

PLASTICITY OF SOYBEAN (*GLYCINE MAX* (L.) MERRILL) ROOT DEVELOPMENT UNDER MILD WATER DEFICITS

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ABSTRACT

Drought is the major abiotic factor limiting soybean yield in the US. Under water deficit conditions, root systems may exhibit developmental plasticity resulting in morphological changes that extend the water-absorbing surface area of the roots. The objective of this study was to identify soybean genotypes which exhibit genetic diversity in root system developmental plasticity in response to water deficits, in order to enable physiological and genetic analyses of the regulatory mechanisms involved.

Studies were conducted both at the seedling stage under precisely-controlled water deficits, and during three-week soil drying treatments of plants growing in 1.5 m-deep soil cylinders in controlled-environment chambers. Using the seedling system, 11 soybean genotypes selected from both domestic and Plant Introduction lines were studied. The results showed substantial genetic diversity in the capacity for increased lateral root development (number and total length of roots produced) and in the responses of overall root and shoot growth under water deficit conditions. Studies of the spatial and temporal patterns of lateral root development showed that the promotion of lateral root length under water deficit conditions was due to an increased root production rate rather than earlier initiation or promotion of root elongation. Genotypes with either superior or inferior root plasticity responses at the seedling stage were selected for more detailed studies using the deeper soil cylinder system with more mature plants. The results showed consistent genetic differences in lateral root developmental plasticity under water deficit conditions between the seedling and more mature plant systems.