this study: four were standard double crosses and five were experimental single crosses of the breeding program to increase sugar in the stalk at and after maturity. Three of the last ones were expected to have high refractometrical reading after maturity. Each hybrid was planted in a single row. Ten days after pollination six plants of each hybrid were inoculated with Diplodia and another six plants were inoculated with Gibberella ("tooth pick" technique). This was done again 15 days later and 30 days later after the first inoculation. The total number of plants inoculated with Diplodia and Gibberella were 36 in each hybrid.

On November 28 refractometrical readings were made on each inoculated plant and on December 1 the same plant was cut from base to top to observe the degree of damage caused by the inoculation. Scores for degree of infection were from zero (no damage) to five (five or more internodes showing the infection). Plants completely killed by infection were also scored five. Fractions of internodes showing infection were scored as corresponding fractions of 1. Correlation analyses for pairs of the individual plant values (for refractometrical reading and infection scores) are shown in Table I. This high correlation between resistance to these two diseases of the stalk and roots confirm previous observations.

Table I

Hybrid		Coefficient of correlation for each hybrid	
Standard double cross	362	-0.49	
" " "	363	-0.62	
" " "	364	-0.78	
" " "	365	-0.66	
Exp. single cross	366	-0.57	for r: ± 0.425 P: 0.01
" " "	367	-0.56	
" " "	368	-0.73	
" " "	369	-0.81	
" " "	370	-0.51	

Correlation coefficient of the hybrid means for refractometrical reading and score of infection, r = 0.897, P = 0.001

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1. Production and testing of pollen restoring inbreds.

Many of the standard Northeastern and Northcentral corn inbreds

have been converted to T sterile cytoplasm for use as seed parents and to restored fertile lines carrying T cytoplasm to be used as pollen restorers. The conversion to fertility restoration has been accomplished by crossing the sterile version of an inbred by a good restorer, such as Ky21, I153, C21, C236, Mo940, NC77, and other sources, or restorer inbreds derived from these sources, backcrossing on the sterile line as the recurrent parent for 3 to 6 generations and selfing for 2 or more additional generations. Many of these restored fertile inbreds are homozygous for the necessary restoring genes while some are still segregating for fertile and sterile plants.

These restoring inbreds have been tested for several seasons on many standard sterile seed parents with generally satisfactory results. Homozygous selections produce all fully fertile progenies. Others segregate in varying ratios ranging from a few to many plants fully fertile with no delay in pollen shedding after the silks appear. In some cases there are partially fertile plants with varying amounts of apparently good pollen. These partially fertile plants usually delay shedding until after the silks have emerged on the same plants.

After the inbreds have been converted to type in appearance they are further selected and tested both for pollen restoration and combining ability by selfing selected individual plants in each progeny and putting the pollen from these selfed plants on appropriate sterile seed parent single cross testers. For example, 26 test crosses of C103TF(Ky21) on (WF9Tx38-11) as the sterile seed parent tester gave 19 progenies all fertile and 7 progenies segregating fertiles and steriles in the combined ratios of 131 completely fertile and 89 completely sterile plants. This is a significant departure from a 1:1 ratio expected on a one factor difference. All of the segregating progenies have an excess of fertile plants. This excess of fertiles is shown by many other test crosses and is significant ($P<.01$).

Eighty single plant test crosses of KrTF(Ky21) restorers were also grown this past season. They were made on two sterile seed parents, (WF9TxR2) and (WF9TxW22). Many lines were tested on both seed parents. Forty-eight of these test crosses gave all fertile progenies with no delay in pollen shedding. Thirty-two segregated, again with an excess of fertile plants deviating significantly from a 1:1 ratio. In stalk growth, yield and time of maturity most of these test crosses were practically identical in performance with the same crosses made with the original fertile lines. A few of the progenies were noticeably poorer in some respect and some seemed to be an improvement in both stalk quality and yield. These will be tested further in a replicated yield test. Many other restored sterile inbreds were tested and gave similar results.

The restored versions of Hy, however, behaved quite differently. Two series were grown, all crossed on to (WF9Tx38-11) as the sterile seed parent tester. Nineteen test crosses of HyTF(Ky21) gave no fully fertile progenies. Eight of these progenies segregated into 81 fully fertile plants and 153 either partially fertile or completely sterile

plants. There were 9 progenies with only partially fertile and sterile plants and 2 progenies with all completely sterile plants. Unlike all the other test crosses the segregating progenies gave an excess of sterile plants. Three progenies seemed to be segregating 1:1 and 5 progenies in a 1:3 ratio of fertile and sterile which indicates either one or two fertility restoring genes with complementary action with this sterile tester.

