as follows: 1) T; 2) S; 3) E; 4) B and F, 5) A, D, G, H. All steriles were chromatographically different from normal WF9. These results suggest that the chromatographic technique may disclose cytoplasmic differences not detected by the restorer tests. These findings may mean that while the sterile cytoplasms are restored by S restorer genes, perhaps even by the same S restorers, the cytoplasms are not absolutely identical in their action, that is, in the metabolic disturbances leading to pollen abortion. There is the possibility that subcategories of S cytoplasm

exist. It is recognized that chromatographic analyses need to be repeated after further generations of backcrossing, so that the genotypes in the various cytoplasms are more nearly alike. But this may not be as essential as appears, for in our extensive investigations of T cytoplasm it was found that the chromatographic pattern of ninhydrin-positive spots in the early backcross generations was identical with the pattern of the later generations.

A second noteworthy feature of the results of the restorer tests concerns cytoplasmic sources F and H. According to the notation accompanying the original seed, the male sterility of source F was iojap induced by introducing the ij gene into the cytoplasm of a normal, fertile line. If this is correct, then S type cytoplasm can arise from the action of the ij gene. Alternatively, it may be suggested that S cytoplasm and S restorers were present in the original female parents, and that as a result of the crosses with iojap the restorer genes were lost, thereby allowing expression of male sterility. In this connection a peculiar feature of the S type sterility system should be pointed out. Since in plants with S cytoplasm the non-restoring allele is eliminated in the pollen, and all functional pollen carries the restorer allele, there is no way, in the normal course of events, whereby sterile plants can arise in a population with S cytoplasm, so long as selfs and intercrosses are confined within the population. The presence of sterile cytoplasm would not be suspected unless outcrosses were made to pollen parents which possessed non-restoring alleles associated with normal (or T) cytoplasm.

The second cytoplasm of interest, source H, is derived from Ind. 33-16. The finding that this is S type cytoplasm means that the peculiar behavior of Ind. 33-16 described by Josephson and Jenkins apparently lies with nuclear factors rather than with the cytoplasm.

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3. Chlorophyll variegation in normal and sterile WF9 lines.

In the 1959 MNL the mode of inheritance of a chlorophyll variegation in a WF9 stock was reported. The results were interpreted to indicate that the chlorophyll abnormality, characterized by streaks of pale to yellow-green leaf tissue, was cytoplasmically inherited. Additional crosses grown in 1959 support this interpretation. Three families of the third backcross generation of WF9 streaked ♀ x WF9 normal ♂ again produced all streaked plants. In contrast, the reciprocal backcross, WF9 normal ♀ x WF9 streaked ♂, now in the second generation, gave all green offspring. Also mentioned in last year's report was the fact that it had not been possible to eliminate the chlorophyll abnormality by selecting, from earlier generations, what appeared to be green plants. This statement still holds. Selfs of the greenest plants again produced some obviously streaked offspring, as did the second generation backcrosses of WF9 "green" ♀ x normal WF9 ♂. The intensity of streaking is, however, somewhat less severe in families of the "green" plants than in families of the obviously streaked plants. As previously mentioned, the families in which this chlorophyll abnormality appeared were derived from two WF9 plants which carried S type cytoplasm, but which had undergone a change from male sterility to male fertility. The event leading to the alteration in pollen behavior presumably occurred in the cytoplasm. As yet there is no indication of any causal connection between the chlorophyll aberration and the alteration in fertility.

In 1959 other WF9 lines were examined for signs of the chlorophyll disturbance. These lines included several normal WF9 stocks as well as cytoplasmic male sterile lines in various stages of conversion to a WF9 genotype. In an attempt to evaluate the chlorophyll variegation on a slightly more objective basis, the top 8 leaves of the plants in each family were scored for the extent (number and size of streaks) of yellow or pale green streaking on a scale from 0 to 5. By adding the values for the 8 leaves it is possible to get numerical expressions for the intensity of variegation for each streaked plant, and from these an average value for the family can be calculated. In scoring, relatively small