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Increase in Productivity by Fertigation Technique in Coconut

R.G. KHANDEKAR*, D.D. NAGWEKAR, V.S. SAWANT,
K.V. MALSHE and P. M. HALDANKAR

Regional Coconut Research Station, Bhatye, Ratnagiri - 415 612, Maharashtra
Dr. B.S. Konkan Krishi Vidyapeeth, Dapoli - 415 712, Maharashtra

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An experiment was carried out at experimental farm, Regional Coconut Research Station, Bhatye, Ratnagiri during the year 2006 to 2013, with four replications and six treatments viz. T_1 control (No fertilizer), T_2 25% of recommended dose of NPK through drip, T_3 – 50% of recommended dose of NPK through drip, T_4 – 75 % of recommended dose of NPK through drip, T_5 – 100% of recommended dose of NPK through drip, T_6 – 100% of recommended dose as soil application. The fertilizer doses were applied through drip from October to May in eight equal splits in treatments T_2, T_3, T_4 and T_5. There were no significant differences among the treatments for pretreatment as well as transit period yield. However increase in nut yield during transit period over pretreatment yield was recorded during 2006 – 2008. It was observed that the treatment T_5 recorded significantly highest yield of 113.78 nuts per palm and significantly superior over all treatments. Further, it was observed that mean yield of four years when compared with pre treatment yield, percent increase was maximum in Treatment T_5 (33%). Economic analysis of fertilizer application revealed that treatment T_5 (100% RDF through drip system) recorded highest net returns (Rs. 108090 ha^{-1}). Also it was observed that there was increase in NPK content of soil due to fertigation treatment.

(***Key wards***: *Coconut, Drip irrigation, Fertigation*)

Coconut (*Cocus nucifera* L.) is an important perennial oil yielding crop of humid tropics and is mainly grown in the Konkan region of Maharashtra state. The nutrient management in coconut is done by application of fertilizes in root zone of coconut basin in three splits. But due to heavy runoff losses, most of the applied nutrients leached away and are not effectively utilized by the palm. Application of nutrients through drip has been found successful for improving efficiency. An experiment on application of fertilizers with drip irrigation was conducted to evaluate effect of fertigation on productivity and economic viability of fertigation over soil application.

MATERIALS AND METHODS

An experiment on fertilizer application through drip- irrigation technique in coconut was conducted at Regional Coconut Research Station, Bhatye, Ratnagiri during year 2006-07 to 2012-13 on 28 years old West Cost tall variety spaced at 7.5 x 7.5 m. Six treatments viz. T_1 control (No fertilizer), T_2 : 25% of recommended dose (RD) of NPK through drip, T_3 : 50 % of RD of NPK through drip, T_4:75% of RD of NPK through drip, T_5:100% of RD of NPK through drip, T_6: 100% NPK, through soil application were replicated four times in RBD. The recommended dose of fertilizer used was 1 kg N, 0.5 kg P_2O_5 and 1 kg K_2O per palm per year. Fifty kg of organic manure were supplied to all the palms in the month of June. For treatments T_2, T_3, T_4 and T_5 NPK was applied through drip irrigation from October to May in eight equal splits. The straight fertilizers were used viz. urea for nitrogen, diamonium phosphate for nitrogen and phosphorus and muriate of potash for potassium.

The nut yield and copra yield per palm & net returns ha^{-1} were recorded in all the treatments. The soil nutrient status was recorded at the start of experiment & leaf nutrient status N, P & K at initial and final stage. The soil was analyzed for available N (Subbhiah and Asija, 1956), available P_2O_5 and K_2O (Jackson, 1969). The data were statistically analyzed as per methods suggested by Panse and Sukhatme (1995).

