

Original Research Article

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## Effect of Fertigation on Productivity and Economics of Dwarf Coconut cv. Chowghat Orange Dwarf (COD)

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### ABSTRACT

An experiment was conducted to study the effect of water soluble on dwarf coconut at Coconut Research Station, Aliyarnagar. Application of 25, 50, 75, 100 and 125% of recommended NPK through drip irrigation system was compared with the soil application of recommended NPK as well as control with no fertilizer application. Application of 125% NPK through drip irrigation resulted in significantly higher Annual leaf production, Number of functional leaves, number of inflorescence and tender nut yield per palm compared to the control and the other fertigation treatments, except 100% NPK through drip irrigation. Higher nutrient availability in split application of fertilizer through fertigation favours increased nutrient uptake resulting in higher nutrient content in coconut leaves. With respect to economics, gross return (Rs. 302400/ha) and net return (Rs.153400/ha) were significantly higher with the application of drip fertigation of 125 per cent RDF through WSF and it found to be on par with drip fertigation of 100 per cent RDF through WSF. The drip fertigation levels 75% of RDF through WSF were found to be on par with 100 % RDF through conventional fertilizers application method *i.e* through soil application. The study indicated the possibility of saving 25% of the recommended fertilizers by adopting fertigation which ensures higher productivity in coconut than soil application.

#### Keywords

Fertigation, Tender nut yield, Economics

#### Article Info

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### Introduction

Coconut is grown in more than 93 countries of the world in an area of 12.29 million ha with a total production in terms of copra equivalent of 11.04 million MT. Indonesia (25.63%), Philippines (23.91%), India (19.20%) are the major coconut producing countries of the world. India occupies a predominant position in respect of production

of coconut in the world. Tamil Nadu produced 6570 million nuts in an area of 461060 ha, with productivity of 14251 nuts per hectare as per CDB statistics in 2016-17. There is a lot of scope for increasing productivity of coconut with better management in the state and thus improving the rural economy. India has one of the largest irrigated areas in the world, but its per-capita as well per-hectare availability of water is one

of the lowest in the world. The efficient and judicious use of both water and fertilizer is the key for improving agricultural production and productivity in the country. Fertigation (application of water-soluble solid or liquid fertilizer through drip irrigation system) is an attractive method of fertilization in intensive agricultural systems. The drip method of irrigation also helps in reducing over-exploitation of groundwater that partly occurs in surface irrigation. Water saving through drip irrigation system is estimated to be in the range of 12-84 per cent in different crops, besides its beneficial impact on crop yields (Narayanamoorthy, 1997). The drip fertigation method has considerable potential to improve water and fertilizer use efficiency. In perennial crops like coconut drip fertigation helps in achieving increased water-use efficiency, decreased tillage requirement, higher quality products, increased crop yields and higher fertilizer-use efficiency besides saving in water (Sivanappan, 2002 and Namara *et al.*, 2005). With the advent of this new method of irrigation system, traditional method of fertilizer application which is still in practice by the farmers is being slowly replaced by fertigation. Under fertilizer management, fertigation is one of the improved and efficient methods of fertilizer application through which nutrients applied directly to root zone of the plants. By this practice fertilizer may be applied in number of split doses which increase efficiency use of water and fertilizer because this technique prevents leaching of nutrients (Karuna *et al.*, 2019). The annual nutrient export by various parts of the palm viz., nuts, fronds, trunk, bunch and spathe reported by different workers vary from 20 to 174 kg N, 2.5 to 20 kg P and 35 to 249 kg K ha<sup>-1</sup> (Pillai and Davis, 1963). Considering the manurial value of the coconut wastes it would be better to incorporate these wastes *in situ* if properly shredded. However, scarce research data is available on the performance of dwarf

coconut palms under drip fertigation with water soluble fertilizers as source of fertilizers and shredded coconut waste as organic manure. Keeping the above facts in view the present experiment was laid out to study the effect of fertigation on growth and yield of dwarf coconut.

