

3. A single main ear borne lower than half-way down the stalk.
4. A tall (9 to 10') late flowering plant with tillers.
5. A long central-spike in the tassel.

Wide row spacing in the field is essential for the development of maximum ear size by this formula. Its plants may even be barren at high population densities. Because the current fad requires that U.S. corn be adapted for close row spacing, this giant eared corn may be better suited to tropical and sub-tropical areas where the greater food demands are met by intercropping such as the ancient corn-beans-squash eco-system or possibly this in combination with multiple cropping or with crops of different maturities. For example an early small sweet corn in alternate rows might be harvested before it competed with the giant eared corn for solar radiation.

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4. Pollen size and the origin of maize.

Because the size of the oldest known Zea pollen is larger than that of present-day Mexican teosinte (Table 1), one can only conclude that the oldest known pollen could not be that represented by any of the present-day Mexican teosintes. Because this oldest known pollen compares more favorably in size with that of present day corn, it has also been concluded that "the ancestor of corn is corn and not (Mexican) teosinte," (Mangelsdorf).

If we consider Mexican teosinte and maize to be products of co-evolution resulting from disruptive selection between man and nature for features involved in their different adaptations for seed dispersal and survival, the above pollen size data could also be interpreted as the result of an alternate possibility involving a large-pollen teosinte such as certain types from Guatemala. The smaller pollen (and fruit case) in present day Mexican teosinte may be, like the block inheritance distinguishing these species, part of a system evolved to cope with some aspects of gene flow from maize. Increased condensation together with increased kernel size due to maize introgression into teosinte produces an incongruous combination of parts for survival in the wild because an expanded kernel that protrudes outside a condensed fruit case is left

Table 1

A comparison of pollen diameter frequencies (%) of 200 pollen grains each from two Guatemalan teosintes (Jutiapa 40-202A and Lake Retana 40-203) to a teosinte growing in the Valley of Mexico and maize from the lowest level of Bat Cave. All pollen treated with lactic acid.

Pollen Diameter Microns	Valley of Mexico Teosinte*	Jutiapa Teosinte**	Lake Retana Teosinte**	Bat Cave Level V Maize*
60	0.5			
62	0.5			
64	1.5	1.0		
66	3.5	1.5		
68	2.5	1.5		
70	6.5	3.0	1.0	
72	11.5	6.5	1.0	
74	14.0	2.5	1.5	
76	12.5	5.5	4.0	
78	17.0	12.0	6.0	1.5
80	13.5	7.5	15.5	1.5
		Av.		
82	9.0	7.0	13.0	1.5
			Av.	
84	3.0	11.5	18.0	5.5
86	2.0	9.5	7.5	6.5
88	2.0	9.0	14.0	11.5
90	0.5	6.0	11.0	13.5
92		7.5	5.0	12.0
				Av.
94		3.0	1.5	14.5
96		2.5	1.0	10.0
98		1.5		7.0
100		1.0		8.5
102		0		3.5
104		0		2.0
106		0.5		0
108				1.0
110				

*Data from P. C. Mangelsdorf (unpub.).

**Stunted plants from 32 year old seed (from cold storage) grown in the greenhouse, Waltham, Mass. winter 1972-73.

unprotected. The evolution of kernel-size suppressors would develop in the teosinte genotype in order to allow a freedom to absorb certain amounts of maize germplasm (i.e., mimetic and heterotic traits). That such suppressors may have a pleiotropic effect in reducing pollen size as well is suggested by the following:- The primitive Guatemalan teosintes have larger pollen approaching the size of Bat Cave pollen (Table 1) together with large fruit cases and large staminate spikelets (long glumes suggesting a Chapalote-like tunicate allele and large anthers). The slight shift to the right for pollen size distribution for Bat Cave maize over that of Jutiapa and Lake Retana teosintes from Guatemala is exactly the type of change one might get during domestication. The few grains of the much older fossil pollen could as well be a part of the Jutiapa size distribution as the Bat Cave and Chapalote size distribution.

The Guatemalan teosintes are sometimes considered as more tripsacoid than the Mexican ones. However, the much smaller size of Tripsacum pollen makes this suggestion inconsistent with the pollen-size data. Thus, on a basis of the pollen evidence available so far, the Guatemalan teosinte could represent a relic from a common stem stock that once produced by disruptive selection the sympatric partners, maize and Mexican teosinte. Work continues on a possible pleiotropic effect of certain Mexican teosinte germplasm (especially chromosomes 1 and/or 7) in reducing both pollen and kernel size in maize.

The waxy locus controls the quality of both pollen and endosperm. Other loci controlling the quantity of both pollen and endosperm storage which are not in the category of heterozygous translocations nor in that of defective seed are probable. Thus, pleiotropic suppressors for size of both pollen and kernel such as hypothesized here for present day Mexican teosinte seem possible. The popcorns with small kernels and small pollen may be secondary products of introgression by present-day Mexican teosinte. Maize with large kernels and pollen may have long ago escaped the bonds of this sympatric coexistence in Mexico. In contrast to such pleiotropy, the correlation of pollen size to ear (style) length is thought to be an evolved assemblage. The combination of large pollen and small kernels in certain Guatemalan teosintes and possibly certain primitive maize, not

being intensively subjected to disruptive selection and coevolution, would not be expected to fit such a relationship.

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5. An interchange between two different *Tripsacum* chromosomes that are partially homoeologous to maize chromosome 4.

We have reported previously that several different *Tripsacum* chromosomes carry individual loci assembled on maize chromosome 4 (M4). *Tripsacum* chromosome 7 (Tr7) bears the Su₁ locus in common with the short arm of M4 while Tr13 bears the Gl₃ locus in common with the long arm of M4. Neither Tr7 nor Tr13 carries certain other M4 loci tested (ra₃, bm₃, i₂). We have reported the pachytene morphology of Tr7 and Tr13 in the 20+2 condition (MNL44:126-128, 1970 and Ann. Rev. Gen. 5:470, 1971).

Tr7 and Tr13 were combined in the 20+1+1 condition on su gl₃ maize for pairing studies by selecting for the Su^d and Gl₃^f combinations. After four generations of inbreeding, we collected cytological material from 38 of the double dominant plants in 1971. In six plants carrying the standard knobless Tr7 (Su^d) and standard knobbed Tr13 (Gl₃^f), we did not observe any pairing between them although they were occasionally observed in close proximity at pachytene. However, one family of the Tr7-Tr13 combination carried two knobbed but different *Tripsacum* chromosomes. Thus, we suspected that the originally knobless Tr7 had acquired a knob from Tr13 by an interchange during an earlier generation.

To determine if the Tr7 chromosome had acquired this knob from Tr13, we made cytological collections from the Su^d gl₃ phenotypes segregating in this family which would be 20+1 carrying the Su^d marked Tr7 but not the Gl₃^f marked Tr13. These 20+1 individuals did indeed carry a knob on their extra Tr7 chromosome.

The reciprocal event producing a knobless Tr13 was recovered in some of the Gl₃^f 20+1 segregates from an earlier generation of this line in which Gl₃^f showed an abrupt increase in transmission frequency, as described last year (MNL 46:114-115, 1972). Furthermore, we have now recovered all four possible combinations of the knobbed and knobless forms of Tr7 and Tr13 from these 20M + 1Tr7 + 1Tr13 families. When both *Tripsacum* chromosomes were knobbed or both were knobless, one was longer than the other as in