RESULTS AND DECISIONS

Yield of coconut

The coconut nut yield and copra yield per palm are presented in Table 1. During pre treatment period (2002-03 to 2005-06) and also at transit period (2006-07 to 2007-08) non significant differences were observed for no. of nuts per palm in coconut. It might be due to recommended package of practices followed for maintenance of coconut palms before exposure of treatments, which had effect upto period of 2007-08 after

**Corresponding Author :* E-mail: agr_agronomist@yahoo.co.in OR rgk.bskkv@rediffmail.com

two years of start of experiment. The significant variations in nut yield and copra yield per palm were observed from 2009-10 to 2012-13. Significantly maximum nut yield (113.78 nuts palm^{-1}) and copra yield (18.61 kg/palm) were recorded in T_5 (100% RD of NPK through drip). This might be due to availability of nutrients for growth & development of nuts & copra in coconut supplied through fertigation by drip methods in eight month i.e. October to February.

Results analogous to the above findings were recorded by Rajakumar *et al*. (2012), they stated that pooled mean annual nut yield recorded better nut yield (139 nuts palm^{-1}) than other treatments at 100% RDF through drip fertigation. Basavraju *et al.* (2013) also reported high nut and copra yield per palm over five years was significantly higher with application of 100% NPK through drip irrigation. However copra content was significantly influenced by fertigation treatment. Results analogous to above findings were recorded by Dhanpal *et al*. (2012) that significantly highest no. of nuts per palm were recorded in 100% NPK fertigation under Kasaragod, Kerala conditions.

Soil Analysis

The data on Soil analysis *viz*. N, P_2O_5 and K_2O recorded at initial and final stage of experiment are presented in Table 2 (a), 2(b) and 2(c).

Non significant difference in nitrogen content was observed at initial stage for all the three depths (0-25, 25-50 and 50-100) where it was significant at 0-25 and 50-100 cm depth at final stage after application of the different doses of fertilizer through drip. The highest nitrogen was recorded at 0-25 cm depth in treatment T_5 (330 kg ha^{-1}) and significantly superior over treatment T_1 and T_2 where as it was at par with T_3, T_4 and T_6. Further highest N was recorded at 50-100 cm depths in T_5 (298 kg ha^{-1}) and it was significantly superior over T_3 and T_4 and at par with T_1, T_2, T_6.

It was observed from data presented in Table 2 (b) that phosphorus content was also non significant at all the three depths in different treatment at initial and final stage. Whereas it was highest in T_5 (25.71 kg ha^{-1}) at 0-25 cm depth and 8.94 kg ha^{-1} 25-50 cm depth at final stage. However P_2O_5 was highest in T_3 (7.50 kg ha^{-1}) followed by T_4 (7.40 kg ha^{-1}) and T_5 (7.02 kg ha^{-1}) at 50-100 cm depth at final stage.

Further the data presented in Table 2 (c) revealed that the potassium content was recorded non significant difference in all the three depths at initial & final stage except 0-25 cm at initial stage. The highest K_2O was recorded at T_5 treatment at final stage i.e. 535 kg ha^{-1} at 0-25 cm depth, 549 kg ha^{-1} at 25-50 cm depth, and 536 kg ha^{-1} at 50-100 cm depth.

Table 1. *Yield of coconut as influenced by fertigation treatments*

Tr. No.	Treatment	Pre treatment yield (nuts palm^{-1} year^{-1})	Transit Period yield (nuts palm^{-1} year^{-1})	Pooled** nut yield (Nos. palm^{-1})	Pooled copra yield (kg palm^{-1})	Pooled net returns (Rs ha^{-1})
T_1	Control (No fertilizer)	99	97	78.77	10.21	49071
T_2	25 % of RD* of NPK through drip	81	89	82.57	11.14	62340
T_3	50% of RD of NPK through drip	85	91	96.28	14.24	85757
T_4	75% of RD of NPK through drip	88	96	100.63	14.21	89462
T_5	100 % of RD of NPK through drip	84	99	113.78	18.61	108090
T_6	100 % of RD of NPK as soil application	93	103	96.34	14.70	85557
	Mean	88.33	95.83	94.73	13.85	80046
	SEm $\pm$	7.54	5.29	2.82	0.61	3012
	CD (0.05)	N.S.	N.S.	7.97	1.73	8520

