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Effect of fertigation on growth and yield of mango cv. Alphonso under Konkan agro climatic condition

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Abstract
A fertigation experiment was conducted to assess the spatio-temporal variation in soil water content, productivity, fruit quality and nutrient distribution in drip irrigated mango cv Alphonso. For this purpose, full bearing and mature (30 years old) trees were subjected to fertigation application of N, P and K in different proportion at different time i.e. after harvest, during fruit set and at marble stage of fruit. Results revealed that the yield parameters namely number of fruits and yield kg/tree was found significant. Significantly the highest number of fruits/tree (140.89) and yield/tree (38.16) were recorded in the treatment T_3 (N-25%, P-50%, K-15%, through drip at after harvesting, N-20%, P-25%, K-15% during fruit set and N-30%, K-45% at marble size of fruits) and was superior over all the treatments under study. The fruit quality parameters i.e. fruit weight (g), Yield (t/ha), TSS (^{O}B) and acidity (%) were found non significant.

Keywords: Fertigation, mango, growth, yield and alphonso

Introduction
Fertigation refers to the application of solid or liquid mineral fertilizers via pressurized irrigation systems, thus forming irrigation water containing nutrients (Magen, 1995) [5]. Major nutrients like nitrogen, phosphorus and potassium play an important role in the vegetative and reproductive phases of crop growth, depending on the cultivar. In general, the input use efficiency of various nutrients used for crop growth and development is currently very low leading to problems of decreased productivity, degradation of soil health and increased environmental pollution apart from the wastage of substantial quantity of costly and scarce inputs. Increasing the efficiency of water and fertilizer can itself go a long way in realizing the growing demand for food and other plant products. These multiple requirements led to adoption of fertigation, which very much improves the nutrient uptake efficiency to an extent of 30-40 per cent, prevents soil degradation, reduces the cost of fertilizer and application besides improving the productivity and quality of the produce. Fertigation also minimizes the pollution of ground water by preventing losses through run off and Leaching. The fertigation results in saving water consumption to an extent of 40-70 per cent and fertilizer use to 25 per cent. The fertilizer application should contain more of potassium and nitrogen. Similarly, the choice and dosage of nutrients, time, mode and frequency of application vary depending on the cultivars, initial soil fertility, the production system and agro climatic conditions. It was proved by many workers that fertilizers applied through broadcasting were not efficiently utilized by plants. On the other hand fertigation ensures application of fertilizers directly to root zone, resulting in higher fertilizer use efficiency. Application of fertilizers through drip irrigation water are more useful in Indian agro climatic condition where most of the orchards are established on sloppy land under rain fed conditions (Naira *et al.*, 2012) [8].

Fertigation in a way can be compared with spoon feeding to plants. It ensures supply of plant nutrients to the root zone along with micro irrigation system. The joint use of fertigation techniques and drip irrigation offers the possibility to optimize the water and nutrient distribution over time (high frequency) and space (precise placement into the active root zone (Nanda, 2010) [9]. In the fertigation process, pre dissolved soluble fertilizers are injected into the feeder line of drip system and made available to the plants (Thangaselvabai *et al.*, 2009) [16]. Soluble fertilizers can be applied directly to the root zone, tuned in accordance with the need of the crop at different growth stages with a systematic scientific basis.

Further, application of fertilizers through drip irrigation system (fertigation) can reduce fertilizer usage, minimize leaching by rain and excessive irrigation, maximize the fertilizer use

efficiency, allows flexibility in timing of fertilizer application, and reduces the labour required for applying the fertilizer (Brad Lewis, 2001) [2]. Fertigation technique makes it possible to irrigate and fertigate over a large area in a more uniform and efficient manner than the conventional method of soil application.

Fertigation can save 20 to 30 per cent of fertilizers, besides improving the yield and quality as compared to the conventional methods of fertilizer application (Mustaffa and Kumar, 2012) [7]. Teixeira *et al.*, (2011) [17] reported that fertigation resulted in 36 per cent higher nutrient use efficiency compared to conventional fertilization, for either nitrogen or potassium.

Materials and Methods

The investigation was carried out (in the one years) at the Regional Fruit Research Centre, Vengurla, Dr. B. S. K. K. V., Dapoli of the University. The experiment was conducted on 30 year old trees of mango cv. Alphonso planted at 10 m distance in square system and maintained under uniform cultural practices. The trees were almost uniform in growth and vigour. The experiment was laid out in Randomized Block Design (RBD) with five treatments combinations and replicated with five replications. The treatment details are as follows.

