Phenotypic Characterization of Maize/Teosinte Hybrids After 25-Year and 50-Year Selection Experiments for Perenniality

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ABSTRACT

Two long-term selection experiments for perenniality were conducted in field plots in Salinas, California. For the 25-year selection experiment, *Zea diploperennis* was crossed to a stiff-stalk-derived inbred maize line, approximately 1,000 F1 plants were grown in isolation, and perennialism or attributes associated with perennialism were selected for. When the selected perennial phenotype was strong enough, plants were backcrossed to the maize inbred line. Generally, the perennial phenotype was lost after backcrossing but was restored after further generations of selection. For the 50-year selection experiment, *Zea perennis* was crossed to an unknown line of tetraploid maize, approximately 1,000 F1 plants were grown in isolation, and perennialism was selected for as in the 25-year selection experiment. Multiple generations of selection for perennialism were done before backcrossing to tetraploid Synthetic B maize lines. Similar to the 25-year selection experiment, perennialism was generally lost after backcrossing but could be restored after generations of selection. Both selection experiments produced populations that were ⅞ maize and ⅛ *Z. diploperennis* or *perennis*. Seed was also obtained from Lawrence Carlson who worked with *Z. diploperennis*/maize hybrids in Minnesota. He selected for perenniality with day length adaptation. Eighty seeds from the Shaver tetraploid population, 40 seeds from the Shaver diploid population, and 20 seeds from the Carlson diploid population were planted in April 2013 in Athens, Georgia for phenotypic characterization.

METHODS

Label	Description	Crossing History
CC1	Shaver 4X	Perenniality selected for in open-pollinating field for multiple generations; when perenniality phenotype strong, backcrossed to 4X Synthetic B maize
CC2	Shaver 2X	Perenniality selected for in open-pollinating field for multiple generations; when perenniality phenotype strong, backcrossed to agronomic maize inbred
CC8	50% per	F1 from cross between 4X Synthetic B and *Z. perennis*
CC7	75% diplo	BC1 from cross between B73 and Z. diploperennis
CC3	75% diplo	Long-term selection by Lawrence Carlson in Minnesota; F1 from cross between Minnesota Hybrid and B73; adapted for day length

- CC1, CC2, and CC3 plants grown in field in Athens, GA
- CC7 and CC8 plants grown in greenhouse in isolation
- All plants flowered late relative to commercial maize lines

RESULTS

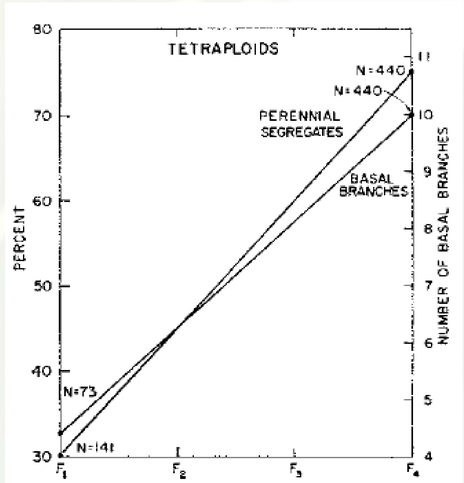

Figure 1. Correlation between percentage of perennial plants and number of basal branches in F1, F2, F3, and F4 plants from parent cross of 4X maize (colchicine induced) and *Z. perennis*. Taken from Shaver (1964) Genetics, 50:393-406.

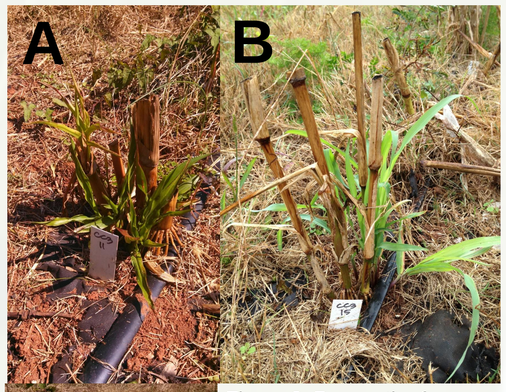

Figure 2. Regrowth of maize-teosinte hybrids after cut back. (A) Carlson diploid plant showing regrowth two weeks after cut back. Went on to produce ears and tassels. (B) Carlson diploid plant showing regrowth four weeks after cut back. (C) Shaver tetraploid plant showing regrowth two weeks after cut back. Went on to produce ears and tassels.

RESULTS

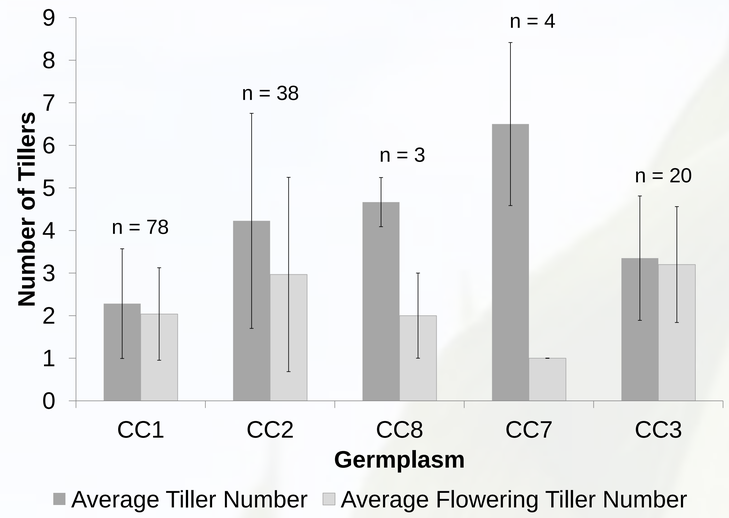

Figure 3. Total tiller number and number of flowering tillers for different hybrid germplasm. Sample size and standard deviation indicated at top of bars.

REFERENCES

Shaver, DL (1964) Perennialism in Zea, *Genetics*, 50:393-406.
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