Original Research Article

Effect of drip fertigation under different fertilizer levels on nutrient status in coconut (*Cocos nucifera* L) leaf

ABSTRACT

A study was conducted during 2017-18 under the All India Co-ordinated Research Project initiated in 2009 at the research farm of Bihar Agricultural University, Sabour, Bhagalpur. This study aimed to compare the nutrient concentration of coconut leaves at different nutrient levels through drip fertigation. Coconut seedling was first planted in the experimental farm in 2009. Drip irrigation along with fertilizer application (Fertigation) was imposed on this experiment in 2012 with Urea, Diammonium phosphate, Muriate of potash in a Randomized Block Design (RBD) with four (4) replications. The results that were observed show that leaf Nitrogen, Phosphorous, Sulphur, Iron, Manganese, Copper, and Boron content under different fertigation treatments were not significantly different from each other. All the treatments for leaf K content were significantly different. Iron, manganese, copper and boron content in coconut leaf under different treatments were significantly different. But all the treatments for Zn content were at par. The content of these micronutrients in leaf was found to increase with increasing fertilizer levels in the treatments. Cation Exchange Capacity was positively correlated with all the leaf nutrients. Organic carbon did not show remarkable relation with plant nutrient parameters. Soil K content of all three depths was positively correlated with all the leaf nutrient elements, but a more significant correlation coefficient value was found with leaf micronutrients. S, Fe, Mn, Zn, Cu and B content in soil across the soil depths was negligibly correlated with the leaf nutrients elements content. The highest content of leaf N content was found in T5 treatment. The effect of all the treatments on the leaf phosphorus content of coconut was also not significantly different, but the highest content was found in the T6 treatment. Its content in leaf under T5, and T4 treatments was higher than T6 treatment. All the treatments for sulphur content in leaf of coconut were not significantly different, but its content increases with increasing levels of NPK fertilizer in the treatments. Similar results were observed for the content of Fe, Mn, Zn, Cu, and B in the leaf of coconut. Soil pH value was positively correlated with leaf P content in coconut, which explains that leaf P content is directly proportional to the soil pH value. Electrical conductivity (EC) of soil was also positively correlated with P, K, and B concentration in coconut leaf, which confirms that coconut plant grows well in soils contained with soluble salt. The correlation coefficient value between CEC and leaf nutrient contents explains that 2nd depth of soil is more important for the mineral nutrition of coconut palm. Coefficient of correlation between nitrogen content in soils of upper two depths and leaf nutrient content suggested that nitrogen concentration in soil to a depth of 0-60 cm is most effective for coconut plant growth and development. Correlation coefficient values between soil P content and leaf nutrient content explain that increasing phosphatic fertilizer levels in the soil increases other macro and micronutrient uptake to the crop plant. A negligible correlation between sulphur content in leaf and soil was found. A higher correlation coefficient value was found at lower soil depth between available sulphur content in soil and sulphur content in the leaf of coconut. A very negligible coefficient of correlation was found between leaf nutrient concentration and Fe, Mn, Zn, Cu, and B content in the soil. This result suggests that the inherent supplying capacity of micronutrients of experimental soil is not so influential for higher plant growth. Still, application of N, P and K fertilizers trigger the absorption capacity for micronutrient from the soil. Under different NPK levels, the applied NPK does not have a significant effect on leaf N, P, S, Zn content after five (5) years of experimentation, However, an effect was found to be significant for few elements like K, Fe, Mn, Cu, and B. An increasing trend was observed for leaf nutrient content with increasing levels of fertilizer application.

