3. Shrunken-2 sweet corn hybrids.

Over the past several years we have carried on a limited program designed to introduce the shrunken-2 factor on chromosome 3 into the standard Golden Cross and Iochief lines of sweet corn. Because the double recessive combination of sugary-1, shrunken-2 is obviously not a commercially suitable type we have substituted the sh_2 factor for the su_1 factor in the converted lines.

It is apparent that hybrid combinations involving the converted lines (sh sh Su Su) retain the characteristics found to be associated with the sh_2 factor in the original genetic background. They have a higher sugar content at picking and at maturity than the standard su_1 material; they also have a superior sugar-holding capacity after picking. Because there is a longer period during which ears of shrunken-2 material may be picked without sacrifice of quality it is conceivable that double-cross production of sh_2 sweet corn may be feasible ultimat

Limited amounts of hybrid shrunken-2 seed are available at this time. Persons interested in receiving small samples of same should wr Dr. Earl B. Patterson, Maize Genetics Cooperative, Department of Botan University of Illinois, Urbana, Illinois.

Lines of shrunken-2 material will be increased this year and will be available for distribution upon request after harvesting of the 195 summer crop.

John R. Laughnan

4. A test of the mutational hypothesis for the origin of the noncross over alpha derivatives from A^b:P and A^b:Ec.

It has been shown by Dr. Laughnan that both A^b:P and A^b:Ec yield pales of noncrossover origin, besides crossover pales due to the norma separation of the α component from the A^b complexes. In heterozygotes with a, A^b yields a second type of pale of crossover origin. This pal is mutable as it carries a in the position occupied by β in the A^b con plex when it is tested for mutability under the influence of Dt. The rate of crossover pales is about 1/2,000 in both A^b:P and A^b:Ec but tl rates of noncrossover pales differ; in A^b:P the noncrossover derivativ are about twice as frequent as the crossover pales but in A^b:Ec they a only about 1/10 of the crossovers.

Among several hypotheses put forth as explanations for the origi of noncrossover alpha derivatives, mutation of the β element in the complexes $\alpha\beta$ (A^b:Ec) and $\beta\alpha$ (A^b:P) to a null level element β_0, was te ed. If a β_0 element is present as a component of the noncrossover al derivatives, this should be separable by crossing over as a colorless element from the complexes $\alpha\beta_0$ and $\beta_0\alpha$. As controls in this experimer stable and mutable alphas of crossover origin were included. The fre-

quency of colorless derivatives, designated a*, separable by crossing over in both noncrossover and crossover mutable pales should be similar as the site of β is occupied by the presumed β_0 in the case of noncrossover alpha and by standard a in the case of crossover mutable alpha. But the a* derivatives of crossover origin from noncrossover alpha should not be mutable under the action of Dt, whereas crossover a* from mutable α should be mutable since the crossover event in this case separates the a that went into the original heterozygote with A^b. The direction in which these crossovers are expected to occur and the mode of oblique synapsis required differ in alphas of the two sources as shown below. Finally, no a* would be expected by crossing over from crossover stable pales.

Oblique synapsis and direction of crossing over

A^b:P	A^b:Ec
c/o stable alpha	
T α Sh → a* not expected by crossing over N βα sh	T α Sh → a* not expected by crossing over N α β sh
c/o mutable alpha	
T a α Sh → Ta* sh (Mutable & recessive brown pericarp) N β α sh	T α a Sh → Na* Sh (Mutable & recessive brown pericarp) N αβ sh
Non cross over alpha	
T β_0 α Sh → Ta* sh (Non-mutable) N βα sh	T α β_0 Sh → Na* Sh (Non-mutable) N α β sh

Several separately occurring pales of each of the three types from both the sources were compounded with A^b:P, A^b:Ec and the North American allele A in well-marked complexes. Pales of A^b:P source were more frequently compounded with A^b:P and vice versa. The F_1 materials were grown in isolation plots and back crossed with a sh or a Sh. Colorless cases occurring on such ears were picked out and analysed for the constitution of markers, mutability under the influence of Dt and pericarp reaction.

Regardless of the type and source of alpha used in the experim
a* cases of noncrossover origin were recovered from them. The mech:
by which these arise is not clear.

Preliminary results are summarized below. Most of the a* deri
tives have been analysed for markers and mutability but the pericar]
tests are not yet available.

Alpha derivatives from A^b:P

The population of pale gametes studied under each class of alp]
and the number, marker constitution and the rates of recovery of a*
10^5 pale gametes are given in table I.

Pales from A^b: P   Table I

Pale Class	Population of Pale gametes	a* Cases			Rate of a* per 10^5 p		
		Total	Non c/o	c/o	Non c/o	c/o	Tot:
Cross over stable	93,905	4	4	0	4.26	0.00	4.:
Cross over mutable	53,250	15	10	5	18.78	9.39	28.:
Non-cross over	107,980	5	5	0	4.63	0.00	4.6
Total for A^b: P	255,135	24	19	5	7.46	1.96	9.4

In this case, the crossover stable and the noncrossover alphas
behaved similarly. Out of over 200,000 pales from these, there was
not a single occurrence of a colorless case of crossover origin. Th
rate of origin of noncrossover a* cases is similar in both. Almost
of these colorless derivatives have been tested for their mutability
are found to be stable. The absence of a* by crossing over in a pop:
tion of 108,000 gametes in the case of noncrossover alphas and 94,00(
gametes in the case of crossover stable alphas shows the structural
similarity of these two classes of pales which are of different orig:
From mutable pales, in which the standard α element is known to be
present, five a* cases of crossover origin were obtained from a popu:
tion of smaller size, 53,250. From this, it may be assumed that the
mutation of β in the complex $\beta\alpha$, to β_0 does not constitute the basis
for the origin of noncrossover pales and that the β element appears
to be completely eliminated during the process. Since noncrossover :
cases are recovered from pales of all the three classes, their occur:
cannot be used in conclusions about the existence of a null level ele
ment. However, the rate of production of noncrossover colorless case
is rather high in the case of mutable pales. Whereas all a* cases of
crossover origin from this source are mutable, the noncrossover a* de
rivatives appear to include both mutable and stable types. The mutat

of some of these noncrossovers indicates that these colorless cases represent the a that was incorporated in the crossover event during the production of a mutable alpha and the mechanism of the separation of this may be analogous to the isolation of noncrossover pales from A^b: P. The stable a* of noncrossover origin from a mutable pale may be attributed to the phenomenon similar to the production of a* from the crossover stable and the noncrossover pales if it is also assumed that the standard a element is lost during this process. Further information on the nature of these colorless cases will be available after the pericarp tests are completed.

Alpha derivatives from A^b:Ec

The populations of pale gametes and the details of the colorless cases obtained from them are given in table II.

Pales from A^b: Ec   **Table II**

Pale Class	Population of Pale gametes	a* Cases			Rate of a* per 10^5 pale gametes		
		Total	Non c/o	c/o	Non c/o	c/o	Total
Cross over stable	125,830	22#	13*	6*	10.33*	4.77*	17.48
Cross over mutable	96,535	21	17	4	17.61	4.14	21.75
Non-cross over	181,120	40	35	5	19.32	2.76	22.08
Total for A^b: Ec	403,485	83	65*	15*	16.11*	3.72*	20.57

\#   3 cases unclassified

*   likely to be revised

Pales from A^b:Ec source differ significantly from those of A^b:P as all the three classes of pales yield both crossover and noncrossover a* derivatives. The direction of crossing over is constant in all the crossover cases, the recombination being always for the distal marker of the chromosome carrying alpha and the proximal marker of the homologous chromosome. In the mutability tests so far, only the a* cases of crossover origin from crossover mutable pales have been found to be dottable under the influence of Dt. This is expected as the standard a is mutable. The colorless crossovers from crossover stable and noncrossover alphas have not so far been found to be mutable.

According to β mutation hypothesis, only noncrossover and crossover mutable alphas are expected to yield a* by crossing over; crossover stables are not. However, 19 colorless cases were obtained from crossover stable alphas and six of these were of crossover origin.

Since the T-Sh region is only about 7.25 recombination units in leng
the proportion of colorless crossovers is too large to interpret tha
the a* in these cases is the usual noncrossover a* which has experie
a coincident crossover for the region. If this were the case, recip
strands carrying a* would also have occurred. This was not the case
all the six cases of crossover a* were recombinants in the same dire
Thus, in the case of crossover stable pale, it is felt that crossing
results in the separation of a pre-existing null level element locat
the right of alpha. Since the postulated null element is situated t
tween α and β, it cannot be separated from the A^b:Ec complex in a si
cycle. This null element seems to be associated also with noncrosso
alpha and it is probable that the crossover stable a* derivatives fi
these constitute the separation of this element. More conclusive pi
that we are not separating a mutated β element, β_0 in this case, has
await further tests.

The colorless cases of noncrossover origin from noncrossover an
crossover stable pales so far tested are not mutable; those from mui
pales, as in the case of mutable alphas of A^b:P, belong to both stal
mutable types.

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1. <u>Interaction of fertility-restoring genes.</u>

Full restoration of male-fertility in the presence of Texas st
cytoplasm has been shown by various workers to depend on two domina
complementary genes. In midwestern dent material, a few inbreds ca
both; most other inbreds carry one; WF9 carries neither. This situ
can be illustrated as follows:

Ky21, K55, I153 = AABB

K4, N6, L317 = aaBB

WF9 = aabb

(The gene here shown as A is Rf_1, located near Rg on Chr.

From self-pollinating plants of the pedigree (WF9 x Ky21) WF9,
line has been isolated which gave on preliminary test a completely
tile progeny with L317^T and a wholly sterile progeny with WF9^T; the