If, however, one works such super early types within the id/id state or phenotype, the very adverse effects of super earliness are avoided, since the plants are only cryptically early, and in reality grow to normal sized (id/id) plants before flowering and ear production. Such plants produce large ears and shed copious, fertile pollen over a long period and would thus be very desirable seedfield parents. If the other parent of the hybrid were normal (Id/Id), the derived seed would all be of normal phenotype, and thus the super-earliness of the id/id parent would be unmasked and made economically available in the form of an early hybrid.

Following this line of reasoning, one can immediately seize upon the idea that, in working for further earliness cryptically in id/id, one might be able to supercede the former limits of earliness described above, and proceed to a whole new plateau of earliness in maize. However, the maternal induction effect might set a limit to earliness in id/id, but this should be tested in other backgrounds than Gaspe Flint. At any rate, it is certain that one can by using id/id, develop super early lines of maize without paying the penalty of small plant size and utter dependence upon a long summer day environment for their successful production.

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1. Cytoplasmic restoration of ms - sterility.

Cytoplasms may occur which restore fertility in single recessive genetic male sterile lines. That is, the various ms genes may be analogous to the rf genes and produce male sterility in the presence of a specific cytoplasm or conversely a specific ms gene may not produce male sterility in the presence of a certain cytoplasm. If such a cytoplasm should be found, a male sterile (S) ms ms line could be increased using the male fertile counterpart (F) ms ms as a male. The female rows in hybrid seed production fields would consist only of genetic male sterile plants (Hermsen, 1968).

The hybrid production system could be represented as follows:

FOUNDATION SEED FIELDS:	Inbred A ♀ (S) ms ms male sterile	X	Inbred A ♂ (F) ms ms male fertile		
COMMERCIAL SEED FIELDS:		Inbred A ♀ (S) ms ms male sterile	X	Inbred B ♂ (S) Ms Ms male fertile	
			Hybrid (S) Ms ms male fertile		

This hybrid production system is not handicapped by a single cytoplasmic background as is true with the maize seed production with T, C, S or other sterile type cytoplasms. The genetic male sterile characteristic could be incorporated into the cytoplasmic background of any seed parent. The cytoplasm restoring fertility would only be used as the male parent for foundation seed increase.

All presently used maize lines are (S) Ms Ms and would restore fertility in commercial grain fields. Any inbred could be converted to (S) ms ms by backcrossing. We have not identified the (F) cytoplasm.

(F) cytoplasms may not have had many opportunities to be identified in maize genetic studies because the genetic male sterile is usually used as the seed parent. In addition, only a small number of cytoplasms may have been sampled. The (F) cytoplasm, if it occurs, could be identified through two different approaches.

1. Crossing the unknown, hopefully (F), cytoplasms using (S) Ms ms as a male parent and determining if non-segregating fertile F_2 populations are present. If all F_2 populations are male fertile, the unknown female parent contains the (F) cytoplasm.

2. A second approach involves using the male sterile (S) ms ms as the female and the unknown, hopefully (F), cytoplasm as the male parent. If the F_1 is (S) ms ms, all plants will be sterile and the fertile

cytoplasm has been identified. The male parent would not be able to shed visible pollen unless it had an (F) cytoplasm. If the F_1's are all fertile, then the cytoplasmic source must have dominant male sterile genes and may or may not have the fertile cytoplasm.

The first approach is more expensive per cytoplasmic source tested; however, it will identify an (F) cytoplasm in an Ms Ms genetic background. The second approach will not provide such identity.

The author is not aware of attempts to locate this type of cytoplasm in maize. This is a preliminary report on an attempt to identify an (F) cytoplasm. Genetic male steriles ms 1, 2, 5, 6, 7, 8, 9, 10, 12, 13, 14 and 17 are being crossed on each of 25 distantly related genetic sources. About half of the genetic sources involve diverse sources which conform to the general plant type common in commercial maize hybrids. The remainder involve exotic type plant introductions.

At this date, 82 different genetic male sterile and cytoplasm crosses have been observed in the F_2. Six F_2 populations did not demonstrate sterile plants. These six conformations are being re-evaluated. One of the six may be a result of small population size, while the other five are unexplained at this date.

References

Hermsen, Th. G. J. (1968). A discussion on cytoplasmic restoration of ms-sterility. Euphytica Supp. No. 1:63-67.

Richard F. Washnok

2. Complementation among EMS-induced lemon endosperm mutants.

There was a relatively large number of lemon endosperm mutants among those previously reported in MGNL 43:23-31, 1969 and MGNL 44:11-17. Eleven of these mutants were crossed together in a diallel and the F_1 ears were examined for complementation. All possible crosses among these mutants were not obtained; however, results of the partial diallel show complementation for three of the mutants. This does not mean that three separate genes are involved, for these three mutants could be at the same locus. One of the mutants that showed complementation was phenotypically classed as slightly lemon; hence, it might have been expected