Thirty-four test crosses of HyTF(C236) gave 3 progenies all fertile, 2 segregating fertile and partially fertile or sterile in a 2:1 ratio and 32 progenies all sterile. The C236 source is a Leaming inbred out of the same strain that Hy was derived.

When the single cross of C103TF(Ky21) x HyTF(Ky21 or C236) was tested on the same sterile seed parent the results were 5 progenies all fertile and 10 segregating 140 fertile and 80 sterile. Two of these progenies seemed to be segregating 3:1 and the remaining in a 1:1 ratio.

In these test crosses the seed was sown by hand, one seed in a place, about 9 inches apart in rows 3 feet apart. Germination was unusually good and no plants were thinned out. A full stand had 37 plants. Very few rows had less than 25 plants. T he differences in the number of fertile and sterile plants in the progenies segregating about 1:1 were plotted against the number of plants in the row. There is no tendency for the thinner stands to give an excess of either fertile or sterile plants and therefore there seems to be no differential elimination.

No satisfactory explanation for the excess of fertile plants in the segregating progenies is at hand. It apparently is not due to selective elimination as stated above. It could be due to selective fertilization favoring the restored fertile plants. It is most probably due to minor modifying genes segregating in the seed parent single crosses as well as in the pollinator inbreds.

The inbreds used as sources of pollen restoring genes were also tested in various combinations with each other on (WF9Tx38-11) as the sterile seed parent. The following combinations gave progenies with all completely fertile plants. Apparently all of these inbred sources have the necessary restoring genes in common and in the homozygous condition.

Sterile Seed Parent	-	Restoring Pollinator
(WF9T x 38-11)		(Ky21 x C21)
" "		(C21 x Ky21)
" "		(K55 x Ky21)
" "		(NC77 x Ky21) I153
" "		I153 (NC77 x Ky21)

Ky21 is a Kentucky inbred out of the Johnson County White variety. C21 is a Connecticut inbred out of Illinois Low Protein originally from the Burr White variety formerly widely grown in southern and central Illinois.

K55 is a Kansas inbred out of Pride of Saline, a white variety widely grown in the west central plains. NC77 is a very late white inbred of a white southern prolific variety. I153 is a short stalked early yellow inbred out of a U.S. Department of Agriculture open pollinated selection 133 of unknown origin. T he slightly reddish pericarp suggests that it may have come from Northwestern Dent. There are several selections of this old inbred, all with restoring ability, such as A344, A293, W153R. NY16 out of Webber Dent is another early inbred that gives good restoration with all T sterile inbreds and single crosses with which it has been tested.

D. F. Jones

2. Independence of cytoplasm and genes.

A sterile inbred, C106T, restored by Ky21 has been selfed for 8 generations. It has produced only fertile plants after it was reduced to homozygosity for the restoring genes. When this fertile inbred, carrying sterile cytoplasm, was crossed by normal C106 the F_1 generation was all fertile and the selfed F_2 grown last year in three separate progenies gave 37 normally fertile and 11 completely sterile plants where 36 and 12 were expected in a monofactorial segregation. For 8 generations the sterile cytoplasm has persisted in fully fertile plants. Also C106T restored by Ky21 was backcrossed on to C106T for 5 generations then selfed 2 generations to give an all fertile progeny. One of these restored fertile plants was crossed by normal C106 and in the F_2 generation selfed grown last year gave 19 fertile and 5 completely sterile plants. This is clear evidence that different cytoplasms and genes can remain together in the same organisms for many generations without altering each other.

D. F. Jones

3. Producing restored sterile hybrids.

There are several ways of producing hybrid corn seed without detasseling now in commercial use. The method of producing two lots of seed of the same genotype, one on a sterile seed parent and one on a normally fertile seed parent by detasseling, and mixing these two lots of seed in various proportions is being widely used. This is a temporary measure and will be superseded by the use of restoring pollinators as soon as these are available. Various ways of using restoring pollinators are being tried.

The method that eliminates all detasseling in the production of the foundation single crosses as well as the final double cross is to use sterile inbreds as the seed parent of both single crosses. The pollinator for the seed parent single cross must be an inbred that has been tested for non-restoration. The pollinator for the pollen parent single cross must be a good restorer. The formula for this type of double cross is: