

# FEASIBILITY OF DRIP IRRIGATION IN MANGO DURING THE LEAN PERIOD OF WATER AVAILABILITY IN WESTERN INDIA

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**Abstract:** A field experiment was conducted for eight years (2002-2003 to 2009-2010) to compare the performance of drip and surface irrigation methods at different levels during lean period of water availability (*rabi* and summer season) in mango orchard cv. Alphonso. The experiment was laid out in randomized block design with four treatments consisting of two drip levels (0.2 and 0.4 PEF), the recommended practice (three surface irrigations starting from pea size of fruits) and a control with no irrigation. The results indicated that mango trees should be drip irrigated at 0.2 PEF in the areas facing water scarcity to save 30% of the irrigation water with ensued higher yields. The system should be operated at 1.2 kg /cm<sup>2</sup> pressure on alternate day for 40 minutes and 60 minutes during winter and summer months, respectively.

**Keywords:** Mango, Experiment, Irrigation, Water

## INTRODUCTION

Mango is native of Indian subcontinent and grown in almost all continents of the world like North, South and Central America, West and Central Africa, Australia. India is the largest producer of mango accounting for nearly 50 % of the total world production, 34.9% of the area under fruit crops in India and 20.7% of the total fruit production of the country (NHB, 2015). In Indian context, it is an important fruit crop ruling both domestic and export markets. The economy of mango growing belts of Western India is greatly affected and often determined by the mango production. This region experiences very heavy monsoon rainfall from June to September leaving rest of the year mostly dry, resulting in water stress to mango plantations during winter, *rabi* and summer seasons when most of phenological stages *viz.* bud differentiation, flowering and fruiting occur. Such stresses, along with poor nutrient management, incidence of insect/pest and diseases contributes to its low productivity. Optimum moisture level in the soil near the root zone of the crop is critical to agriculture and fruit crops and yield get adversely affected due to excess or deficit water supply. In general, water management assumes paramount importance to reduce the wastage of water and is necessary to increase the Water Use Efficiency (WUE) and ensure equitable water distribution. Irrigation for orchard crops on PEF (Pan Evaporation Factor) eliminates the use of flood irrigation that applies large quantities of water to the soil which in turn tends to leach nitrogen and other nutrients to depths below the root zone. This approach applies lesser amount of water frequently to the root zone based on water evaporation from soil and maintains moisture favouring uptake of nutrients thus avoiding stress and

sustaining production in water deficit areas. In this experiment, an attempt was made to study the response of different methods and intensities of irrigation during period of water scarcity (winter, *rabi* and summer seasons) on growth and yield of mango.

## MATERIAL AND METHOD

The study area is located at Agriculture Experimental Station (AES), Paria, India which is situated at 22°44' N latitude and 72°94' E longitude at an altitude of 10 m above the mean sea level. The climate of the region is humid, with an average annual rainfall of about 2207 mm distributed from June to September. The minimum and maximum temperature ranges from 9.6 °C to 27°C and 27.2°C to 41.8°C, respectively while relative humidity varies from 57.1 to 92 % during the year. The soils of the area are fine-textured heavy soils classified as Vertic Ustochrepts. Field experiment was conducted in mango orchard cv. Alphonso planted (10 x10 m) at AES, Paria on 20<sup>th</sup> November, 1988 and the trees were fourteen years old when the experiment started. Four treatments were assessed which included two levels of drip (0.2, 0.4 PEF), recommended practice (three surface irrigations 1<sup>st</sup> at Pea Stage, 2<sup>nd</sup> at Marble Stage and 3<sup>rd</sup> 20 days after second irrigation) and un-irrigated control. The experiment was laid in randomized block design with eight replications. The trees were fertilized with recommended fertilizer doses (100 kg FYM and 750, 160, 750 g NPK/tree) before the onset of rains. The irrigation treatments were applied after cessation of rains from the month of October and continued up to May. The DRIP system consisted of 50 mm HDPE main line, 16 mm LDPE lateral line at 10 m spacing. Eight drippers with discharge rate 8 lph (litre per hour) were placed

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at 1 m circumference around the tree and the system was operated at 1.2 kg/cm<sup>2</sup> while the surface irrigation treatment was applied at 60 mm depth with flood. The data on tree height (m), plant spread from north-south and east-west (m) and stem girth (cm) were recorded using meter scale and vernier caliper. Mature fruits were harvested from each treatment separately and the weight was recorded with the help of single pan balance and expressed in kilogram. The data obtained on various characters were subjected to Factorial RBD analysis and interpretation of the data was carried out in accordance to Panse and Sukhatme (1985).

