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Varietal Differences in Growth Response of Soybean to Soil Moisture Depletion

Yushi HIDA, Tadashi HIRASAWA and Kuni ISHIHARA

- 1) Faculty of Agriculture, Tokyo University of Agriculture and Technology
- 2) Faculty of Agriculture, Tokyo University of Agriculture and Technology
- 3) Faculty of Agriculture, Tokyo University of Agriculture and Technology

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Abstract:

Crop plants suffer water deficits when soil moisture is depleted significantly throughout the rhizosphere and even when only surface soil moisture decreases rapidly after they have been grown under humid conditions. For breeding drought-tolerant varieties, it is necessary to clarify the physiological, ecological and morphological characteristics of the varieties which can attain a high and reliable yield under both conditions. We compared dry matter and grain production among 34 soybean cultivars under conditions where soil moisture was depleted gradually after the emergence of seedlings in the field. The decrease in dry matter and grain productions was less in the early maturing cultivars than in the late maturing cultivars. Significant differences in the decrease were also observed among the cultivars classified into the same ecotype or maturity group. Then, cultivars, classified into the same ecotype and growth habit but different in the decrease, were grown in a row alternatively under deficient soil moisture conditions. The reductions in leaf xylem water potential and photosynthetic rate during the daytime were less and leaf expansion was less suppressed in the cultivars, which attained less decreased dry matter and grain productions. These cultivars were expected to have developed expansive root systems from the results of higher pre-dawn leaf xylem water potentials. Expansive root system development might be a common characteristic in drought-tolerant cultivars.

Keywords:

Drought tolerance, Dry matter production, Grain yield, Pre-dawn leaf xylem water potential, Root system, Soil moisture, Soybean cultivar, Water deficits

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