

Original Research Article

<https://doi.org/10.20546/ijcmas.2022.1107.034>

Impact of Potassium-Boron Content of Leaf on Nut Yield of Coconut (*Cocos nucifera* L.) in *terai* Region of West Bengal

N. Sathi Babu^{1*}, P. S. Medda², Himadri Bhattacharjee², A. Kumar Sinha³ and A. Ghosh⁴

¹Krishi Vigyana Kendra, Kondempudi, Visakhapatnam Dist. Acharya N.G Ranga Agriculture University, Lam, Guntur, Andhra Pradesh, India

²Department of Plantation crops and Processing, ³Department of Soil Science and Agril. Chemistry,

⁴Department of Agril. Statistics, Uttar Banga Krishi Viswavidyalaya, West Bengal, India

*Corresponding author

ABSTRACT

Wide spread potassium and boron deficiency in coconut (*Cocos nucifera* L.) is a limiting factor for increased nut production in *terai* region of West Bengal. Accordingly, an experiment was undertaken in a 7.5 m x 7.5 m spaced 11 years old coconut plantation (cv.ECT) laid out in Factorial randomized block design with 9 treatments and 4 replications with graded levels of potassium (900, 1200 and 1500 g of K₂O per palm) and boron (25, 50, and 100 g borax/palm) for two consecutive years (2014-15 and 2015-16) to study the influence of leaf potassium and boron on nut yield in coconut in the region. The leaf samples collected from the index leaf (14th frond) was taken for analysis of boron and potassium content at 6 and 12 months after soil application of both the nutrients. The results revealed that both leaf boron and potassium content increased significantly with increasing levels of applications. However, the intermediate dose of both the nutrients recorded the highest nut yield (88.38 nuts per palm per year or 15642.38 number of nuts per ha per year) when leaf potassium and boron were 1.97% and 24.52 mg/kg, respectively. With further increase in the rate of application of the nutrients, there was a decline in nut yield, despite an increase in the respective nutrient content in the leaves. The interaction effect also revealed the same trend. The nut yield production thus showed a positive correlation with increased content of leaf potassium and boron up to a certain level. And, both the nutrients produced a negative effect at 'more than optimum' doses in respect of nut yield production.

Keywords

Potassium and Boron content of 14th frond, Coconut, Sandy loam soils

Article Info

Received:

10 June 2022

Accepted:

28 June 2022

Available Online:

10 July 2022

Introduction

Since the last two decades, there has been a steady and consistent increase in the acreage under the cultivation of coconut (*Cocos nucifera* L.) in West Bengal. It is more so in the districts of North Bengal, where the palm is grown in homestead gardens, though the crop is gaining increasing importance of a plantation crop in the region.

However, based on soils' inherent capacity to meet the plant's requirements, rational crop culture and nutrient management are very poorly practiced. Sandy soils, heavy rainfall, acidic nature of soil, nutrient removal by the crop, and leaching and percolation losses result in multiple nutrient deficiencies and make the situation further complicated. Among the deficient plant nutrients in such coconut growing soils, potassium and boron are the most important. Both the nutrients play very significant roles in increasing the sizes of the nuts and copra biomass, enhance their softness, improve kernel development, help in translocation of starch from the leaves to the nuts, and increase the sweetness of the coconut water.

Further, potassium helps regulating the plant's metabolism, closing and opening of the stomata required for water economy, acts as activator of many enzymes, maintains cation-anion balance of in the cell, and controls the transport of metabolites for cell division which in turn enhance the copra yield of coconut.

Though such effects of the two nutrients are well known, studies on boron and potassium nutrition in coconut in the *terai* region of the West Bengal are not available. Accordingly, the present investigation was undertaken to evaluate the effects of boron and potassium application to coconut in such soils and study their concentration in leaf and relate these concentrations to copra yield of the nuts.

