MANAGEMENT OF BUBBLER IRRIGATION SYSTEM IN FRUIT ORCHARD

By

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B.Sc. Agric. Eng., Faculty of Agric., Ain Shams University, 2009

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ABSTRACT

Shereen Mamdouh Abdallah Ahmed. Management of Bubbler Irrigation System in Fruit Orchard. Unpublished M.Sc. Thesis, Department of Agricultural Engineering. Faculty of Agriculture, Ain Shams University, 2017.

The main objective of this study aims at determining an appropriate bubbler system for palm trees (*Phoenix dactylifera*) age four years in El-Wady El-Geded Governorate. The three types of bubbler were tested to select a proper type for palm trees and compared with "Basin Irrigation system" in two successive growing seasons (2013-2014) - (2014-2015). Laboratory and field tests were carried out to determine engineering and hydraulic characteristics of the selected bubbler type. The selected bubbler discharge was 62 L\h at 1.5 bar, with 0.04 coefficient variation of variation and distribution uniformity 94.5%. Water saving by using selected bubbler of 50% was obtained compared with basin irrigation system. Effect of using selected bubbler on vegetative properties for date palm was determined. The leaf length, number of bunches, pinnae length, number of pinna, length of trunk and trunk diameter were measured and recorded for selected bubbler and basin irrigation system. The soil under bubbler irrigation system stored water more efficient than under basin one in soil root zone. The annual costs increased under basin irrigation system and the annual costs decrease by using the bubbler irrigation system about 38%.

Keywords: Palm trees, Basin Irrigation System, Water Management, hydraulic properties, Water Saving

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INTRODUCTION

Limited water resources and The gap between irrigation supply and demand is increasing from year to year are considered as the main challenge facing agricultural development and sustainability in Egypt. Adding for new water resources is too difficult and very expensive process, so the shortest way is to maximize the use efficiency throughout optimizing water use efficiency. Bubbler irrigation management under orchard crops consists of system design that can be adopted under different aspects like as areas, weather climate, soil condition and water flow rate/ discharge fruit trees. In some developing countries, high efficiency localized irrigation method and attributed systems: drip, bubbler and mini sprinkler irrigation are now in applicable, which save the water and produce high yields**.**

Date palm is playing an important role in the Egyptian agriculture and represents a significant part in the reclamation program. Besides the nutritional values and health benefits of the fruits, the date palm by-products are daily used by Egyptians. Adaption of date palm to water stress made it as one of the first fruit trees distribution and taken into cultivation in arid and semi-arid regions of Egypt **(Bekheet, 2013)**.

Date palm tree are grown all-over Egyptian lands from Alexandria North up to Aswan South and from Red sea east up to the New Valley and the Oases in the west. In addition, date palm trees considered the most successful fruit tree to be cultivated land in Toshki, El-Ewinates and Sinai areas. The total number of palm planted in Egypt is 16 million including 12 million fruiting tree **(FAO STAT, 2009)**.

The date palm tree tolerates relatively harsh climatic and soil conditions under which no other crop will give reasonable returns. It is an irreplaceable tree in irrigable desert lands, providing protection to under-crops from heat, wind and other threats and plays a big role in combating desertification **(Mohammad 2010).**

INTRODUCTION

Most date palm farmers in the Arab countries, inducing Egypt, care little about irrigation**.** They believe that date palms can grow and bear fruits under drought conditions and do not require much irrigation. But all studies indicated that date palm must fulfill their water needs to grow and produce quality fruit and yield. In general, the date Palm irrigation water requirement needs more advanced studying use up-to-date calculation under different environmental conditions. Most of the date palms in Egypt are grown under traditional farming system and are suffer from shortage of irrigation water and, therefore, have few green leaves. Moreover, efficient fertilization depends mainly on irrigation because nutrients are absorbed well when the trees are given sufficient irrigation water. In Egypt research on design, implementation and management of water application methods for the date are needed palm **(FAO, 2008)**.

This research aims to study some of the engineering factors affecting the performance of the bubbler irrigation system compared traditional irrigation system under operating conditions, in terms of:

1) Study the performance of bubbler hydraulic parameters,
2) Determine the irrigation requirements for date palms depend on climate data of El-Dakhla area,
3) Effect of different irrigation systems on water saving and vegetative properties for date palm,
4) Effect of different irrigation systems on water distribution around root zoon of date palm, and
5) Operating Economical for used different irrigation systems.

REVIEW OF LITERATURE

2.1. Bubbler irrigation system:

Rawlins (1977); Behoteguy & Thornto (1980); **and Hull (1981)** defined the bubbler irrigation system as type of drip irrigation typically delivers flow rates of 2 to 4 liters per minute through a small diameter polyethylene (P.E) delivery tube attached to a large diameter of corrugated (P.E) pipe (buried lateral).