## RESULT AND DISCUSSION

The data of eight years (2002-2003 to 2009-2010) were pooled and the results are presented (Table 1). The irrigation treatments had a significant effect on plant height and the maximum plant height 9.11 m was recorded in 0.4 PEF irrigation level while un-irrigated trees recorded 6.54 m height at the end of the experiment. The treatments also differed significantly in increasing the plant spread (EW&NS) and plant girth where the maximum spread (11 m) and widest girth (144 cm) was observed in 0.2 PEF irrigation level which were at par with the other two irrigation levels while the un-irrigated trees recorded minimum spread (8.5 m) and least girth (112 cm). Application of optimum irrigation through drip during experimentation effectively increased vegetative growth due to the constant supply of water to the plant. Maintaining soil moisture at optimum level eliminates water stress to the plant resulting in greater vigour (Subramanian *et al.*, 1997). Bhardwaj *et al.* (1995) and Maas and Van (1996) reported that vegetative growth of the plants was found to be influenced favorably by uniform distribution of water in the soil through drip irrigation to young fruit trees. Plant height and canopy spread were significantly better under alternate day drip irrigation over conventional method in aonla (Chandra and Jindal, 2001). The

results are in accordance with the findings of Shukla *et al.* (2001) in aonla, Shirgure *et al.* (2004) in acid lime, Sulochanamma *et al.* (2005) and Agrawal and Agrawal (2007) in pomegranate. The eight year pooled data presented in Table 1 reveals that irrigation levels had significant effect on number of fruits/tree and yield (kg/tree). Maximum yield (48 kg/tree) and maximum number of fruits/tree (158) were recorded in 0.4 PEF irrigation levels which were at par with 0.2 PEF and recommended practice of providing three flood irrigations starting from pea size of fruits. The un-irrigated trees recorded 111 (number of fruits/tree) and 31.35 yield (kg/tree). The use of pan evaporation based irrigation achieves additional benefits of conserving water and saving fertilizer besides greater yields. Fruit weight, volume, and peel-pulp ratio increases with the optimum irrigation water supply as water availability influences cell division more than cell expansion but there is no influence on fruit shape (Proietti and Antognozzi, 1996). The results are in conformity with the findings of Biswas *et al.* (1999) who obtained higher yields from drip-irrigated and mulched plots at an IW: CPE ratio of 0.8 compared with those irrigated using a conventional system in papaya. Patil and Patil (1999) observed that guava fruit yield was highest when irrigated at an IW: CPE ratio of 0.8 and Singh *et al.* (2007) revealed 164% greater yields in case of drip as compared to that of ring basin irrigation in guava. Similar findings were reported by Singh and Singh (2005) in papaya and Sharma *et al.* (2011) in guava. In this experiment on yearly pooled basis 128, 256 and 180 mm of water was applied in 0.2 PEF, 0.4 PEF and surface irrigation methods, respectively. These results indicate that 30 % of the irrigation water can be saved if mango plantations experiencing water scarcity are irrigated at 0.2 PEF rather than flood irrigating them three times from pea stage of fruits. Saving in irrigation water (Kanannavar, *et al.*, 2009) and greater net profit due to drip irrigation in banana production has been reported by (Pawar *et al.*, 2010).

**Table 1.** Effect of different levels of irrigation growth and yield of mango cv. Alphonso.

Treatment	Height (m)	Girth (cm)	Spread (m)	No of fruits/tree	Yield (kg/tree)
I <sub>1</sub> - 0.2 PEF	8.57	144	11.00	142	43.76
I <sub>2</sub> - 0.4 PEF	9.11	143	11.00	158	48.00
I <sub>3</sub> - Three Surface Irrigations 1 <sup>st</sup> at Pea Stage 2 <sup>nd</sup> at Marble Stage	8.35	144	11.00	133	42.23

3 <sup>rd</sup> 20 days after second irrigation					
I <sub>4</sub> - Control	6.54	112	8.5	111	31.35
SEm±	0.11	1.82	0.13	10.7	3.02
CD at 5%	0.33	5.04	0.36	31.50	8.9
CV %	12.16	11.29	10.82	31.50	29.85

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