

Comparison of cold test data with cold wave tolerance of young maize seedlings —

Cold tests have commonly been used in maize to determine genotypes tolerant to low temperatures at the time of germination. The study reported herein was conducted to evaluate the growth behavior of three adapted hybrids of maize (MvTC290, MvSC429 and MvSC598) grown in a phytotron with three-day periods of 5 to 15°C temperatures starting on the 8th, 15th and 22nd days after germination and to compare these observations with the corresponding data on cold test germination.

Observations on ten seedlings of each of the three hybrids on the 36th day of growth in the chamber, along with the cold test data, have been presented in Table 1. It can be seen that the hybrid MvTC290, belonging to early maturity

Table 1. Mean observations on cold wave tolerance and cold test germination.

| Character              | Hybrid  |         |         |
|------------------------|---------|---------|---------|
|                        | MvTC290 | MvSC429 | MvSC598 |
| Cold wave tolerance    |         |         |         |
| Greenness counts       | 4.9     | 4.6     | 2.6     |
| Total leaves           | 6.9     | 6.9     | 7.0     |
| Plant height (cm)      | 56.4    | 59.2    | 54.3    |
| Fresh weight (g)       | 12.2    | 13.5    | 10.7    |
| Dry weight (g)         | 1.1     | 1.3     | 1.0     |
| Cold test germination* |         |         |         |
| CT-value               | 2.2     | 3.3     | 1.6     |
| Emergence (%)          | 46.0    | 66.0    | 40.0    |
| Days of incubation     | 21.0    | 20.0    | 25.0    |

\*For the procedure adapted see Gupta and Kovács (Euphytica 24, No. 1, 1975).

group, had maximum greenness counts (arbitrary scores from 0 for completely yellow to 5 for deep green) after having been cold-treated three times. The hybrid MvSC429, belonging to a medium maturity group, had a mean greenness count of 4.6, slightly lower than that of the early hybrid. The late hybrid MvSC598, however, had a mean greenness count of only 2.6, indicating poorer chlorophyll synthesis (i.e., far lower tolerance to cold temperatures).

The number of seedling leaves varied little if any among the hybrids. Plant height, fresh weight and dry weight measurements of the young seedlings demonstrated that the hybrid MvSC429 exhibited the most cold tolerance, followed by MvTC290 and MvSC598; this sequence corresponds to that observed in the low-temperature germination tests. Thus, there seems to be the same genetic mechanism

working for cold tolerance in maize both at the time of germination and at the seedling stage.

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Morphological and physiological analysis of d alleles — To characterize the d alleles of maize, mature plants of d, d-Tall, the  $F_1$  between d-Tall and d and the heterozygotes +/d and +/d-T were compared with respect to total height, leaf length and area, and internode length and diameter. The data suggest regression of the  $F_1$  toward the d-T parent, even when heterosis is taken into account. It is interesting that the leaf area comparisons show that only d plants differ from the heterozygotes.

Data for sixth node down from tassel

|                                      | <u>+/d-T</u> | <u>+/d</u> | <u>d-T</u> | $F_1$  | <u>d</u> |
|--------------------------------------|--------------|------------|------------|--------|----------|
| internode length (cm)<br>(nodes 5-6) | 16.79        | 15.41      | 6.08       | 8.25   | 6.15     |
| internode diameter (cm)<br>(node 6)  | 1.36         | 1.56       | 1.35       | 1.32   | 1.17     |
| leaf length (cm)                     | 88.29        | 81.13      | 60.00      | 79.33  | 58.17    |
| leaf area (cm <sup>2</sup> )         | 565.75       | 450.00     | 442.92     | 539.08 | 339.33   |

Total height (first node to tassel top) measurements show d-T plants to be 20 cm taller than d plants and the  $F_1$  to be 13 cm taller than d-T; the +/d plants are 30 cm shorter than +/d-T plants. These data support the inference that d-T is a leaky mutant and that the function or structure of the protein involved is not as completely impaired as in d.

Morphological comparisons of four-day-old GA-treated coleoptiles and mesocotyls revealed a difference in the response of the two alleles to GA. The coleoptiles of d-T do not respond, but the mesocotyls do; in d, both respond. Measurements on 12-day-old GA-treated seedlings revealed similar responses by both alleles.

Biochemical analyses of coleoptiles and mesocotyls for RNA, amylases and peroxidases are in progress. Preliminary data indicate a difference in amylase activity when expressed as mg of starch converted per 20 minutes per mg of protein. Peroxidase electrophoretic patterns show a distinct difference between alleles and in response to GA. Ribosomal RNA shows no difference in the ratio of smaller molecular weight to larger molecular weight species.

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