## Materials and Methods

Field experiment was conducted for three consecutive years from during 2015-16, 2016-17, and 2017-18 at Coconut Research Station, TNAU, Aliyarnagar. The research station is situated at 10.49° N latitude and 77° E longitude with an altitude of 20 m above the mean sea level. The soil was sandy loam, non-calcareous, non-saline and neutral in pH. The experiment on intercropping of flower crops in coconut garden was laid out in RBD with three replications. The experiment consisted of eight different levels of water soluble fertilizer was given as treatments viz.,: T<sub>1</sub> - Control, T<sub>2</sub> -25 % of RDF through WSF, T<sub>3</sub> -50 % of RDF through WSF, T<sub>4</sub> -75 % of RDF through WSF, T<sub>5</sub> -100 % of RDF through WSF, T<sub>6</sub> -125 % of RDF through WSF, T<sub>7</sub> -100 % RDF through conventional fertilizers and T<sub>8</sub> - farmers' practice (20kg FYM + 1Kg urea + 1Kg MOP). Fertigation were given 15 years old COD (Chowghat Orange dwarf) garden planted at a spacing of 7.5 m x 7.5 m. The fertilizers were applied through drip fertigation in 12 splits at monthly intervals with Urea, Diammonium phosphate and Muriate of Potash as sources of nitrogen, phosphorus and potassium respectively. Benefit Cost ratio was computed as the present value of benefits divided by the present value of costs by using the following formula

$$BCR = \frac{\sum_{t=1}^{t=T} \frac{(Benefit_t)}{(1+r)^t}}{\sum_{t=1}^{t=T} \frac{(Cost_t)}{(1+r)^t}}$$

where  $B_t$  is the benefit in time  $t$  and  $C_t$  is the cost in time  $t$ ,  $r$  is the discount rate.

### Statistical analysis

The experimental data were subjected to statistical analysis in order to find out which of the treatments showed significant variation in different parameters studied under investigation. The technique of analysis of variance (ANOVA) for randomized block design (RBD) was adopted as suggested by Panse and Sukhatme (1967).

### Results and Discussion

#### Effect of fertigation on growth and yield of dwarf coconut

The results obtained by the effect of various level fertigation treatments growth and yield were carefully recorded and depicted in Table 1 and Table 2. Annual leaf production, Number of functional leaves and number of inflorescence did not influenced by different fertigation levels at both the 2015-16 and 2016-17. Though the above growth attributes were found to be statistically significant during 2017-18, the variation was found to be minimal. Number of functional leaves (30) and number of inflorescence were higher in drip fertigation of 125 per cent RDF through WSF ( $T_6$ ) were found to be on par with drip fertigation of 100 per cent RDF through WSF ( $T_5$ ).

Significantly lowest number of inflorescence (8.5) recorded in control treatment ( $T_1$ ). Higher dose of fertilizer through fertigation helped the plants for better uptake of nutrients and consequently the good growth of plant. These results are in confirmation with Honnappa *et al.*, (2017) in fenugreek. These data also supported by the findings of Ramana *et al.*, (2014) who found maximum plant growth when higher NPK dose were supplied in the sweet orange

Highest nut yield (135.6 nuts/palm/year in 2016-17 and 138.4 nuts/palm/year in 2017-18) recorded in drip fertigation of 125 per cent RDF through WSF ( $T_6$  treatment) and it found to be on par with drip fertigation of 100 per cent RDF through WSF ( $T_5$  treatment). Drip fertigation of 75 per cent RDF through WSF ( $T_4$ ) were found to be on par with 100 per cent RDF through soil application ( $T_7$ ). The per cent increase over the pre-treatment nut yield was more (16.26 per cent) with drip fertigation of 125 per cent RDF through WSF ( $T_6$ ) followed by drip fertigation of 100 per cent RDF through WSF ( $T_5$ ). The treatment without fertilizer application ( $T_1$ ) (-11.93 per cent) and drip fertigation of 100 per cent RDF through WSF ( $T_2$ ) (-2.79 per cent) recorded a negative increase over the pre-treatment nut yield.

#### Economics of fertigation in tender coconut

Three years of mean data related to economics of different levels of fertigation have been analyzed and presented in Table 3. Gross return worked out based on the mean nut yield of three years and market price of tender nut values. gross return (Rs. 302400/ha) and net return (Rs.153400/ha) were significantly higher with the application of drip fertigation of 125% of RDF through WSF ( $T_6$ ) and it was on par with drip fertigation of 100 per cent RDF through WSF ( $T_5$ ). Highest B:C ratio of 2.05 recorded in drip fertigation of 100% of RDF through WSF ( $T_5$ ). Lowest net return of Rs. 54640/ha and B:C ratio of 1.44 was obtained in the treatment with control plot (shredded coconut waste alone). Higher nut yield with fertigation of 75 % recommended NPK over other fertigation treatments was mainly attributed to increased availability of soil NPK, higher annual leaf production and higher photosynthetic activity and more number of female flower production (Subramanian *et al.*, 2012; Basavaraju *et al.*, 2014).