Keywords: Drip fertigation, Coconut leaf, Nutrient status

1. INTRODUCTION

The coconut palm (*Cocos nucifera* L.) is globally cultivated in around 93 countries, and in India, it is grown in 2.1 million ha (2015-16, 3rd estimates) with a production of 14 075 million nuts and average productivity of 6 702 nuts/ha/year (CDB 2016). In the fertigation method, nutrient use efficiency could be as high as 90% compared to only 40–60% in conventional methods (Basavaraju et al., 2014). In the fertigation method, the amount of nutrients lost through leaching can be as low as 10%, whereas it can be >50% in the traditional system (Solaimalai et al., 2005). Soil nutrient status can be improved by fertilization but maximum plant growth could only be achieved when the nutrient availability matches water availability (Amer *et al.,*2009). Therefore, water and fertilizer management technology development that enhances efficient water use has become an important strategy to guarantee sustainable crop production. To sustain the quality and quantity of crop production system, maintaining and improving soil fertility is very important, and this can only be achieved by applying fertilizers either in inorganic or organic form (Efthimiadou *et al*. 2010). Adeniyan & Ojeniyi (2006) stated that the main purpose of fertilization in agriculture is to obtain a high yield and to enhance soil fertility. Adoption of drip fertigation method is an option for efficient use of water and nutrients through improved crop yield per unit volume of water and nutrients used (Patel and Rajput, 2011). Keeping this in view, the present investigation was carried out to determine the effect of different fertigation levels on plant nutrient contents of coconut, especially in leaves, with a goal to how fertigation affects nutrient contents in plants after five years of application.

2. METHODOLOGY

2.1 Experimental site, soil and weather

The present investigation entitled "Effect of drip fertigation with different fertilizer levels on nutrient status in coconut (*Cocos nucifera* L) leaf " was conducted during 2017-18 under the All India Co-ordinated Research Project initiated in 2009 at the research farm of Bihar Agricultural University, Sabour, Bhagalpur. In this section, efforts have been made to present observations, including the nutritional status of coconut leaf after long-term drip fertigation. The soil was silty clay loam type in texture. Coconut seedling was first planted in the experimental farm in 2009. Plant to plant distance is 25’x 25’ both ways. Drip irrigation and fertilizer application (Fertigation) were imposed on this experiment in 2012 with urea, diammonium phosphate, and muriate of potash. The experimental area is situated in tropical to sub-tropical climates and is characterized by hot desiccating summer, cold winter, and moderate annual rainfall with latitude and longitude of 25^{0}14’11” N and 87^{0}04’1.6” E, respectively. The altitude of the area is 52.73 m above mean sea level. This area receives an average annual precipitation of 1407 mm (mean of 10 years). December and January are usually the coldest months where the mean temperature normally falls as low as 8.2^{0}C. April and May are the hottest months, with a maximum average temperature of 36.6^{0}C.

2.2 Treatments detail

T1 = Control (No fertilizer), T2 = 25% of the recommended dose of NPK fertilizers (RDF) through drip system, T3 = 50% of the RDF through drip system ,T4 = 75% of the RDF through drip system,T5 = 100% of the RDF through drip system,T6 = 100% of the RDF through soil application.

2.3 Experimental design

The experiment was formulated in a Randomized Block Design (RBD) with four (4) replications. Each treatment plot occupies four coconut palms. Drip fertigation is provided during the dry season from October to May every year with eight equal split applications of fertilizer. The amount of fertilizers that are scheduled to be applied through direct soil application is split into two halves and are applied once during April-May (pre-monsoon season) and another during October-November (post-monsoon season) every year.

2.4 Plant sample and analysis

Plant leaf samples were collected from the experimental coconut palm. Every 6th/7th leaf from the top of each experimental palm was selected for sampling. Middle leaflets were taken from each leaf chosen and then a middle portion of each leaflet was considered for the study. The midrib of leaflets was separated, washed first in running tap water, followed by dilute 0.01 *N* HCl, and finally with double distilled water. The plant leaf materials were dried first in the air and then in the oven at 65^{0}C to a constant weight. Then, samples were ground in a stainless steel grinder (Willey-mill) and stored in desiccators for further analysis.

