

PURDUE UNIVERSITY  
Lafayette, Indiana  
Department of Botany and Plant Pathology

1. Recombination between alleles at the  $sh_2$  locus.

In addition to the  $wx$  locus, there is also evidence for recombination between mutations at the  $su_1$  and  $gl_1$  loci (Salamini). It seems apparent that this is general. We have been interested in the  $sh_2$  locus because it is implicated in the production of the enzyme adenosine diphosphate glucose pyrophosphorylase.

It has been found both at the Coop and here that the defective seed stock  $bt^{60-156}$  is allelic to  $sh_2$  (MNL 41:207). We have used the  $F_1$  stock from the allelism test to test for recombination. The  $F_1$  seed was planted in 1967, and the plants pollinated by a stock that was  $wx^c/wx^c$ ;  $sh_2/sh_2$ . A total of 44491 kernels were produced, and 17 kernels were normal in phenotype.

The plants from these kernels were grown in the 1968 greenhouse, and the pollen checked to ascertain if the plants were  $wx/wx$  as would be expected if the seeds arose from fertilization by the  $wx^c/wx^c$ ;  $sh_2/sh_2$  stock. Of the 17 plants, 10 were  $wx/wx$ ; 3 were  $Wx/Wx$  indicating contamination; and 4 plants did not produce tassel samples that could be checked. This would indicate a recombination rate between  $sh_2$  and  $bt^{60-156}$  of  $22 \times 10^{-5}$  on the female side.

Oliver Nelson

2. A lethal ovule factor linked to  $wx$ .

In 1965, a plant of the genotype  $wx/wx^{B1}$ ;  $Sh_2/sh_2$  when self-pollinated produced 228 kernels of which 172 (75.4 percent) were  $wx/wx$ . The ear was semi-sterile.

In 1966, when the non-waxy kernels were planted and the plants selfed, 9 plants gave high percentages of waxy kernels (ranging from 53.0 to 75.5 percent); 7 plants had percentages varying about 25 percent; one plant was  $Wx/Wx$ . Six plants were crossed as females times a  $wx/wx$  stock; 4 gave high percentages of waxy kernels (91.1-95.3 percent); 2 had approximately 50 percent waxy kernels. All plants with aberrant percentages of waxy kernels were semisterile. The backcross results indicate a

lethal ovule ( $\underline{lo}_x$ ) factor linked to  $\underline{Wx}$  (ca. 6 percent recombination), but this could not explain the high percentages (up to 75 percent) of waxy kernels in selfed  $\underline{Wx} \underline{lo}_x / \underline{wx} \underline{Lo}$  plants unless the factor also affects the competitive effectiveness of pollen grains carrying  $\underline{lo}_x$ .

In 1967, normal (non-waxy) kernels from a plant - 34187-8(X) - that had given 75.2 percent waxy kernels in 1966 were planted. The plants were crossed as females times  $\underline{wx}/\underline{wx}$  and as males onto  $\underline{wx}/\underline{wx}$ . The results are given in Table 1. Clearly, the competitive effectiveness of  $\underline{Wx}$  pollen from  $\underline{Wx} \underline{lo}/\underline{wx} \underline{Lo}$  plants is reduced. The mean percentage of waxy kernels in the 7 plants with high percentages of waxy kernels when crossed by  $\underline{wx}/\underline{wx}$  was 93.6. If no  $\underline{lo}$  gametes are capable of functioning, this would indicate recombination approximating 6 percent between  $\underline{wx}$  and  $\underline{lo}$ .

Table 1

The results of crossing plants from non-waxy kernels from ( $\underline{Wx} \underline{lo}/\underline{wx} \underline{Lo}$ ) (X) by and onto a  $\underline{wx} \underline{lo}/\underline{wx} \underline{lo}$  stock

Plant	Percent waxy kernels	
	x $\underline{wx}/\underline{wx}$	onto $\underline{wx}/\underline{wx}$
39141-1	49.7	45.6
" -2	94.3	82.8
" -4	52.1	51.8
" -6	88.6	78.4
" -7	93.2	73.2
" -8	93.9	63.5
" -9	93.0	70.3
" -10	95.4	79.4
" -11	96.8	71.4

In 1968, non-waxy seeds of the crosses of 39141-2, 39141-6, 39141-7 times  $\underline{wx}/\underline{wx}$  and onto  $\underline{wx}/\underline{wx}$  were planted. The progenies of the three plants by  $\underline{wx}/\underline{wx}$  were selfed. In a total of 19 plants, 17 had percentages of waxy seeds distributed around 25 percent. Two plants had high waxy percentages (54.8 and 51.2). The results indicate that the functional megaspores carrying  $\underline{Wx}$  usually result from recombination between  $\underline{Wx}$  and

lo. Apparently, however, megaspores carrying lo are rarely functional as shown by the two plants with high percentages of waxy kernels. The frequency of functional lo megaspores is not high enough to invalidate the conclusion of 6 percent recombination between lo and wx.

The plants from the crosses of 39141-2, -6, and -7 onto wx/wx were selfed and crossed onto a c sh wx gl<sub>15</sub>/c sh wx gl<sub>15</sub> stock. The results are given in Table 2. The percentages of waxy kernels in both (X)'s and crosses are somewhat lower than previously noted indicating that the proportion of lo pollen grains effecting fertilization is probably affected by the genotype of the plants producing them.

Table 2

The results of selfing and crossing onto wx/wx plants of plants from non-waxy kernels of wx lo/wx lo x Wx lo/wx Lo

Row	Percent <u>waxy</u> kernels	
	(X)	onto <u>wx/wx</u>
41146-2 ( <u>wx/wx</u> x 39141-2)	56.4	55.7
-3	48.4	55.9
-4	62.2	58.6
-5	56.9	
-6	63.4	64.9
-8	24.6	46.3
-10	57.1	57.6
-11	29.1	
41147-1 ( <u>wx/wx</u> x 39141-6)	69.3	61.6
-3	61.7	60.4
-4	51.5	57.0
-5	44.0	54.3
-7	53.1	58.8
-9	58.9	65.5
-10	100	100
41148-1 ( <u>wx/wx</u> x 39141-7)	51.1	61.6
-3	53.4	57.8
-5	60.5	61.9
-6	40.5	
-7	51.8	56.1
-10	100	100
-11	100	100
-12	28.9	53.7

No indication is yet available as to whether lo<sub>x</sub> is proximal or distal to wx.

Joseph Van Horn  
Oliver Nelson

UNIVERSITY OF RHODE ISLAND  
Kingston, Rhode Island

1. Further studies of x-ray-induced mutations at the Sh and Bz loci.

Preliminary data were presented in the 1965 Maize News Letter on the nature of x-ray-induced mutations at the bronze locus. One mutant in particular (bz-x<sub>1</sub>), which appeared originally as a possible intragenic change, was studied extensively. Since then, three additional alterations involving bronze which were suspected of being other than gross changes have been subjected to genetic and cytological tests. This report includes data collected on all four mutants.

Pollen from plants homozygous for the Sh, Bz and Wx alleles was x-rayed and applied to silks of sh bz wx tester stocks. (For a complete presentation of the materials and methods employed in these experiments, refer to the 1965 MNL, p. 98.) Three classes of bz mutants were identified--sh bz and Sh bz wx types, showing loss of two dominant markers, and Sh bz Wx mutants, exhibiting loss of Bz only. Table 1 lists the mutants observed in the endosperm and embryo. Of the endosperm mutants, only those of Sh bz phenotype were tested for Wx versus wx. Bronze mutants identified at the seedling stage were scored for Sh and Wx by progeny tests. Putative sh bz embryo mutants may include plants of Sh bz<sup>1</sup>/sh bz constitution in which the Sh bz<sup>\*</sup> gametophytes were non-functional, as well as the expected - -/sh bz class in which both dominant markers have been lost. Simultaneous mutations of Sh and Bz are nearly twice as frequent in the endosperm as in the embryo. Either the viability of the double mutants is lower in the embryo than in the endosperm or selective fertilization occurs in which the sperm nucleus containing the normal chromosome 9 preferentially fertilizes the egg nucleus. Many F<sub>1</sub> seeds

<sup>1</sup>The symbol bz<sup>\*</sup> refers to any change at the Bz locus resulting in the bz phenotype.