**Table.1** Growth attributes of coconut at different levels of fertigation

Treatments	Annual leaf production			Number of functional leaves			Number of inflorescence		
	2015-16	2016-17	2017-18	2015-16	2016-17	2017-18	2015-16	2016-17	2017-18
T <sub>1</sub> - Control	11.5	10.6	10.0	25.0	23.0	23.0	9.5	8.2	8.5
T <sub>2</sub> - 25 % of RDF through WSF	11.1	11.2	11.0	23.0	22.6	23.0	9.8	9.2	9.8
T <sub>3</sub> -50 % of RDF through WSF	11.0	11.2	11.1	25.0	25.4	28.8	10.3	10.0	10.3
T <sub>4</sub> -75 % of RDF through WSF	11.1	11.4	11.3	25.8	26.8	28.6	10.5	10.8	10.4
T <sub>5</sub> -100 % of RDF through WSF	11.6	11.8	11.2	26.8	28.4	29.5	10.6	11.0	10.6
T <sub>6</sub> -125% of RDF through WSF	11.3	11.6	11.4	26.3	28.0	30.0	10.5	10.8	10.6
T <sub>7</sub> -100 % RDF through soil application	11.0	11.6	11.0	26.0	27.4	28.4	10.0	10.6	10.0
T <sub>8</sub> -Farmers' practice	11.2	10.6	11.0	25.0	26.4	27.6	9.8	10.0	10.0
<b>SEd</b>	1.61	1.59	0.102	3.15	2.90	0.50	0.93	0.82	0.11
<b>CD</b> (p=0.05)	<b>NS</b>	<b>NS</b>	<b>0.218</b>	<b>NS</b>	<b>NS</b>	<b>1.05</b>	<b>NS</b>	<b>NS</b>	<b>0.237</b>

**Table.2** Effect of different levels of fertigation on tender nut yield of coconut

Treatments	Pre-treatment tender nut yield	Annual tender nut yield			Cumulative mean nut yield	% Increase
		2015-16	2016-17	2017-18		
T <sub>1</sub> - Control	112.0	105.3	98.2	92.4	98.63	-11.93
T <sub>2</sub> - 25 % of RDF through WSF	115.8	115.4	112.3	110.0	112.57	-2.79
T <sub>3</sub> -50 % of RDF through WSF	117.0	119.0	121.4	124.0	121.80	4.10
T <sub>4</sub> -75 % of RDF through WSF	115.2	120.3	125.2	130.2	125.57	9.00
T <sub>5</sub> -100 % of RDF through WSF	116.6	128.8	133.8	136.2	132.93	14.01
T <sub>6</sub> -125% of RDF through WSF	115.6	129.2	135.6	138.4	134.40	16.26
T <sub>7</sub> -100 % RDF through soil application	116.8	120.4	124.6	129.8	124.93	6.96
T <sub>8</sub> -Farmers' practice	110.2	112.6	114.8	113.6	113.67	3.15
<b>SEd</b>	-	<b>12.75</b>	<b>2.88</b>	<b>2.77</b>	<b>4.26</b>	-
<b>CD</b> (p=0.05)	-	<b>NS</b>	<b>6.175</b>	<b>5.914</b>	<b>9.134</b>	-

**Table.3** Economics of fertigation in tender coconut (Mean of 3 years)

Treatments	Gross returns (Rs./ha)	Cost of cultivation (Rs./ha)	Net returns (Rs./ha)	B:C Ratio
T <sub>1</sub> - Control (shredded coconut waste alone)	186640	130000	56640	1.44
T <sub>2</sub> - 25 % of RDF through WSF + shredded coconut waste	253275	136400	116875	1.86
T <sub>3</sub> - 50 % of RDF through WSF + shredded coconut waste	272550	139750	132800	1.95
T <sub>4</sub> - 75 % of RDF through WSF + shredded coconut waste	282533	143000	139533	1.98
T <sub>5</sub> -100 % of RDF through WSF + shredded coconut waste	299100	146000	153100	2.05
T <sub>6</sub> - 125% of RDF through WSF + shredded coconut waste	302400	149000	153400	2.03
T <sub>7</sub> - 100 % RDF through conventional fertilizers + shredded coconut waste	281093	142000	139093	1.98
T <sub>8</sub> -Farmers' practice	221925	132000	89925	1.68
SEd	<b>4497.76</b>	-	<b>3105.41</b>	<b>0.021</b>
CD (p=0.05)	<b>9647.77</b>	-	<b>6661.17</b>	<b>0.044</b>

The drip fertigation level 75% of RDF through WSF (T<sub>4</sub>) was found to be on par with 100 % RDF through conventional fertilizers application method *i.e* through soil application. A fertilizer saving of 25 per cent is possible by adopting fertigation with 75 per cent NPK through drip irrigation compared with 100 per cent RDF through soil application.

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