2.5 Analysis for Total N, P, K, S, Fe, Cu, Mn, Zn, B in coconut leaf for nutrient status after long term frtigation

2.5.1 Total Nitrogen

Total nitrogen (N) was determined by using concentrated H_2SO_4 and digestion accelerator mixture (K_2SO_4: $CuSO_4$ :: 10:1) as described by Jackson (1973), and the digest was steam distilled with concentrated 40% NaOH.

2.5.2 Total P

For determination of Total P, K, S plant samples were digested with di-acid mixture (HNO_3:$HClO_4$::9:4) with HCl on a hot plate as described by Blanchar *et al.,* (1965). The phosphorous in digest was determined by Vanado-molybdate solution with yellow colour appearance, and reading was taken by spectrophotometer at 760 nm (Page *et al.*, 1982).

2.5.3 Total K

Total potassium in Plant sample digest (prepared as in total phosphorous) was determined by the flame photometric method (Jackson, 1973).

2.5.4 Total S

Total sulphur content in plant digest (prepared as in total phosphorous) was determined turbidimetrically by using $BaCl_2$ crystal (retained in 30 to 60 mesh sieve) and gum acacia method of Chesnin and Yien (1951) using a spectrophotometer at 420 nm wavelength.

2.5.5 Total Micronutrients (Fe, Cu, Mn, Zn)

Micronutrients from plant sample digest (prepared as in total phosphorous) were estimated by the help of Atomic Absorption Spectrophotometer**.**

2.5.6 Total B

The boron concentration in ground leaf samples was determined following the standard method of dry ashing and colorimetric analysis by Azomethine-H (Gaines and Mitchell, 1979). Boron content in the filtrate was determined spectrophotometrically by Azomethine-H method as described by Berger and Truog (1939).

2.5.7 Statistical analysis

The mean value, critical difference, coefficient of variance of each parameter, and the correlation coefficients between leaf nutrient contents and different soil chemical characteristics and available nutrients were calculated as per procedure referred in Gomez and Gomez (1983). Microsoft excel package (Office - 2003) and Statistical Package for the Social Science (SPSS) were used for the analysis.

3. RESULTS AND DISCUSSION

3.1 Effect of different levels of chemical fertilizer on nutrient content in coconut leaf

Laboratory analysis data of leaf samples of coconut under long-term (5 years) fertigation treatments are presented in table 2. Nitrogen content in coconut leaves under different fertigation treatments was not significantly different from each other. But its content in the leaf was increasing gradually with increasing levels of fertilizers in the drip fertigation system. The highest content of nitrogen was found in T5 treatment (1.82 mg kg^{-1}) (Table 2), which was 19.0% more than that in the control treatment (1.53 mg kg^{-1}). Increase (%) in nitrogen content of leaves under different treatments over control was in the order of T5> T4 (17.6%)> T3 (10.5%)> T6 (5.9%)> T2 (3.9%). Nitrogen content in the coconut leaf was found to increase with increasing fertilizer levels in the experiment. Still, this increase was not significantly different among treatments. Srinivas (1997) reported that the nutrient uptake (N, P, and K) in leaves increased with nitrogen application through drip irrigation. The highest content of leaf N content was found in T5 treatment that might be due to the effect of the highest quantity of nitrogenous fertilizer application *i.e.* 100% recommended dose in the soil through drip irrigation. But plant leaves under T6 treatment resulted in comparatively very low nitrogen content than T5 treatment because of direct soil application of nitrogenous fertilizer, which is very prone to volatilization loss immediately after application.

