

Corn Belt inbred lines. When a diploid plant homozygous for am is crossed by a tetraploid pollen parent, a few tetraploid kernels are formed. All possible crosses and selfs will be made in this pool and kept separate. Every year plants from this pool will be self-fertilized and used as the male parents in crosses with tetraploids which are homozygous for one or more of the markers: bz₂, lg₁, a₁, su₁, pr, y₁, gl₁, v₁₆, wx, and g₁. There is one marker for each of the 10 chromosomes. Ideally, all these markers would be in the same strain. Since some of the traits interfere with expression of other traits (a₁ with bz₂ for example), two or three strains will be used. These strains will be made as closely related as possible and will arbitrarily be called the standard. In the following year the hybrids will be testcrossed onto the standard multiple recessives and a value called the allosyndetic index will be computed. The allosyndetic index is the sum of the percentages of all 10 recessive segregants. It has a theoretical maximum of 214 and a minimum of 0. The maximum occurs when all genes are segregating as in random chromatid assortment. The minimum would be found in a true breeding allotetraploid. Strains which have a high allosyndetic index will be discarded from the pool, and those with low indices will be retained and crossed with each other in an effort to concentrate the structural differences responsible. Several strains which have high allosyndetic indices will be maintained outside the pool to provide the eventual breeding partners with the modified strains.

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6. X-ray induced duplications from translocations between homologous chromosomes.

This experiment has been described in great detail in previous reports. Translocations between the same arms of homologous chromosomes form a chromosome with an interstitial deletion and a chromosome with a tandem duplication. The probability of this occurrence is rather low in relation to the frequency of translocations between nonhomologous chromosomes. For a particular gene to be included in the tandem duplication the probability is $1/4(n-1)(1/2n)(1/2)T$, where n is the haploid number of chromosomes and T is the frequency of translocations between

nonhomologous chromosomes. The observed value of T was 15.4%. In the experiment reported earlier, 1,169 ears were tested for tandem duplications involving any one of six genes. The expected number of cases would then be 0.72.

However, if there is a tendency for homologous chromosomes to be in a semi-paired condition in the interphase nucleus, then we would expect the frequency of tandem duplication production to be considerably higher since the probability of two broken ends of chromosomes uniting to form a new combination is a function of the distance between them.

In last year's report, 36 cases which suggested the presence of tandem duplications were cited. In order to verify the presence of a tandem duplication, the presumptive duplication chromosome must be made heterozygous with a chromosome carrying the dominant gene and backcrossed to the recessive to see if there are any recessive revertants. In other words, the original state must be restored.

All of these tests were made and the results were completely negative in all cases. Some odd patterns of inheritance were observed but they do not conform to theoretical expectations. In some cases sublethal genes were induced which were linked to the recessive gene and modified what should have been a 1 : 1 ratio. In the case of the "Lg-lg duplications" the so called lg revertants reported last year proved to have normal ligules on the second and higher leaves. Sandbench classifications were made on the first leaf and this is not reliable. Apparently some modifiers of the expression of lg were present or induced in the material. Also, some errors in classification probably occurred, particularly in the case of golden which, in some backgrounds, is a poor sandbench character. It was thought that there were some spurious cases. It appears they all are.

The second method of detecting tandem duplications is faring a little better. The procedure is to irradiate kernels which have two very closely linked markers in the repulsion phase (in this case A sh/a Sh) and to cross the plants grown from these kernels to the double recessive. Kernels in the progeny with a tandem duplication involving the loci will have the constitution (A sh-a Sh/a sh) which may be distinguished from normal crossover events (A Sh/a sh) by

crossing the plants grown from these kernels to homozygous a Sh plants and detecting the presence of A sh gametes in the next generation. However, there is a third source of A Sh kernels which was recognized but not noted in the last report because it was thought of negligible importance. It is the result of the non-disjunction of either the A sh or the a Sh chromosome which produces trisomic sectors on the ears of the X_1 generation. These sectors yield trisomic kernels of the genotype A sh/a Sh/a sh which are phenotypically A Sh.

Much of the excess in the number of A Sh in the irradiated material over the controls is due to this. In the control there were three trisomic 3 plants out of 14 A Sh kernels tested. In the irradiated material 20 out of 44 A Sh plants were trisomics. Irradiation probably increases the frequency of non-disjunction. A great volume of material was obtained last summer in a repetition of the original experiment and the results of this experiment will be reported later in greater detail.

In 19 out of the 33 cases of trisomy there was non-correspondence between the phenotypes of the endosperm and the genotype of the embryo, which probably indicates some sort of tetrasporic development of the megagametophyte, as suggested by Neuffer.

It appears that tandem duplications are extremely hard to obtain. Oddly enough, this difficulty may be used in support of the hypothesis that homologous chromosomes tend to be in a semi-paired state in the interphase nucleus. If the hypothesis is true then most of the tandem duplications produced would tend to be very short and the probability that a duplication would include the loci followed would be very low.

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1. An observed alteration of the opaque-2 phenotype.

The opaque-2 recoveries of 2 inbred lines of corn (hereafter referred to as Line A and Line B) were crossed reciprocally to obtain F_1