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The Growth Response of Soybeans by Integrated Subsurface Drip Irrigation and Drainage System

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[Introduction]

Soybean has a great water requirement while it is more vulnerable to drought and wet injury than other upland crops. Therefore irrigation and drainage management is very important and it is a critical environmental factor in soybean cultivation and yield. Therefore, this study investigated growth and yield changes of soybean under an integration technology of irrigation and drainage.

[Materials and Methods]

This study tested three water management methods (i) Subsurface Drip Irrigation (SDI), (ii) Trenchless Subsurface Drainage method (TSDM) and (iii) Intergration of Irrigation and Drainage (IID). SDI pipes had 20cm of a drip space, 2.3L/hr of discharge properties, and the SDI pipes were buried at 40cm deep and 1.2m apart. TSDM pipes(Ø50mm) wrapped with felt were buried at 80cm and 2.4m apart. IID was installed by laying SDI pipes and TSDM pipes in an intersecting direction. Irrigation efficiency, water productivity, growth and yield of soybean were analyzed by effects of different water management methods.

[Results and Discussion]

Water efficiencies from three water management methods showed that SDI had 126.3% and IID had 80.7%. Results of water productivities were 1.26 from SDI and 0.81 from IID, respectively. Leaf indexes at a flowering period were 1.94 from soybeans with no irrigation treatment, 3.06 from TSDM, 3.35 from SDI and 4.12 from IID which was the greatest value than other water management methods. After comparing yield characteristics, pod numbers per plant, results of seed numbers per pod and 100 seed weight showed statistical differences across treatments. Especially, soybeans from IID had greater 100 seed weights than SDI and TSDM and the ratio of large seed(>7.1mm) was 83.4% from no irrigation treatment and 96.4% from IID. This results represent that IID improved the quality of soybean seeds. Soybean yields were 284.0kg/10a from no irrigation treatment, 329.9kg/10a from TSDM, 384.2kg/10a from SDI and 409.3kg/10a from IID. Compared to the yield of no water treatment, the yield from TSDM increased by 16%, SDI 35% and IID 44%.

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