Phosphorus content in coconut leaves under different fertilizer treatments was also not significantly different from each other. A gradual increase in phosphorus content in leaf was observed with increasing fertilizer levels in the treatments. The highest content of phosphorus was found (Table 2) in T6 (1.60 mg kg^{-1}) treatment (100% RDF through soil application) which was 55.3% increase over the control treatment (1.22 mg kg^{-1}). The order of percent increase in the content of phosphorus in the coconut leaf under different treatment over control was T6> T5 (37.9%)> T4 (35.9%) = T3 (35.0%)> T2 (18.4%). The effect of all the treatments on leaf phosphorus content of coconut was also not significantly different, but the highest content was found in T6 treatment that may be due to the direct soil application of 100% RDF for phosphatic fertilizer to the upper layer of soil. As phosphate is immobile in soil and has very fewer chances of loss from soil, plant roots absorb a high quantity of phosphate, which is reflected in the leaf content under T6 treatment. But T5 treatment, where 100% RDF of phosphatic fertilizer was applied through drip irrigation, resulted in little less content of P in leaf than T6 treatment but both treatments were not significantly different due to the immobile nature of phosphorus in soil.

Unlike nitrogen and phosphorus, potassium content in coconut leaf under different drip fertigation treatments was significantly different from each other. Leaf content (Table 2) of potassium was found highest in T5 treatment (1.42 mg kg^{-1}), which was 52.7% increase over control treatment (0.93 mg kg^{-1}). A gradual increase in the leaf potassium content was observed with increasing levels of drip fertigation treatments. T6 treatment (100% RDF through soil application) resulted in much lower values than T5 (full dose of fertilizer application with drip irrigation). The percent increase in the content of potassium in leaf under various treatments followed the order of T5> T4 (47.3%)> T3 (45.2%)> T6 (34.4.1%)> T2 (15.1%). Potassium content in coconut leaf in all the treatments was significantly different because potassium is highly soluble and highly mobile in soil. Increasing levels of potassic fertilizer in the treatments results to an increased potassium content in soil across the soil depths, which is reflected in the potassium content in the coconut leaf. Its content in leaf under T5, and T4 treatments were higher than T6 treatment that may be due to the high downward movement of potassium ion in the soil through drip irrigation water.

Sulphur content in coconut leaf under different fertigation treatments was not significantly different from each other. Among all treatments, the highest sulphur in leaf was recorded (Table 2) in T5 treatment (3.44 mg kg^{-1}), which was 18.2% increase over the control treatment (2.91 mg kg^{-1}). A gradual increase of the leaf sulphur was recorded with increasing level of fertigation treatments whereas T6 treatment (100% RDF through soil application) resulted in lesser content of sulphur than T5 treatment (100% RDF through drip fertigation). The percent increase in the content of sulphur in leaf under various treatments followed the order of T5> T4 (17.2%)> T3 (14.8%)> T6 (14.4%)> T2 (2.7%). All the treatments for sulphur content in leaf of coconut were not significantly different, but its content increases with increasing levels of NPK fertilizer in the treatments. A similar phenomenon was also found for the content of Fe, Mn, Zn, Cu, and B in leaf of coconut. This evidence proves that applying a higher amount of NPK fertilizers into the soil leads to the mining of inherent sources of essential macro and micro nutrients.

Among all micronutrients in coconut leaf, it was observed that a significant difference in iron content in leaf from each other was observed under different drip fertigation treatments. In T5 treatments, the highest (299.75 mg kg^{-1}) iron content was recorded (Table 2) in coconut leaf, which was 95.3% increase over control (153.50 mg kg^{-1}). Gradual increase of iron content in the leaf was observed with increasing levels of drip fertigation treatments, but T6 treatment(100% RDF through soil application) showed lesser value than T5 treatments (100% RDF through drip fertigation). The order of percent increase of iron content in leaf followed the order of T5> T4 (84.2%)> T3 (73.6%)> T2 (44.8%)> T6 (43.8%).

Similarly, for manganese content in the leaf, a significant difference was observed under different fertigation treatments. T5 treatment resulted the highest (39.50 mg kg^{-1}) content (Table 2) of Mn in coconut leaf that was 305.1% higher than control (9.75 mg kg^{-1}). Mn content in coconut leaf was gradually increased with increasing levels of chemical fertilizer through drip irrigation, and T6 treatment showed a lesser Mn value for T5 treatment (100 % RDF through drip fertigation). The percent increase of Mn content in coconut leaf was in the order of T5> T4 (189.7%)> T6 (143.6%)> T3 (138.5%)> T2 (79.5%).

All the treatments under this study were statistically at par for the content of zinc coconut leaf. The highest content of Zn in leaf was found (Table 2) in T5 treatment (25.00 mg/kg), which was 63.9% increase over control (15.25 mg kg^{-1}). Zinc content in coconut leaf gradually increased with increasing levels of drip fertigation treatments whereas T6 treatment (100% RDF through soil application) resulted in lower Zn content with respect to T5 treatment (100 % RDF through drip irrigation). The order of percent increase of Zn content in coconut leaf was T5> T4 (50.8%)> T3 (47.5%)> T6 (24.6%)> T2 (16.4%).

The copper content in coconut leaf under different fertilizer treatments was significantly different from each other. Drip irrigation with higher doses of fertilizers resulted (Table 2) similar values (6.25 to 6.50 mg kg^{-1}) for leaf copper content, which was 92.3 to 100% increase over control.

Boron contents in the leaf of coconut under different fertilizer treatments were significantly different from each other. There was the highest value observed (Table 2) in treatment T5 (16.16 mg kg^{-1}) which was 154.1% increase over control (6.36 mg kg^{-1}). Boron content in coconut leaf was gradually increased with increasing fertilizer dose. The order of percent increase in the content of boron in the coconut leaf under different treatment over control was T5> T4 (109.3%)> T2 (84.4%) > T6 (73.1%)> T3 (67.5%).

Table 3 explains that the Chemical properties of soil influence the nutrient absorption phenomenon by the plant. Soil pH directly influences the availability of phosphate ions in soil. Soil pH value was positively correlated with leaf P content in coconut, which explains that leaf P content is directly proportional to the soil pH value. Electrical conductivity of soil was also positively correlated with P, K, and B concentration in coconut leaf, which confirms that coconut plant grows well in soils with soluble salt. The correlation coefficient value between CEC and leaf nutrient contents explains that 2nd depth of soil is more important for the mineral nutrition of coconut palm. Results of the correlation coefficient between organic carbon and leaf nutrient content prove that organic carbon content in soil at different depths does not playsuch an important role in mineral nutrition for the higher perennial plant.

, The coefficient of correlation between nitrogen content in soils of upper two depths and leaf nutrient content, suggested that nitrogen concentration in soil to a depth of 0-60 cm is most effective for coconut plant growth and development and nitrogen content at lowest depth (60-90 cm) has no importance. It also explains that with the increasing availability of nitrogen in upper 60cm soil increases the micronutrient uptake from soil by the plant.

Correlation coefficient values between soil P content and leaf nutrient content explain that increasing levels of phosphatic fertilizer in the soil increases other macro and micronutrient uptake to the crop plant. A depth of 30-60 cm in the soil profile is a highly effective source of P for uptake by coconut palm.

The coefficient of correlation values suggested that all three soil depths were equally responsible for potassium supply to the coconut leaf nutrition, and micronutrients concentration in the leaf increases with increasing levels of potassic fertilizer in the treatments.

A negligible correlation between sulphur content in leaf and soil was found that may be due to no application of S fertilizer from an external source in the experiment. Sulphur is highly soluble and leachable. Therefore comparatively higher correlation coefficient value was found at lower soil depth between available sulphur content in soil and sulphur content in leaf of coconut.

A very negligible coefficient of correlation was found between leaf nutrient concentration and Fe, Mn, Zn, Cu, and B content in the soil. This result suggests that the inherent supplying capacity of micronutrient of experimental soil is not so influential for higher plant growth, but the application of N, P and K fertilizers trigger the absorption capacity for micronutrient from the soil.

3.3 Relationship between plant leaf nutrient concentration and soil chemical properties

Co-efficient of correlation value between coconut leaf nutrient concentration and some soil chemical properties are presented in the table 3.

