Relationship Between Chromosome Knob Number and Yield in Corn.

In a study of the races of corn in Mexico it was found that races which were derived from the intercrossing of two other races in general had a higher chromosome knob number than the average of the putative parents. In certain races of hybrid origin the knob number was higher than either one of the parents. This led us to believe that there might be some relation between chromosome knob numbers and yield.

In order to obtain more precise data on this relationship, knob numbers were counted in lines of high and low combining ability (as determined in top-crosses on two different testers) from each of 12 different open-pollinated varieties. The average chromosome knob number of the high combiners compared to that of the low combiners within each of these 12 different varieties may be seen in Table 1.

Table 1. Average Number of Chromosome Knobs in High and Low Combining Inbred Lines from 12 Different Varieties.

	Arg	B I	Gto.20	Gto.29	Gto.58	Gto.61	Jal.35	Jal.37	Jal.58	Jal.99	L II	M30
High	6.29	6.28	4.23	4.92	3.95	6.51	3.49	6.05	5.14	6.57	4.89	9.1
Low	5.20	4.13	5.82	3.70	3.80	5.85	5.38	4.85	3.16	4.96	4.28	
Diff.	1.09	2.15	-1.59	1.22	0.15	0.66	-1.89	1.20	1.98	1.61	0.25	4.8

Mean = 0.97 ± .47

The number of high or low combiners involved in the counts for each of the varieties varied from 2 to 6. It is evident from the table that the lines with high combining ability have a higher average knob number in all the varieties except varieties 3 and 7. The average difference is 0.97 ± 0.47. Although the differences are very small in some of the varieties, the data clearly indicate some relationship between knob number-and combining ability.

Why this relationship should exist we are not sure. It could be that the knobs themselves have some useful purpose or they merely may be associated with germplasm obtained from Teocinte or Tripsacum that has some favorable effect on yield.

Corn is grown in Mexico from sea-level up to 10,000 feet elevation. The high knobbed Tripsacums and Teocintes are generally found at the lower elevations up to 5,000 feet. The varieties of corn listed in Table 1 are all best adapted to the intermediate elevations of around 5,000 feet and could well have obtained much of their drought resistance and general toughness, or ability to produce under adverse conditions, from Teosinte or Tripsacum.

Table 2. Average Knob Numbers of High Combining Inbred Lines Compared to the Varieties From Which They Were Derived at High Altitude.

	1	2	3	4	5	6	7	8	9	10	11	12	13
Variety	6.40	5.51	5.74	5.86	6.28	5.58	4.26	5.22	4.90	5.47	3.98	5.04	5.01

Lines	7.68	3.53	5.13	4.24	2.57	5.39	3.61	2.53	5.70	3.62	3.05	4.37	5.68
	-1.28	1.98	0.61	1.52	3.71	0.19	0.65	2.69	-0.80	1.85	0.93	0.67	-0.67

Mean = 0.93 ± .39

Table 2 shows data obtained with a different type of corn at high altitude. In this table average knob numbers of the high combining inbred as obtained from inbreeding and testing at 7,500 feet elevation, are compared to the knob number of the open-pollinated varieties from which they were derived. In ten out of the 13 comparisons, the average knob number of the high combining lines was lower than the knob number of the varieties from which they came. The average difference of all the comparisons is 0.93 ± .39. The 13 varieties involved in the comparisons were all late varieties from the race Chalqueño and the majority of them were best adapted to an elevation of 6,000 feet slightly lower than the station where the inbreeding and testing were done. It is apparent that selection for high combining ability at 7,500 feet elevation resulted in a reduction in chromosome knobs. If knobs are associated with Tripsacum germplasm and are indicative of the amount of Tripsacum or Teocinte introgression into the different varieties, then we might expect selection for high combining ability at high altitudes to have a tendency to eliminate knobs since Tripsacum is primarily a tropical plant and not well adapted to elevations of 7,500 feet.

In conclusion, these data suggest that there is a relationship between knob number and yield factors. At low altitude the high knobbed inbred lines tend to be better combiners than the low knobbed ones. At high altitude the reverse seems to be true; the low knobbed lines tend to be the best combiners.

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