

**STUDIES ON FERTILIZATION AND IRRIGATION
OF CITRUS CROP IN DESERT REGIONS
AND INFLUENCED BY CLIMATIC
CONDITIONS**

By

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B.Sc. Agric. Sc (Horticulture), Ain Shams University, 2010

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ABSTRACT

Abd El-Atty Mohamed Abu El-Ezz . Studies on Fertilization and Irrigation of Citrus Crop in Desert Regions and Influenced by Climatic Conditions. . Unpublished M.Sc. Thesis, Department of Horticulture, Faculty of Agriculture, Ain Shams University, 2016.

The present study was carried out during 2013 and 2014 seasons on Balady mandarin trees to evaluate two levels of irrigation water (4000 and 5000 m³/fed. / year which equal 24 and 30 m³ / tree/ year respectively) and three NPK levels depending upon fertilizer equal N1: P0.5: K1 i.e. 70-35-70; 90-45-90 and 110-55-110 on growth, yield and fruit quality in desert regions and their influenced by climatic conditions

The obtained data showed that vegetative growth parameters including average shoot length (cm), leaf area (cm²) number of leaves / shoot and shoot thickness (cm) greatly improved with high irrigation level (5000 m³/fed./year) and high NPK fertilization level (110-65-110 units).

Additionally , leaf N, P and K and C/N ratio values were increased with 5000 m³ of water irrigation per fed. and fertilization with NPK at 110-55-110 absolute units per fed. Fruit set of Balady mandarin trees and total yield as kg/tree were increased with high irrigation and fertilization levels.

No significant effect to irrigation level on TSS , acidity and TSS /acid ratio were obtained whereas high irrigation level increased L-ascorbic acid content.

However, NPK fertilization level greatly affected fruit chemical constituents and the great effect was true with medium and high NPK levels.

Keywords: Irrigation, Fertilization, Balady mandarin Vegetative, Growth, Chemical constituents, Fruit quality

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INTRODUCTION

Citrus trees are among the favorite fruit trees grown around Hawai'i's homes. They are relatively small and widely adapted. The main types grown are lemon, lime, orange, mandarin (tangerine), tangelo, grapefruit, and pummelo. Some culinary and ornamental citrus. Citrus is one of the most important fruit tree species in the world, as the fruits are a valuable source of nutrients, vitamins and other antioxidant compounds. It is presumed that during the growing season flowers and fruits compete one another and with vegetative growth for plant metabolites (**Rivas *et al.*,2007**). This competition hypothesis is based mainly on the carbohydrate supply and reserves, which regulate fruit set and subsequent fruit drop (**Rivas *et al.*, 2006**). Fruit set and growth requires large amounts of carbohydrates, which are provided by the photosynthesis of the current season's leaves and/or by the reserves accumulated during the winter. If the requirements exceed the capacity of the tree to supply assimilates, fruitlet abscission is triggered, in order to adjust the final fruit load to carbohydrate supply. **Peter and Tassis (2011)** the most important factors affecting growth of newly planted citrus trees are irrigation and fertilization

Agriculture is the main sector in water demand at the national level. Water allocation in irrigation is about 85% from the total national water. So, effective management at the irrigation sector is the principal way towards the rationalization policy of the country. In this aspect, effective irrigation management on-farm level becomes a must. One of the main procedures to achieve this target is through how much water should be applied by studying water regime of navel orange through investigation which the suitable number of irrigation that gave the best yield and fruit quality and also makes rationalization for irrigation of this crop. The irrigation custom creates different problems to both soil and

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cultivated trees caused by soil water logging, raising soil water table and pathological disorders. So that, calculating water requirements of the conducted research. The research on citrus irrigation has been reviewed by several authors (**Levy *et al* 1978, Garica, 1995 a&b and Lal *et al* 1997**). Fruit set percentage and yield as kg/tree of Washington Navel orange increased with irrigation rate (6000 m³ of water/fed./year).(**El-Sabrou and Kassem,2002**)

Water is essential for citrus trees (or for any plant) because it is an integral component of the biochemical reactions that occur within the plant. Water is also important because it is the carrier that moves plant nutrients and other substances throughout the tree. Water also helps maintain plant temperature through transpiration. Finally, water helps maintain leaf and fruit turgidity The optimum amount of water applied through irrigation had been discussed by different authors, **Koo *et al.*, (1974); Nakhlla *et al.*, (1998)**. The optimum water use efficiency determined by 6.56kg fruit /m³ water for producing Kutdiken cv. Lemon by drip irrigation (**Cevik *et al.*, 1993**). Fruit quality had been highly influenced by irrigation method and the quality had been highly influenced by the irrigation method and the quantity of water applied, **Koo and Reese (1977); Deidda *et at.*, (1994) and Nakhalla *et al.*, (1998)**. The last author indicated that the quality of navel orange fruit was greatly enhanced by drip irrigation applied at 4300 m³ water/fed compared with the surface irrigation at the same amount. Yield of most orange cvs was positively affected by using N via fertigation, **Bedford (1979); Smith *et al.*, (1979); Buck *et al.*,(1982) and Boman (1996)**.

The application of macro-nutrients particularly nitrogen (N), phosphorus (P) and potassium (K) plays important role in yield, as well as fruit quality (**Albrigo, 2002; Storey & Treeby, 2002; Srivastava & Singh, 2009; Hammami *et al.*, 2010; Lester *et al.*, 2010; Liu *et al.*, 2010**),especially N is necessarily needed for optimum vegetative, as well as reproductive growth (**Alva *et al.*,**

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2006). The level of N fertility has more influence on the growth, yield and quality of citrus than any other single plant nutrient (**Thompson *et al.*, 2002**). It is an essential ingredient of chlorophyll, proteins, growth hormones and enzymes and is a building block for fruit production (**Huett, 1996**). P performs many vital functions in the plant photosynthesis, enzyme activity, metabolism and movement of sugars (**Davies & Albrigo, 1994**). It is also important for growth and development of flowers, as well as fruits. Low P contents in leaves have been reported to produce misshaped poor quality 'Kinnow' mandarin fruit with open centers, coarse and thickened peel, low and acidic juice contents (**Raza *et al.*, 1999**). K plays a regulatory role in physiological and bio-chemical processes of citrus plant (**Davies & Albrigo, 1994**). It is involved in the formation and functioning of proteins, fats, carbohydrates, chlorophyll and maintaining the balance of salts and water in plant cells. The K application has also been reported to play important role in the acid metabolism of the citrus juice (**Achilea *et al.*, 2002**). Hence, a balanced supply of N, P and K gives high yield with better citrus fruit quality (**Albrigo, 2002**).

This work aimed to investigate the effect of varying amount of irrigation and N , P and K fertigation on the vegetative growth , yield and chemical constituents of Balady mandarin trees in desert regions and their influenced by climatic conditions .

REVIEW OF LITERATURE

The available review on fertilization and irrigation of citrus crops will including the main types grown of citrus i.e, lemon, lime, orange, mandarin (tangerine), tangelo, grapefruit, and pummelo. and their newly introduced varieties to Egypt

Agriculture is the main sector in water demand at the national level. Water allocation in irrigation is about 85% from the total national water. So, effective management at the irrigation sector is the principal way towards the rationalization policy of the country. In this aspect, effective irrigation management on-farm level becomes a must. (**Levy *et al* 1978, Garica a&b 1995 and Lal *et al* 1997**). Fruit set percentage and yield as kg/tree of Washington Navel orange increased with irrigation rate (6000 m³ of water/fed./year) as reported by **El-Sabrouit and Kassem,2002**

1. Effect of water irrigation management on growth, flowering , fruiting and quality of citrus

Water is essential for citrus trees (or for any plant) because it is an integral component of the biochemical reactions that occur within the plant. Water is also important because it is the carrier that moves plant nutrients and other substances throughout the tree. Water also helps maintain plant temperature through transpiration. Finally, water helps maintain leaf and fruit turgidity The optimum amount of water applied through irrigation had been discussed by different authors, **Koo *et al.*, (1974); Nakhlla *et al.*, (1998)**. The optimum water use efficiency determined by 6.56kg fruit /m³ water for producing Kutdiken cv. Lemon by drip irrigation (**Cevik *et al.*, 1993**). Fruit quality had been highly influenced by irrigation method and the quality had been highly influenced by the irrigation