Soil pH value at three different depths was positively and significantly correlated with phosphorus content in leaf (r =0.46*, 0.60**, 0.45*) (Table 3). But pH at 2nd depth of soil was highly significant than other depth. Electrical conductivity of soil at three different depths was found be positive but non-significant correlation with available phosphorus (r = 0.13, 0.26, 0.20) and potassium (r = 0.09, 0.27, 0.37) content in coconut leaf. EC of 2nd depth of soil was positively and significantly correlated with B (r = 0.42*) content in coconut leaf.

A positive correlation value was found between cation exchange capacity (CEC) and leaf nutrient content. But among three soil depths, CEC at 2nd depth showed higher coefficient of correlation with all the leaf nutrient concentrations. Organic carbon (OC) content in soil at three depths was not markedly correlated with leaf nutrient concentration.

The coefficient of correlation values between nutrient concentration in coconut leaf and available nutrient content in soil are presented in table 4 to compare the plant nutrition study under different fertilizer levels through irrigation.

Nitrogen content in surface soil, D1 (0 – 30 cm) was positively correlated (Table 4) with leaf N (r = 0.40) and leaf P (r = 0.37) content but significantly correlated with leaf K (r = 0.60**), leaf S (r = 0.48*), leaf Fe (r = 0.60**), leaf Mn (r = 0.73**), leaf Zn (r = 0.54), leaf Cu (r = 0.47*) and leaf B (r = 0.56**) concentrations. Similar relation also found between 2nd depth (D2) of soil and leaf nutrient concentrations. But at 3rd depth of soil, this relation was negligible.

Phosphorus concentration at 0 – 30 cm depth (D1) of soil was positively correlated with leaf N (r = 0.49*), leaf P (r = 0.29), leaf K (r = 0.48*), leaf S (r = 0.44*), leaf Fe (r = 0.42*), leaf Mn (r = 0.63**), leaf Zn (r = 0.35), leaf Cu (r = 0.33) and leaf B (r = 0.47*) concentrations (Table 4). But P content at D2 *i.e.* 30-60 cm soil showed highest correlation coefficient value with leaf P (r = 0.35).

Potassium content in soils of all three depths was positively correlated with all the leaf nutrient parameters. But more significant correlation coefficient value was found with leaf micronutrients content in coconut.

Sulphur content in soil across the soil depths was negligibly correlated with the leaf nutrients content. A very small positive correlation value was found (Table 4) between leaf S content and available S content in soil at three different depths (r = 0.05, 0.14, 0.20). Very negligible coefficient of correlation values was found between leaf nutrient element concentration and Fe, Mn, Zn, Cu, and B content in soil across the soil depths.

Table 1. Details of the treatments

Treatments	Fertilizer application (g plant^{-1} year^{-1})		
	N	**P_2O_5**	**K_2O**
No fertilizer	0	0	0
25% RDF NPK	250	112	300
50% RDF NPK	500	225	600
75% RDF NPK	750	300	900
100% RDF NPK	1000	450	1200

Table 2. Effect of long term (5 years) fertigation on macro and micronutrients content (mg kg^{-1}) in coconut leaf

