mutant's endosperm is variable. The most common phenotype is that of a typical opaque; but frequently the seeds will be decidedly shrunken, approaching *sh*$_1$ in phenotype. In most stocks (dent or flint) the seed classification has been satisfactory.

The seeds, when planted at about seventy degrees Fahrenheit, produce yellow-green seedlings which are easily distinguishable from normal siblings. Seedlings grown at higher temperatures (e.g. about ninety-five degrees Fahrenheit) will approach normal pigmentation. Under field conditions these seedlings are viable, and stands comparable to normal are common. The mature plants are a foot or two shorter than their normal siblings and mature about a week later. The symbol *o*$_5$ has been given this mutant.

Testcrosses heterozygous for *o*$_5$ and a series of chromosome 9 translocations gave indications of linkage only with T7-9a (7L.63, 9S.07) (Table 1). Although the data are meager, they are sufficient to indicate that the gene is located on chromosome 7. No indication of linkage was found with waxy.

Table 1

Testcross progeny of *wx* *T7-9a* + / + + *o*$_5$ x ++ ++ *o*$_5$*o*$_5$

T +	+ *o*$_5$	T *o*$_5$	+ +	Total	% recombination
29	32	3	6	70	12.86

Allele tests with *o*$_2$, which is also on chromosome 7, were negative. This is an excellent new marker that can be used either as an endosperm or seedling trait.

Donald S. Robertson

3. Electron microscopy study of plastid development in dim light grown seedlings of *w*$_3$, *pas*$_{8686}$, *lw*$_1$, and *cl*$_1$.

As part of a larger project involving genetic, biochemical, and cytological studies of mutant seedlings of maize, we have been using electron microscopy to study plastid structural differentiation. The white-albino, *w*$_3$; its pastel allele, *pas*$_{8686}$; and their heterozygote (*pas*$_{8686}$/*w*$_3$) were grown, along with a normal control, in the dark for eleven to fourteen days at 26.6 degrees C. The seedlings were illuminated with 2,000 foot candles of light and samples taken in the dark and at intervals up to twenty-four hours after illumination. (Results of these experiments were discussed in last year's News Letter and presently a more detailed report is in preparation for publication.) Tissue was fixed with 3% glutaraldelhyde, post-fixed with 1% osmium tetroxide in phosphate buffer, dehydrated in an alcohol series, embedded in Epon 812 and sectioned on a LKB microtome with a diamond knife. Sections were

stained with uranyl acetate in methanol and examined under an R.C.A. EMU-3F electron microscope.

The dark grown normal plastid, under these conditions, contains one or more large ordered prolamellar bodies, radiating stroma lamellae, and dense osmiophilic globules. With illumination, there is a disorganization and disappearance of the prolamellar bodies, an increase in the number of lamellae and the formation of grana by twenty-four hours within the plastids of normal seedlings. Plastids of the albino, $\underline{w_3}$, after the disappearance of the prolamellar bodies and formation of some lamellae, break down structurally within one to four hours, and after twenty-four hours contain only scattered lamellae, vesicles, and starch grains. Both the pastel and heterozygote proceed initially along similar developmental pathways, but each eventually shows abnormal differentiation. The pastel plastid by twenty-four hours of light contains large grana aggregates and the heterozygote contains large loosely arranged prolamellae bodies.

Both the mutants and normal seedlings studied are capable of producing protochlorophyllide when grown in the dark and show equal ability to convert this to chlorophyllide and chlorophyll after a one-minute exposure to light. Carotinoid contents of these seedlings, however, are not equal. The albino, $\underline{w_3}$, contains no colored carotinoids but does accumulate carotinoid precursors; the heterozygote and the homozygous pastel both contain colored carotinoids in amounts much lower than normal.

Since these mutants are able to produce chlorophyll, they were next grown under a light intensity of approximately one foot candle. This was low enough for the plastids to accumulate chlorophyll, even with carotinoid levels which are insufficient to protect chlorophyll from photo-destruction at higher light intensities. Under these conditions, $\underline{w_3}$ will produce about one hundred times as much chlorophyll as dark-grown seedlings.

Seedlings of $\underline{w_3}$, $\underline{pas_{8686}}$, the heterozygote, and normal, as well as two white-albinos, $\underline{cl_1}$ and $\underline{lw_1}$, which do not accumulate carotinoid precursors, were grown in dim light for fourteen days at 26.6 degrees C. Fixation and embedding procedures were the same as those for the dark-grown seedlings.

The $\underline{w_3}$ plastid contained numerous long lamellae, similar to the large grana aggregate found in $\underline{pastel_{8686}}$ at twenty-four hours, but the discs are separate from one another. Small grana consisting of two discs are also present. The pastel and heterozygote plastids also contain small grana, but these are more numerous. These plastids also contained areas of discontinuous lamellae concentrated in parallel rows. The normal plastid contains numerous lamellae and small grana but no groups of parallel lamellae.

Plastids grown in dim light are much more lens shaped (as are light-grown normal plastids) than those in any of the dark-grown seedlings. Lamellae are long and continuous, not distinctly different from the normal control. Thus, although structural differences were observed in these plastids, they all produced long continuous lamellae with small

grana and attained a more normal shape than dark-grown plastids.

The two mutants which do not accumulate carotinoid precursors are able to produce chlorophyll, but when grown under dim light conditions only retain one-third to one-half as much chlorophyll as $\underline{w}_3$. Plastids of these albinos contain prolamellar bodies, few lamellae and almost no osmiophilic globules. They definitely are less structured than $\underline{w}_3$ under the same conditions. The absence of globules in these non-accumulating albinos suggests that the precursors and/or colored carotinoids when accumulated, as in $\underline{w}_3$, are stored in such globules. The presence of fewer lamellae in $\underline{cl}_1$ and $\underline{lw}_1$ and their inability to form grana probably are related to the lower levels of chlorophyll and possibly relate indirectly to the absence of precursors. Perhaps these precursors accumulated in $\underline{w}_3$ play some role in protecting chlorophyll from photodestruction when plants are grown in weak light.

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1. Reversion frequency of alleles of the $\underline{su}_1$ locus and of some of their compounds.

Seven alleles of the $\underline{su}_1$ locus ($\underline{su}_1$ a-b-c-d-e-f-g) have been obtained by EMS-treatment. The reversion frequency of these mutants is reported together with the rate for a standard allele of presumed natural origin ($\underline{su}_1{}^{st}$, which is used as a common pollen source) in comparison with the reversion rates of some of their compounds (among which are included also compounds of three mutants with the $\underline{su}$ WMT allele present in the multiple tester of P.C. Mangelsdorf). The data suggest the occurrence of intragenic recombination and a possibility of ordering linearly some of the sites studied.

Both the homoallelic and the compound plants were detasselled and pollinated by a common recessive stock bearing the $\underline{su}_1{}^{st}$ allele and $\underline{gl}_4$. The data collected from the homoallelic types are presented in the following table: