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Response of Coconut (*Cocos nucifera* Lin.) to Fertigation in East Coast Region of Tamil Nadu

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A field experiment was conducted at Coconut Research Station, Tamil Nadu Agricultural University, Veppankulam during 2008-2013 to study the effect of different levels of fertilizer application through drip irrigation on growth, nut yield and economics of coconut in the East Coast Region. The experimental result revealed that 100 % dose of recommended NPK (560 g: 320 g: 1200 g / NPK / tree / year) was the best for obtaining higher values of yield attributes and nut yield, in addition to effective building up of soil available NPK. However, considering the economic viability, the fertilizer application through micro-irrigation may be restricted to 75% of recommended NPK dose of 420 g: 240 g: 900 g NPK / tree / year for obtaining sustainable coconut yields.

Key words: Coconut, Fertigation**,** Nut yield and Economics

Coconut (*Cocos nucifera* Lin.) is an important plantation crop cultivated in coastal belts of India, which could survive for more than 60 years and continue to yield under ideal management conditions throughout the year. However, it requires a continuous and balanced supply of nutrients for higher productivity (Upadhyay *et al.,* 1998). Coconut palm annually depletes huge quantum of nutrients from the soil *i.e.,* from 20 to 174 kg N, 2.5 to 20.0 kg P_2O_5 and 35 to 49 kg K_2O ha^{-1} (Ouverier and Ochs, 1978). Hence, nutrients management plays a decisive role in determining the productivity of palms. Application of fertilizers containing NPK along with Mg at recommended rates might compensate nutrient loss from the soil (Nadheesha and Tennakoon, 2008) and its optimal fertilizer requirements could be assessed by studying the yield response to graded levels of fertilizer applications (Wahid, 1984).

The present day agriculture is challenging to effective management of water and nutrients so that production oriented monetary benefits are maximized, while adverse environmental effects are reduced. The appropriate combination of moisture and nutrients and its application methodology are of much more important in improving the application efficiency of the both the inputs. Under this juncture, fertigation enables adequate supply of water and nutrients at precised timing with uniform distribution to meet out the crops moisture and nutrients demand (Mmolawa and Or, 2000). Studies in arecanut demonstrated an yield increase of 45 per cent with drip fertigation over basin irrigation (Bhat and Sujatha, 2006) and it also improves soil P and K nutrients movement of around the root zone (Bhat *et al*., 2007). In perennial crops, the requirements of nutrients are higher than the nutrients removal. Considering these factors in view, the present study was programmed to elucidate optimal fertilizer usage and appropriate method of its application.

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Materials and Methods

A field experiment was laid out Randomized Block Design in three replications. The coconut palms were of 35 years old and the experimental soil was sandy loam in texture with a pH of 7.1; EC of 0.16 and the organic carbon content of 0.20 per cent. The available NPK content of the experimental soil was low in N, medium in P and K *i.e.,* 118, 11.5 and 135 kg ha^{-1}, respectively. The treatments consisted of control (T_1), 25 (T_2), 50 (T_3), 75 (T_4) and 100 % recommended dose of NPK through drip fertigation (T_5) and 100 % recommended NPK as soil application (T_6). Drip fertigation was given as per schedule starting from the month of January to September every year from 2008 to 2013. The irrigation hour was derived based on the mean monthly pan evaporation values. The biometric observations *viz.,* mean number of functional leaves / palm / year, number of bunches / palm / year, number of female flowers / bunch and annual nut yield were recorded and analyzed statistically. The NPK content of residual soil was also analyzed and documented.

Results and Discussion

Effect of fertigation levels of NPK on growth and yield attributes and nut yield of coconut

The fertigation of varied doses of NPK along with the soil application of 100 % RDF imparts significant influence on growth, yield parameters and nut yield of coconut. The maximum values of the yield parameters *viz.* number of functional leaves / palm / year (29.21), number of bunches / palm / year (12.0) and number of female flowers / palm / year (27.0) were obtained under fertigation of 100 recommended dose of NPK (T_5) treatment. However, it was on par with fertigation

of 75 per cent dose of NPK (T_4) treatment (Table1). The application of 100 % RDF through fertigation might have resulted with ample availability of major nutrients *viz.* N, P and K at the actual site of crop requirement, the root zones of coconut palms. Under this situations the crop might have judiciously utilized the nutrients for its varied metabolic activities and this might be the reason for enhanced number of functional leaves. The assured and constant supply of nutrients and moisture in this treatment, the crop would have resulted with high quantum of photosynthetic activity, which might