Treatments	N	P	K	S	Fe	Mn	Zn	Cu	B
	(in %)				(in mg kg^{-1})				
T1	1.53	1.03	0.93	2.91	153.50	9.75	15.25	3.25	6.36
T2	1.59	1.22	1.07	2.99	222.22	17.50	17.75	4.50	11.73
	(3.9)*	(18.4)	(15.1)	(2.7)	(44.8)	(79.5)	(16.4)	(38.5)	(84.4)
T3	1.69	1.39	1.35	3.34	266.50	23.25	22.50	6.50	10.65
	(10.5)	(35.0)	(45.2)	(14.8)	(73.6)	(138.5)	(47.5)	(100.0)	(67.5)
T4	1.80	1.40	1.37	3.41	282.75	28.25	23.00	6.25	13.31
	(17.6)	(35.9)	(47.3)	(17.2)	(84.2)	(189.7)	(50.8)	(92.3)	(109.3)
T5	1.82	1.42	1.42	3.44	299.75	39.50	25.00	6.25	16.16
	(19.0)	(37.9)	(52.7)	(18.2)	(95.3)	(305.1)	(63.9)	(92.3)	(154.1)
T6	1.62	1.60	1.25	3.33	220.75	23.75	19.00	3.75	11.01
	(5.9)	(55.3)	(34.4)	(14.4)	(43.8)	(143.6)	(24.6)	(15.4)	(73.1)
Mean	1.68	1.34	1.23	3.24	240.91	23.67	20.42	5.08	11.54
CD (0.05)	NS	NS	0.31	NS	91.85	7.58	NS	2.34	5.18
CV (%)	15.00	11.84	6.55	14.92	15.30	2.12	2.33	3.05	2.98

* Figure in the parenthesis represents percent (%) increase over control treatment
Unit of N, P, K, S are in % whereas unit of micronutrients are in mg kg^{-1}

Table 3. Co-efficient of correlation value between chemical properties of soil and nutrient concentrations in plant

Parameters	Soil depth	Leaf N	Leaf P	Leaf K	Leaf S	Leaf Fe	Leaf Mn	Leaf Zn	Leaf Cu	Leaf B
Ph	**D1**	-0.05	0.46*	0.30	0.10	-0.02	0.10	0.18	-0.05	0.11
	D2	-0.07	0.60**	0.36	0.24	0.04	0.20	0.20	0.15	0.20
	D3	-0.08	0.45*	0.27	0.15	0.04	0.35	0.25	0.19	0.29
EC	**D1**	-0.03	0.13	0.09	-0.09	-0.15	-0.09	-0.33	-0.21	-0.01
	D2	-0.14	0.26	0.27	0.25	-0.04	0.25	0.23	0.26	0.42*
	D3	0.01	0.20	0.37	0.29	0.31	0.33	0.41*	0.39	0.44*
CEC	**D1**	0.08	0.33	0.33	0.05	0.14	0.40	0.26	0.07	0.13
	D2	0.34	0.17	0.45*	0.23	0.50*	0.49*	0.37	0.37	0.30
	D3	0.01	-0.09	0.01	-0.05	-0.09	-0.18	0.06	0.07	-0.10
OC	**D1**	0.17	0.24	0.20	0.27	-0.06	0.25	-0.01	0.29	0.15
	D2	-0.08	0.28	0.12	-0.04	-0.10	0.16	-0.16	-0.11	-0.14
	D3	0.03	-0.06	-0.06	0.02	-0.15	0.16	-0.10	-0.07	0.01

D1 : 0 – 30 cm soil depth, D2 : 30-60 cm soil depth, D3 : 60-90 cm soil depth
* and ** : refer to level of significance at 0.05 and 0.01 probability level respectively

Table 4. Co-efficient of correlation value between available nutrient content in soil and nutrient concentrations in plant

