of segregating $\underline{Rf}_2$ were almost entirely fully fertile. Further, a usually completely sterile line of the genotype ($\underline{ms}_1$) $\underline{Rf}_1$ $\underline{Rf}_1$ $\underline{rf}_2$ $\underline{rf}_2$ was partly fertile.

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2. Allelism of Rf_1 and partial-restorer genes.

The partial fertility restoration ability of several inbred lines has been found to be due in each case to a single dominant gene. A preliminary series of test crosses has indicated that the single gene is in every case allelic with $\underline{Rf}_1$. That is, test cross populations of ($\underline{ms}_1$) $\underline{rf}_1$ $\underline{rf}_1$ x ($\underline{Rf}_1$ $\underline{Rf}_1$ x partial restorer) gave segregations of approximately 1 full fertile to 1 partial fertile. The possibility that there is an allelic series of restorer genes at the $\underline{Rf}_1$ locus is being explored.

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3. $\underline{Ga}^S$ $\underline{Ga}^S$ in foreign cytoplasms.

The effect of $\underline{Ga}^S$ $\underline{Ga}^S$ in Japanese Hulless popcorn apparently does not change in the presence of other cytoplasms. By recurrent backcrossing, the genotype of a Hulless inbred line was transferred to the cytoplasm of (1) Gourdseed Southern Dent, and (2) Argentine multiple eared popcorn. When these two new lines plus the original Hulless were pollinated as females by two corn belt inbred lines of $\underline{ga}$ $\underline{ga}$ constitution, virtually no pollinations were effected on any of the three strains.

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1. Investigations on possible episomic nature of Modulator.

As reported in the 1962 Newsletter (p. 78-79) several experiments were undertaken to test for a possible cytoplasmic state of the controlling element, Modulator.

Firstly, a number of reciprocal crosses were made between a white inbred line (colorless pericarp, Pww) and plants heterozygous for light variegated pericarp (P^{rr}Mp + 1 transposed Mp) or very light variegated (P^{rr} Mp + 2 tr-Mp's). If Mp is chromosomal, the expected results for such crosses is a ratio of 1 white ear to 1 colored ear. The colored class includes light variegated (1 tr-Mp), very light variegated (2 tr-Mp's), medium variegated (no tr-Mp's) and red pericarp (no Mp at the P locus), the ratios of the various types varying with the position of the tr-Mp and the frequency of secondary transpositions of Mp. If Mp were capable of a cytoplasmic state in some cases, the expectation would be that the families resulting from crosses of a variegated female parent with a white male parent would still show a 1:1 ratio with the colored ears distributed as in the parental variegated while those in which the variegated plant was used as pollen parent would show a higher frequency of red ears (if the Mp at the P locus were lost in the cytoplasm) or a higher frequency of medium variegated ears (if the tr-Mp's only were lost). Neither expectation was realized. The rather surprising result was a preponderance of white ears in the crosses where the variegated plant was used as pollen parent while the reciprocal cross (variegated plant used as female parent) gave the expected 1:1 ratio. The results were as follows:

	Number of families giving					
	more than	less than	exactly			
female parent	50% colored ears	50% colored ears	50% colored ears	Total No. families	Total ears colored	white
lt. or very lt. var.	16	12	3	31	1302	1256
white	12	40	2	54	1229	796

Some pairs of reciprocal crosses showed very striking deviations from the expected ratios with the maternal transmission of variegated giving the expected results while the reciprocal cross gave no colored ears or one or two out of some fifty ears.

It would appear from these results that for some reason, either the chromosome carrying the color gene or the gene itself is discriminated against in pollen transmission. Brink some years ago reported normal transmission of variegated through both male and female gametes and this is still the case for some variegated lines in the present study. Brink and Wood showed that Modulator had no effect on pollen tube growth and Fradkin and Brink found no pollen sterility in plants carrying Mp even though endosperm mosaicism indicated that chromosome breaks were probably occurring in that tissue. Episomes in bacteria (e.g. transducing phages and the sex factor of E. coli in cases of sexduction) occasionally carry the gene or genes near to their point of chromosomal

attachment into the cytoplasm with them when they enter the cytoplasmic state. If such a phenomenon occurred with the Mp at the P locus and the red gene, results such as those obtained might be expected. Experiments are now under way to clarify the situation.

Secondly, experiments were carried out in which variegated kernels were given treatments (heat and acriflavine) known to cure cells of lower organisms of cytoplasmic particles. The heat treatment as outlined by Braun (MGCNL 35:83-84) had no effect on the phenotype of the resulting plants. Acriflavine treatment had no effect on medium variegated but two strong treatments gave a higher ratio of medium variegateds to lights (69 and 61%) than either a weak treatment (42%) or three related untreated families grown in previous years (43, 36 and 43%). This is a shift in the direction expected if the treatment were destroying some of the transposed-Modulators. The acriflavine treatment and several other treatments having similar effects on microorganisms are being repeated on a larger scale during the current growing season.

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2. An acute molybdenum deficiency in maize.

A general yellowed and stunted appearance associated with yellow interveinal streakings which soon become necrotic resembling a kind of marginal leaf scorch was found to be the symptom of an acute molybdenum deficiency in maize.

This condition was particularly prevalent during the first 5 to 6 weeks after emergence of the plants. From this stage onwards, plants were found to recover from the acute symptoms. In many instances the plants recovered to such an extent that distinct symptoms were no longer visible. At this stage, affected plants could be recognized only by their smaller size when compared with the better growing plants in the same field.

Molybdenum deficiency symptoms in maize were found to occur on soil with a pH of 4.4 and lower but not on soils with a pH of 4.66 or higher, which indicates a critical pH level. A similar condition was found in a bean field were ten pH readings made from rhizosphere soil of 10 severely affected bean plants averaged 4.33, while readings from 10 symptomless plants growing in the near vicinity, averaged 4.52. The pH of the soil, therefore, had a very marked effect on the availability of molybdenum to plants. This was further proved by adding enough slate lime to the experimental soil to bring the pH from 4.03 and 4.37 to 4.67 and 4.77. In this experiment severe deficiency symptoms were found in maize plants grown at the lower pH values and none at the higher