

P266

Effects of different soil moisture conditions on growth, yield and stress index of adzuki bean from paddy field cultivation

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Abstract

Accurate and optimal water supply to cereal crop is critical in growing stalks and producing maximum yields. Excessive soil moisture may cause nutrient deficiencies and oxygen deficiency. Excessive soil water during crop growth stages results in decrease of yields. In Korea, the largest agricultural lands are paddy fields. Recently, upland crops are cultivated in paddy field soils to reduce overproduced rice in Korea. In order to success this policy, it is necessary to fully understand crop response to excessive soil moisture condition from paddy field soils. Adzuki bean is one of major legumes which provide protein in daily diet. Adzuki bean has been well know its weakness to excessive soil moisture condition, In order to obtain optimal yields of adzuki bean from paddy field cultivation, it is necessary to understand response of adzuki bean under different soil moisture conditions. This study investigated characteristics of growths, yields and response degree of water stress from adzuki bean. Three cultivars were selected for this study; Chungju, Hongoon, and Arari. All adzuki beans were cultivated in a paddy field which was divided into three sections with different soil moistures. The paddy field was located in Milyang, Gyeongsangnam during 2016. One section of the paddy field had the greatest average soil moisture content as 35.1% during adzuki bean cultivation (very poor). The second greatest soil moisture section had 32.6% (somewhat poor) and the smallest soil moisture section had 28.9% of soil moisture (somewhat well). During cultivation of three cultivar adzuki beans, soil moisture contents and groundwater levels were monitored. All the characteristics of growth and yield components were measured; height, thickness, 100 seed weights etc. Stress index values were calculated by Stress Day Index (SDI). All cultivars had the greatest yields from somewhat well section. Chungju had the greatest yields throughout all three sections compared to other cultivars. Chungju had 81% greater yield than Hongoon which had the smallest yield from somewhat well section. Arari set in middle from all sections. However there was no significant differences yields from very poor and somewhat poor sections. Leaf SPAD values tended to decrease and stable carbon isotope values increased as soil moisture increased. However, Chungju had no difference across different soil moistures in SPAD and stable carbon isotope values, while Hongoon had the greatest differences across sections. These trends followed by SDI values. Chungju had the smallest SDI values compared to other cultivars, which meant that Chungju was the strongest tolerance against excessive soil moisture than other cultivars. All three cultivars showed severe decrease of yields from very poor and somewhat poor sections. Arari and Hongoon showed great decrease from somewhat well section compared to yields from upland soil. These two cultivars may not be proper cultivating in paddy fields. In conclusion, adzuki bean is very sensitive to soil moisture condition and detailed soil managements are required to obtain optimal yields of adzuki bean from paddy field cultivation.

Keywords: adzuki bean, soil moisture, paddy field, stress day index

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