Para-meters	Soil Depth	Leaf N	Leaf P	Leaf K	Leaf S	Leaf Fe	Leaf Mn	Leaf Zn	Leaf Cu	Leaf B
Available N	**D1**	0.40	0.37	0.60**	0.48*	0.60**	0.73**	0.54**	0.47*	0.56**
	D2	0.40	0.14	0.58**	0.31	0.59**	0.76**	0.39	0.48*	0.49*
	D3	-0.03	-0.11	0.15	0.14	0.12	0.17	-0.03	0.01	0.23
Available P	**D1**	0.49*	0.29	0.48*	0.44*	0.42*	0.63**	0.35	0.33	0.47*
	D2	0.01	0.35	0.29	0.34	0.07	0.30	0.24	0.21	0.27
	D3	0.09	0.25	0.63**	0.09	0.30	0.44*	0.35	0.23	0.26
Available K	**D1**	0.17	0.09	0.35	0.26	0.42*	0.35	0.50*	0.44*	0.16
	D2	0.12	0.12	0.17	0.14	0.53**	0.56**	0.55**	0.36	0.29
	D3	0.42*	0.06	0.31	0.39	0.68**	0.62**	0.57**	0.63**	0.55**
Available S	**D1**	0.06	0.19	-0.10	0.05	-0.15	-0.06	-0.10	-0.07	0.01
	D2	0.05	-0.08	-0.22	0.14	-0.13	-0.26	0.10	0.28	-0.03
	D3	-0.03	-0.17	-0.07	0.20	-0.01	-0.21	-0.08	-0.05	0.03
Available Fe	**D1**	0.14	-0.04	0.13	0.05	0.19	0.07	0.23	0.38	0.03
	D2	-0.23	-0.43*	-0.40	-0.10	-0.23	-0.51*	-0.47*	-0.01	-0.22
	D3	-0.12	-0.24	-0.30	-0.23	-0.17	-0.05	0.06	0.33	-0.12
Available Mn	**D1**	0.05	0.21	0.10	0.32	0.07	0.14	0.34	0.04	0.26
	D2	-0.02	0.15	0.14	-0.01	0.05	-0.07	-0.32	-0.38	-0.30
	D3	0.08	-0.07	-0.37	-0.08	-0.41*	-0.38	0.04	0.01	-0.26
Available Zn	**D1**	0.24	0.50*	0.21	0.22	0.17	0.38	0.01	-0.05	0.47*
	D2	-0.05	-0.46*	-0.19	-0.22	-0.10	-0.11	-0.09	-0.08	-0.09
	D3	0.39	0.37	0.60**	0.37	0.60**	0.67**	0.58**	0.56**	0.60**
Available Cu	**D1**	-0.02	0.11	-0.13	0.01	-0.07	0.01	0.04	-0.01	0.06
	D2	0.01	-0.10	-0.25	0.04	-0.21	-0.10	0.12	0.07	0.05
	D3	-0.23	-0.26	-0.15	-0.10	-0.21	-0.19	-0.05	-0.05	-0.15
Available B	**D1**	-0.18	0.34	0.03	0.06	0.08	0.15	-0.12	-0.21	0.12
	D2	0.07	-0.35	-0.14	-0.12	-0.02	-0.04	-0.29	-0.02	0.07
	D3	0.08	-0.44*	-0.17	-0.06	-0.09	0.06	-0.10	0.14	0.03

D1 : 0 – 30 cm soil depth, D2 : 30-60 cm soil depth, D3 : 60-90 cm soil depth
* and ** : refer to level of significance at 0.05 and 0.01 probability level respectively

4. CONCLUSION

Leaf N, P and S content under different fertigation treatments were not significantly different from each other. All the treatments for leaf K content were significantly different. But the content of these leaf elements increased gradually with increasing fertilizers in the drip fertigation treatments. Iron, manganese, copper, and boron content in coconut leaf under different treatments were significantly different. But all the treatments for Zn content were at par. The content of these micronutrients in leaf were found to increase with increasing levels of fertilizer in the treatments. CEC was positively correlated with all the leaf nutrients. Organic carbon did not show remarkable relation with plant nutrient parameters. Soil K content of all three depths was positively correlated with all the leaf nutrient elements, but a more significant correlation coefficient value was found with leaf micronutrients. S, Fe, Mn, Zn, Cu, and B content in soil depths was negligibly correlated with the leaf nutrients elements content.

Under different NPK levels, the applied NPK does not have a significant effect on leaf N, P, S, Zn content after five (5) years of experimentation, while the effect was found to be significant for few elements like K, Fe, Mn, Cu, and B. An increasing trend was observed for leaf nutrient content with increasing levels of fertilizer application. The conclusions of this study were based only on five years of drip fertigation experimentation data. The results may have some limitations and conditions, so further research is needed in the future.

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