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Effectiveness Comparison of Pot, Porous Pipe and Gravity Drip Irrigation Methods in the Range of Gravity Pressures

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Introduction: Practical problems such as rushing roots toward pot, difficulty of manually filling with water and deficit irrigation due to permeation from regular pots prevents the development of pot irrigation. With regard to increasing irrigation efficiency importance and preventing water loss to fix the problems of this irrigation method.Changing physical structure of pot could solve many problems and issues which this irrigation technique is facing. Comparison of the two major characteristics of localized irrigation hydraulic characteristics (coefficient of variation and distribution uniformity) and also using gravity pressure can achieve a solution for water and energy shortage problems. So far, with knowledge of the role of water pressure at gravitational pressures in hydraulicproperties of these methods, some effective features in these methods application is specified.

Material and Methods: This study was carried out in randomized complete block at water engineering department of Sari Agriculture Science and Natural Resources university laboratory from September to December 2015. In this study, in the form of randomized complete block, hydraulic specifications of three treatments of pot irrigation, gravity drip irrigation and porous pipe irrigation investigated under water pressure of 0.5, 1.5 and 3 m. In each of the water column pressure, output water volume from 10 samples of each irrigation method treatments calculated from 7 replicates during one hour in about two months. Porous pipes which used in this study were imported 16mm sample pipes from Anahita Company. GDI gravitational emitter model, porous pipe and containers made of cellulose clay pots in the form of cylinder shape with diameter of 15 cm were used. Thus, within one hour of irrigation, water volume withdrawn from tested samples under constant pressure of irrigation were collected by suitable containers and measured by graded container and flow rate of each samples were calculated. Christensen distribution uniformity coefficient was calculated with Christensen distribution uniformity coefficient formula. Based on USA agronomical engineers, a pointed emitters with variation coefficient less than 0.05 is good, with cv of 0.05-0.10 is medium and with cv of 0.10-0.15 is weak. After calculating evaluation parameters, the results were analyzed with SPSS statistical software and Tukey test at 1 %and 5 % level of probability.

Results and Discussion: The results of statistical analysis of randomized complete block design and mean comparison of different level of treatments effects with Duncan test (irrigation method treatment and water pressure treatment) at 5 %level of probability showed that maximum distribution uniformity achieved in gravitational drip irrigation among samples. With increasing pressure, coefficient of variation was less affected and at lower pressures, coefficient of variation among tested samples were more evident. In addition, it is indicated that increasing pressure have maximum effect on flow rate and distribution uniformity increment while with increasing pressure, minimum changes observed in coefficient of variation. Therefore, among possible gravitational pressures in each project, maximum pressure should be selected for design and implementation. Result showed that in porous pipes and in pressures of 50, 150 and 300 cm, average flow rate were 0.31, 1.4 and 4.2 liter per hour in meter, average coefficient of variation were 0.88, 0.61 and 0.83 and average distribution uniformity were 2.2, 6.2 and 1.6 percent, respectively. In the main-treatment and in each pressure sub-treatment, samples flow rate changes at different replicates is so high that coefficient of variation was more than conventional coefficient (more than 0.6) and thus classified in unacceptable emitters. In this treatment, distribution uniformity was so low that using this irrigation method at gravitational pressures range cannot be recommended. Based on statistical analysis results, it is indicated that increasing pressure in gravitational drip irrigation have maximum effect and in pot irrigation, have minimum effect on flow rate changes, and in addition, maximum distribution uniformity among samples was in gravitational drip irrigation while in porous pipe irrigation besides high coefficient of variation, minimum

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distribution uniformity among samples were observed.

Conclusion: Due to the high influence of pressure changes in gravitational pressures on hydraulic characteristics of mentioned three irrigation method, among investigated gravitational pressures in this study, pressure of 3m as appropriate pressure at gravitational pressures and among localized irrigation methods, gravitational drip irrigation were recommended. It is recommended to paying attention to the development of gravitational drip irrigation application in large-scale garden and agriculture projects with positive approach.

Keywords: Coefficient of Variation Manufacturing, Distribution Uniformity, Gravitational Pressurized Irrigation