*RD – Recommended dose

**Pooled data for 2009-10 to 2012-13

Table 2(a). *Soil nitrogen status as influenced by fertigation treatment in Coconut*

Treatment	N (kg ha^{-1})					
	Initial	Final	Initial	Final	Initial	Final
	0-25		25-50		50-100	
T_1	172	188	134	237	95	267
T_2	212	173	148	284	125	252
T_3	220	282	165	282	118	189
T_4	188	283	149	173	141	220
T_5	235	330	157	220	133	298
T_6	188	283	158	204	118	252
Sem ±	29.36	19.25	27.40	27.63	18.46	19.93
CD (0.05)	NS	57.99	NS	NS	NS	60.09

Table 2(b). *Soil phosphorus status as influenced by fertigation treatment in coconut*

Treatment	P_2O_5 (kg ha^{-1})					
	Initial	Final	Initial	Final	Initial	Final
	0-25		25-50		50-100	
T_1	11.16	18.61	9.17	5.47	11.26	5.37
T_2	9.78	18.83	10.85	6.92	14.75	5.56
T_3	19.30	22.32	10.67	8.88	11.03	7.50
T_4	17.18	16.46	9.62	8.15	5.64	7.40
T_5	18.98	25.71	6.15	8.92	6.92	7.02
T_6	11.99	20.19	5.38	7.29	10.00	4.05
SEm ±	4.059	6.38	2.69	1.23	2.04	0.88
CD (0.05)	NS	NS	NS	NS	NS	NS

Table 2(c). *Soil potassium status as influenced by fertigation treatment in coconut*

Treatment	K_2O (kg ha^{-1})					
	Initial	Final	Initial	Final	Initial	Final
	0-25		25-50		50-100	
T_1	287	331	413	285	318	371
T_2	247	378	378	410	230	422
T_3	340	445	268	464	203	486
T_4	247	452	280	479	229	467
T_5	430	535	237	549	279	536
T_6	212	459	227	408	263	416
SEm ±	36.74	108	71.36	135	41.835	134
CD (0.05)	110.74	NS	NS	NS	NS	NS

Leaf Analysis

The data regarding NPK content in leaf are presented in Table 3 revealed that there was no significant difference in NPK content in all the treatment for both the year at initial & final stage. However increase in NPK was observed after receiving different fertilizer doses through drip.

Economics

The net returns (Rs ha^{-1}) obtained by effect of different fertigation treatments are presented in Table 1. Significantly maximum net returns (Rs. 108090 ha^{-1}) were recorded in treatment T5 (100% RD of NPK through drip), over other treatments under study. Similar results were also reports by Dhanpal *et al.* (2012) and

Table 3. *Leaf nutrient status in coconut as influenced by fertigation treatment in initial and final stage*

Treatment	N (%)		P_2O_5 (%)		K_2O (%)	
	Initial	Final	Initial	Final	Initial	Final
T_1	1.40	1.66	0.05	0.05	0.6	0.09
T_2	1.41	1.71	0.04	0.08	0.7	0.95
T_3	1.45	1.82	0.05	0.09	0.8	0.8
T_4	1.43	1.76	0.06	0.10	0.7	0.95
T_5	1.37	1.90	0.06	0.13	0.6	1.0
T_6	1.48	1.62	0.06	0.11	0.7	0.7
SEm ±	0.052	0.13	0.018	1.82	0.10	0.093
CD (0.05)	NS	NS	NS	NS	NS	NS

Subramanian *et al.* (2012) in micro irrigation experiment in coconut at CPCRI, Kasaragod.

CONCLUSION

100% recommended fertilizer through drip (1000 g N + 500 g P_2O_5 + 1000 g K_2O per palm) in eight splits from October to May was found suitable to increase yield with maximum net returns per ha in coconut

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