Hull (1981) illustrated that the bubbler irrigation is very sensitive to changes of pressure head and a constant head _source is essential for a commercial orchard or plantation**.** A change_in pressure. head at the inlet to the system results in non-uniformity of application at each outlet. A pressure head of one meter is very small and small changes in head can thus have a marked effect on the flow rate, which is fixed once the system is installed and is not easily changed.

In this system, water applied through bubblers and there are small emitters placed in the basins which discharge water at the flow rates of 60-240 l/h **(Nakayama and Buck, 1986).**

Habib *et al.* (1992) stated that the discharge uniformity from bubbler irrigation system is controlled by varying the tube diameter and / or length and / or using a valve for each bubbler along lateral-line (Fig. 2-1).

Yitayew *et al.* (1994) showed that the name of the bubbler system is derived from the fountain of water streaming out from that hoses and from the bubbler noise made as air escapes from the pipe line when the system is turned on bubbler irrigation system differ from other micro – irrigation systems low as lm (3.3ft) and do not require elaborate filtration system.

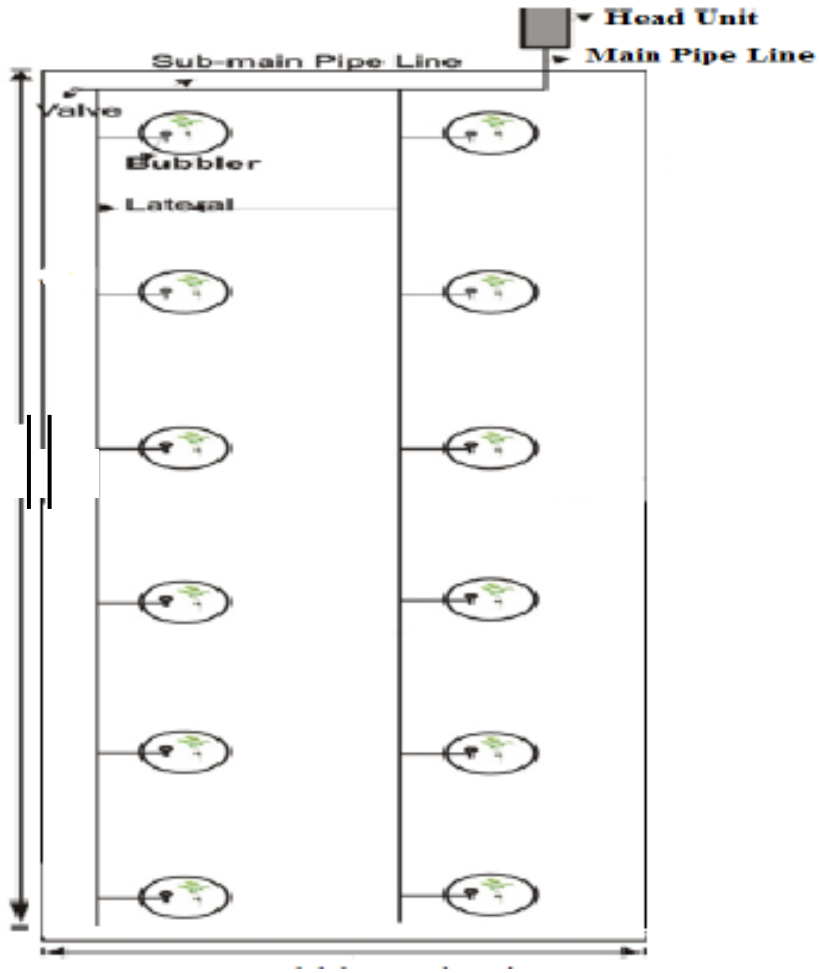

Fig. (2-1) Layout of bubbler irrigation system.

2.1.1. Advantages and disadvantages of bubbler irrigation system:

a- advantages of bubbler irrigation system:

El-Lithy (1998) indicated that the advantages of the bubbler irrigation system include: -

- Bubbler advantage of the wide slots so it does not need a lot of maintenance,
- The ability to more precisely apply nutrients to the tree and lower water application rate,
- Also, the bubbler irrigation system features flexible and adjusted on the trees.

Lamm *et al.* (2006) mentioned some potential advantages compared with other micro irrigation systems, Energy requirements are low – While the annual required depth of water is similar for all micro irrigation systems, the energy needed to apply water by gravity flow bubbler systems is typically less than for other systems. Pressures as low as 10 kPa may be adequate for bubblers, whereas pressures of between 100 to 200 kPa are typical for other micro irrigation emitter types. Maintenance is low – Low-pressure bubbler systems use less equipment, such as filters and pumps, in the control head. Typically, chlorination and acidification are not needed unless poor water quality leads to a buildup of aquatic plants in the system, the degree of clogging of the opening is very low – compared witty other micro irrigation system.

Water with higher suspended solids concentration can be used – The water quality for bubbler systems can be of a lower standard with regard to solids content than that typically needed for most micro irrigation emitters. Filtration is usually not required.

b- Disadvantages of bubbler irrigation system: -

Hull (1981) hull mentioned that the disadvantages of the bubbler irrigation system are.