T. No.	Treatment details		
T_1	Control as per RDF (after harvest) in basin after harvest		
T_2	N - 40%	P – 60%	K – 20% (after harvest)
	N - 40%	P – 40%	K – 20% (during fruit set)
	N - 20%		K – 60% (marble size)
T_3	N - 25%	P – 50%	K – 15% (after harvest)
	N - 20%	P – 25%	K – 15% (during fruit set)
	N - 30%		K – 45% (marble size)
T_4	N - 20%	P – 30%	K – 10% (after harvest)
	N - 20%	P – 20%	K – 10% (during fruit set)
	N - 10%		K – 30% (marble size)
T_5	N - 10%	P – 20%	K – 5% (after harvest)
	N - 10%	P – 5%	K – 5% (during fruit set)
	N - 5%		K – 15% (marble size)

Recommended dose of fertilizer (RDF) : N – 1500g, P_2O_5 – 500g and K_2O – 1000g.

During harvest, ten disease and insect-free, fruits were taken, out of these five fruits were separated and were weighed and remaining five fruits wrapped in paper and stored at room temperature in a basket up to ripening. For biochemical analysis, fruits were peeled and flesh was homogenized in a blender. Quality parameters like total soluble solid (TSS) and titrable acidity content of ripen fruits were analyzed following the methods described by A.O.A.C. (1995) [1]. Experimental data were statistically analysed following the analysis of variance method (Panse and Sukhatme, 1984) [10].

Results and Discussion

Average fruit weight (g)

The data regarding average fruit weight showed non significant relation among different treatments due to application of different levels of fertigation. However, maximum average fruit weight (g) was observed in the control treatment T_1 (application of RDF through basin).

Number of fruits per tree

The data on number of fruits presented in Table 1. highest number of fruits/tree (140.89) was recorded in the treatment T_3 (N-25%, P-50%, K-15%, through drip at after harvesting, N-20%, P-25%, K-15% during fruit set and N-30%, K-45% at marble size of fruits) while, the lowest number of fruits/tree (81.32) recorded in the treatment T_5 (N-10%, P-20%, K-5%, through drip at after harvesting, N-10%, P-5%, K-5% during fruit set and N-5%, K-15% at marble size of fruits). Similar results were observed by Mahalakshmi *et al.* (2001) [6], Pinto *et al.* (2005) [12] and Dineshkumar *et al.* (2012) [3] in banana and Ramniwas *et al.* (2012) [3] in guava, Jeyakumar *et al.* (2010) [4] and Sadarunnisa *et al.* (2010) [14] in papaya supported the present findings.

Yield (Kg/tree)

Improvement in fruit yield was recorded with application of different treatments. The data on fruit yield presented in Table 1 revealed that Maximum fruits yield per tree (38.18 kg/tree) recorded in the treatment T_3 (N-25%, P-50%, K-15%, through drip at after harvesting, N-20%, P-25%, K-15% during fruit set and N-30%, K-45% at marble size of fruits) while, the minimum yield/tree (21.41) recorded in the treatment T_5 (N-10%, P-20%, K-5%, through drip at after harvesting, N-10%, P-5%, K-5% during fruit set and N-5%, K-15% at marble size of fruits). The results are in conformity with those of Pawar and Dingre (2013) [11] in banana, Ramniwas *et al.* (2012) [3] in guava, Tank and Patel (2013) [15] in papaya.

Total Soluble Solid (^{O}Brix) and acidity (%)

Both quality attributes i.e. total soluble solids (^{O}Brix) and acidity (%) showed non significant relation among the different treatments (Table 1).

Table 1: Effect of fertigation on fruit yield and quality of mango cv. Alphonso.

S. No.	Treatments	Average fruit weight (g)	No. of fruits (fruits/tree)	Yield (kg/tree)	Yield (t/ha)	TSS (^{O}B)	Acidity (%)
1	T_1	281.55	94.32	26.59	2.65	17.82	0.21
2	T_2	281.24	90.14	25.33	2.53	17.92	0.19
3	T_3	271.05	**140.89**	**38.18**	3.81	17.71	0.17
4	T_4	267.56	95.88	25.65	2.56	17.97	0.23
5	T_5	262.89	81.32	21.41	2.14	18.23	0.18
SEm±		8.37	0.70	0.87	0.09	0.15	0.02
CD at 5%		NS	2.16	2.67	NS	NS	NS

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