Table 1.Effect of drip fertigation levels of NPK on growth and yield attributes and nut yield of coconut (Mean of 6 years)

Treatments	Number of functional leaves / palm / year	Number of bunches / palm / year	Number of female flower / bunch / year	Nut yield / palm / year
T_1 – Control (No fertilizers)	23.00	8.00	15.00	87
T_2 – 25% of RD NPK (140:80:300 g NPK/tree/year through drip)	25.26	9.00	19.00	100
T_3 – 50% of RD NPK(280:160:360 g NPK / tree / year through drip)	27.11	10.00	24.00	100
T_4 – 75% of RD NPK(420:240:900 g NPK / tree / year through drip)	28.30	11.00	25.00	105
T_5 – 100% of RD NPK(560:320:1200 g NPK / tree / year through drip)	29.18	12.00	27.00	112
T_6 – 100% of RD NPK (soil application)	28.55	10.00	21.00	102
CD (p=0.05)	0.56	1.03	1.59	9.0

be the probable reason for production of higher number of functional sink components like number of bunches / palm / year, female flower / palm / year and its subsequent storage of the assimilates in the sink region, especially in nuts. Similar inference of overall performance of palms with 100 % dose of recommended NPK was earlier documented by Sudhakar and Nambiar (1991) and Reddy and Upadhya (2002).

Table 2. Effect of drip fertigation on soil fertility

Treatment	Available soil nutrients (kg ha^{-1})		
	N	P	K
T_1 – Control (No fertilizers)	124	3.60	76
T_2 – 25% of RD NPK	167	5.61	112
T_3 – 50% of RD NPK	212	7.40	126
T_4 – 75% of RD NPK	224	7.49	128
T_5 – 100% of RD NPK	224	7.80	131
T_6 – 100% of RD NPK (soil application)	249	7.90	134
CD(p=0.05)	1.58	0.19	1.56

The on par values with regard to varied growth, yield parameters and the nut yield might be due to the effective utilization of available nutrients under minimal nutrient deficit conditions by the palms for their active metabolic activities, which would have resulted in comparable values of growth and yield attributes of palms and subsequent positive impact on final nut yield.

Regarding the residual soil fertility (Table 2), in terms of available N,P and K, application of 100 per cent of recommended dose of NPK through drip irrigation (T_5) significantly registered the maximum of 224, 7.80 and 131 kg/ha of NPK, respectively and it was on par with the treatment T_4. While, the surplus availability of N, P and K, which enables judicial uptake by the palms for their metabolic activities might be the probable reasons for the resulted higher amount of residual NPK with the treatment (T_5). Also, the optimal utilization of available soil nutrients by the palms for effective utilization of their growth and production would be the probable reason for the on par values of soil residual NPK with the treatment T_4.

Considering the economics (Table 3) and cost of return and B: C, the fertilizer application through drip fertigation can be restricted to 75% RD of NPK for obtaining comparable nut yield of coconut with 100 % dose of NPK. Moreover, there is a possibility of saving 25 per cent dose of NPK fertilizers through drip fertigation. In line with this, Ravi Bhat and Sujatha *et al.,* (2007) claimed that 75 % of NPK fertigation at 10 days intervals was highly profitable in arecanut.

Table 3. Economics of drip fertigation

Treatment	Nut Yield (Nuts/ha^{-1})	Gross return (Rs.ha^{-1})	Cost of cultivation (Rs.ha^{-1})	Net return (Rs.ha^{-1})	Benefit cost ratio (Rs.ha^{-1})
T_1 – Control (No fertilizers)	15400	123200	45800	77400	1.70
T_2 – 25% of RD NPK	17500	140000	55750	84250	1.51
T_3 – 50% of RD NPK	19775	158200	58000	99890	1.72
T_4 – 75% of RD NPK	20650	165200	58360	106840	1.83
T_5 – 100% of RD NPK	21700	173600	59780	113820	2.00
T_6 – 100% of RD NPK (soil application)	18900	151200	60200	91000	1.51

Considering the above results, it may be concluded that even though 100 % recommended dose of NPK applied through drip irrigation had higher values of growth, yield related, attributes and nut yield, fertigation at 75% of RD of NPK was observed to be economically viable dosage to get sustainable nut yield of coconuts in East Coast Belt of Tamil Nadu.

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