IMPROVEMENT OF ON-FARM IRRIGATION WATER USE EFFICIENCY BASED ON RECENT APPROACHES

By

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B.Sc., Agricultural Engineering, Ain Shams University, 2009

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ABSTRACT

Rania Gamal Ebrahim Mostafa: Improvement of on-Farm Irrigation Water Use Efficiency Based on Recent Approaches. Unpublished M.Sc. Thesis, Department of Agricultural Engineering, Ain Shams University, 2016.

The field experiment was conducted at Wadi El-Natroon station of Water Management Research Institute, El-Behera Governorate, Egypt, to study the effect of surface and subsurface drip irrigation on onion yield and which would be the most appropriate irrigation level with effective depth of drip tape line and plant population.

Data reviewed that onion yield production has been increased by about 15-25 % under surface drip comparing with sub-surface drip. Moreover, water saving had been increased by about 27% by using a developed criteria compared with a traditional calculation way of crop water requirement (Cropwat 8.1, FAO). In addition, WUE had been improved by using the developed criteria, besides bulb size that called marketable yield was highest by using surface drip irrigation with a developed criteria.

The obtained results revealed that: A clear difference is noticed between the calculated values of a developed criteria data range and the traditional method FAO. In the same time, the data recorded in two successive seasons, data show that surface drip irrigation was better than subsurface drip with 6 rows per lateral and had a mixed sizing bulb although 4 row per lateral had a large bulbs and 8 row per lateral had a small bulbs almost.

The highest values of K_c in the initial stage was 0.78 and 0.76, in the mid-season was 1.15, 1.14 and 1.13and the end stage 1.15, 1.02 and 0.93respectively.

The highest values of ks in initial stages was 1.1 and 1 , in mid-stages was 0.99 and 0.96 and in the ending stage was 0.96 and 0.94.

The tendency of water distribution and its average content in the soil profile increase relevant to the irrigation under the CROPWAT 8.1 comparing with A developed criteria.

Keywords: Onion, Drip irrigation, Surface and subsurface drip irrigation, Water regime, Plant population, Vegetable crops. Agricultural water productivity, A developed criteria.

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I. INTRODUCTION

Egyptian agricultural development processes depends entirely, on the water conveyed by River Nile. This water represents about 97% of the natural water resources of Egypt and about 68% of Egypt's water footprint. Owing to the accord of 1959, Egypt's share of Nile water was determined by 55.5 billion cubic meters annually as a limited constant share. Recently, the Egyptian per capita share diminished to 620 m^3 /year, so they are under the water poverty line (1000m^3 / year) in the present time **(FAO 2008)**. The Egyptian rapid population increase and the distinguished sustainable agricultural development strategy and attributed policies multiplies the stresses on water supplies by more water requirements and increased irrigation water use efficiencies to meet higher food demands.

Hereby, agricultural water should be utilized as a rare commodity. Lot of procedures could be followed to maximize the water use efficiency, some of them are related to the soil, and some are related to the plant, and others belong to on-farm irrigation systems themself. One of the most important challenges facing sustainable agriculture is to provide crops with optimal quantity of water and nutrients efficiently based on it's need throughout the growing season with efficient method possible. Therefore, pressurized irrigation systems in general and drip irrigation systems in particular may be considered as a curcial way for this regard, this may be due to improve on-farm water use efficiency and rationalize irrigation water. Moreover, the adaptation of calculated method of the required applied amount of appropriate irrigation water to the plant needs within different growth stages, would save any losses of water and give the plant the precise essential needs of water and nutrients for its optimal growth and production.

INTRODUCTION

Onion is considered as one of the most important vegetable crops grown in the world, However, Egypt is 7th of the largest producer of onions in the world**(FAO 2008)** due to its medical and fresh uses for human health, as well as, its potentiality for expert it. Water management of onion crop has a significant effect on its production. Both, irrigation system, water management and level of deficit conditions, the applied technology and its management processes have a significant effect on onion's productivity and quality.

Therefore, the aims of this study were to:

- Evaluate the response of onion crop to different drip irrigation systems and the levels of deficit irrigation.
- Investigate the effective buried depth of lateral for subsurface drip irrigation systems and its effect on onion crop yield and quality.
- Investigate water and agronomical technologies management on onion yield and quality.

2. REVIEW OF LITERRATURE

2.1. Definitions of Irrigation:

Su and Midmore (2005) defined irrigation as an age-old practice and has been continuously refined to meet different requirements.

El-Gindy (2007) said that irrigation is generally known that the process of adding water to the root zone of the plant to cover the water needs of the crisis for growing with the leaching of salts to maintain the level of salt in the appropriate limits to give higher yield but he also define the irrigation methods as supply ground water either flooding irrigation or in the form of falling water droplets on the surface as in spray irrigation or plug next to the plant, as in irrigation objective or from the bottom of the root zone as in the sub-surface irrigation.

So, on-farm irrigation methods is as following:-

1. Surface (gravity) irrigation.
2. Pressurized irrigation (sprinkler irrigation – localized irrigation).
3. Sub-irrigation.

The types of pressurized irrigation is (surface drip irrigation-subsurface drip irrigation, bubbler system – mini sprinkler or micro-jet spray).

Larry (2007) said that the objective of irrigation is to maintain a favorable plant water environment to optimize crop growth.

Childs (2010) indicated that "irrigation system" means any device or combination of devices having a hose, pipe, or other conduit which connects directly to any source of ground or surface water, through which water or a mixture of water and chemicals is drawn and applied to land, crops or plants. The term does not include any hand-held sprayer or other similar device which is constructed so that an interruption in water flow automatically prevents any backflow into the water source.