COLD TOLERANCE OF SEED FROM INBRED MAIZE LINES SOWN AT VARIOUS SOWING DATES IN DIFFERENT YEARS

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Introduction

Maize, which is of tropical origin, often suffers from cold stress in early spring when grown under a continental climate. This stress may affect either the seed in the cold soil, or young plants after emergence. The inbred lines used as parental components when producing hybrid maize seed are particularly sensitive to cold stress. Nevertheless, if the inbred lines have sufficient genetic cold tolerance, seed producers endeavour to sow the seed as early as possible in order to make good use of the available vegetation period and, perhaps more importantly, to ensure that flowering takes place before the plants are exposed to heat stress. Numerous methods have been used to test the cold tolerance of maize (Tatum 1942, Neal 1950, Hoppe 1951, Clark 1954, Kovács 1961) and, though they are not uniform and were mainly designed to determined seed quality, they can also be used to demonstrate genetic differences (Herczegh 1978). The results achieved with these methods have shown that different genotypes have diverse levels of cold tolerance for a number of parameters (Marton et al. 1997, Marton 1991, Kovács et al. 1992, Marton and Kuti 2002, Marton 2000, Páldi et al. 1998, Marton et al. 2000, Záborszky et al. 2001).

Material and methods

Eight inbred lines with different genotypes (HMV 09, F564, HMV5226, HMV141, HMV651, HMV5332, HMV5408, HMV5328) were tested in the experiments. The seed originated from two years (2003, 2005) of a sowing date experiment using four sowing dates. The plants were allowed to flower and pollinate naturally, so that grain yield and grain moisture at harvest could be evaluated. Although this meant that only 50% of the genetic background of the genotypes included in the cold tolerance experiment was known, it has been shown by many authors that maternal effects are dominant in the inheritance of cold tolerance (Grogan 1970, Persev 1970, Pinell 1949, Ivakhnyenko 1979). Seed originating from various sowing date treatments in two years were sown with or without seed dressing under cold conditions in the phytotron, and data were collected on the emergence percentage, plant height and dry matter content. The experiment was conducted in a PGV-36 growth chamber in the phytotron of the Agricultural Research Institute of the Hungarian Academy of Sciences. The plants were sown in wooden boxes measuring 20×30 cm, into which a 10 cm layer of a soil/compost mixture was firmly pressed. Ten seeds were sown in each row. The seed dressing agent Maxim was used to treat the seeds. The soil was moistened to 70% water capacity, after which the seeds were covered with a 4 cm layer of quartz sand to prevent soil cracking. The boxes were covered with polythene prior to emergence to prevent water loss, after which the quantity of water lost was replaced after weight measurements. The experiment was carried out with two true replications. During the first ten days the temperature in the chamber was

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+8°C, followed by 20 days at 13.5°C. The relative humidity was 75% during the day and 70% at night. The maximum illumination level was 20 klx, with a third of the lamps lit from 6–16 hours, a third from 7–17 hours and a third from 8–18 hours.

Results and discussion

The grand experimental mean for the emergence percentage was 84.5%. The genotype was found to have a significant effect on this trait, the best emergence being observed for F564 (92.8%) and the poorest for HMV5226 (76.6%) (Fig. 1).

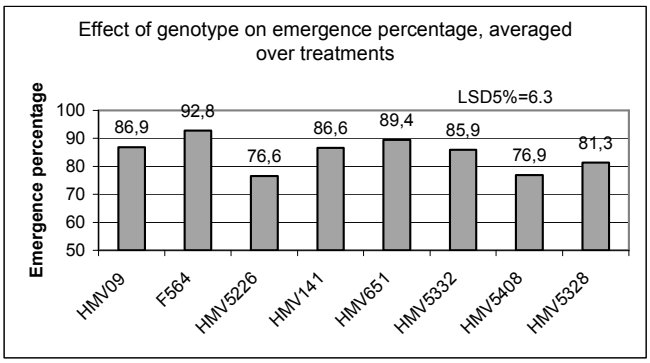

Fig. 1. Effect of genotype on emergence percentage, averaged over treatments

Seed dressing also had a significant effect on emergence percentage, which averaged 87.3% for dressed seed and 81.7% in the undressed treatment. The year and the sowing date treatment from which the seeds originated did not have a significant effect on the emergence percentage, though this does not mean that the emergence percentage is not influenced by the year. There was a difference of two years between the two growing seasons (2003, 2005). The germination percentage did not decrease significantly during this period (84.1% in 2003, 84.9% in 2005). Plant height was significantly influenced by genotype (Fig. 2), year and seed dressing, but not by the sowing date treatment from which the seed originated.

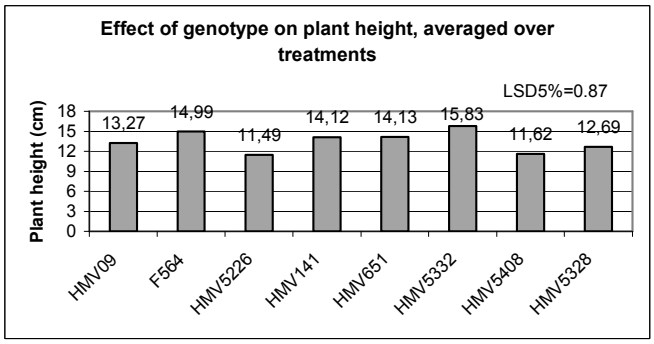

Fig. 2. Effect of genotype on plant height, averaged over treatments