Materials and Methods

The experiment was carried out during 2014-15 and

2015-16 at the Instructional Plots of the Department of Plantation Crops and Processing, Uttar Banga Krishi Viswavidyalaya, West Bengal. The experimental field is located at 43 m above mean sea level at 26°19'86"N latitude and 89°23'53" E longitude. Physico-chemical properties of the soil analysed by standard methods were: texture- sandy loam, pH - 5.45 (Jackson, 1973), electrical conductivity - 0.06 dsm⁻¹ (Jackson, 1973), organic carbon - 0.93% (Walkley and Black, 1934), available N - 159.32 kg/ha (Subbiah and Asija, 1956), available P - 23.15 kg/ha (Bray and Kurtz, 1945), available K - 87.15 kg/ha (Jackson, 1967), and available B - 0.59 mg/kg (Hot water extractable as proposed by Berger and Truog, 1939).

The experiment was laid out in Factorial Randomised Block Design with 9 treatments, with three different levels of potassium viz. K₁, K₂, and K₃ @ 900, 1200 and 1500 g of K₂O (as MoP, 60% K₂O) and three levels of boron viz. B₁, B₂, and B₃ @ 25, 50, and 100 g (as borax, 10.5% B) per palm per year at a spacing of 7.5 x 7.5 m in 9 years old East Coast Tall. Each treatment was replicated 4 times. The nine different treatment combinations were as follows: T₁: B₁K₁: 25 g borax/palm + 900 g K₂O/palm, T₂: B₁K₂: 50 g borax/palm + 1200 g K₂O/palm, T₃: B₁K₃: 25 g borax/palm + 1500 g K₂O/palm, T₄: B₂K₁: 50 g borax/palm + 900 g K₂O/palm, T₅: B₂K₂: 50 g borax /palm + 1200 g K₂O/palm, T₆: B₂K₃: 50 g borax/palm + 1500 g K₂O/palm, T₇: B₃K₁: 100 g borax/palm + 900 g K₂O/palm, T₈: B₃K₂: 100 g borax/palm + 1200 g K₂O/palm and T₉: B₃K₃: 100 g borax /palm + 1500 g K₂O/palm. All the palms were fertilized uniformly with 500 g N (as urea, 46% N) and 320 g of P₂O₅ (as SSP, 16% P₂O₅) per palm along with the required amount of boron and potassium as per the treatment combinations.

Half of the doses of the nutrients were applied in May, 2014 as pre-monsoon application, while the remaining half was applied in September, 2014 as post-monsoon application. The same fertilizer schedule was repeated for the year 2015. The fertilizers were applied at 180 cm away from the

base of the palms (De Silva, 1968). The initial soil samples at 0-30 cm depth were collected at random before commencement of the study; thereafter, sampling was done at 6 month intervals at the same depth at sites 1.8 m away from the trunk of the palm. For the determination of boron and potassium content of leaf, the leaf samples were collected from the index leaf *i.e.* 14th fronds for analysis before application of the fertilizers and subsequently at 6 and 12 months after application. The 14th fronds were chosen as the index leaf for analysis of as suggested by Reuter and Robinson (1997). The leaf samples were digested by tri-acid mixture and the acid digests as such or after proper dilution were analysed for their potassium content by flame photometry as described by Muhr *et al.*, (1965). For determining boron, the digests were analysed by the method suggested by Berger and Truog (1939).

Results and Discussion

Effect of K and B application and their interactions on leaf K content in coconut growing soils

Results with respect to the effect of application of boron at different levels on leaf K content are presented in Table 1 and Fig.1 showed that there was not much variation in leaf K content between the two years. The results of the two years were thus fairly consistent. With increase in the level of boron from B₁ to B₂, there was significant increase in leaf K content. Thus, the leaf K content increased from 1.72 at B₁ level to 1.82 % at B₂ level at 6 months after application in the year 2014- 15.

The increase in leaf K content thus increased with the additional supply of boron. Both B and K serve as buffers and are necessary for the maintenance of conducting tissues (Mengel and Kirkby, 2001). This variation might be due to its maintenance of conducting tissues and cation – anion balance as a result of which cell membrane permeability to K⁺ uptake was increased. Stimulation of the proton pump with subsequent hyper polarization of the membrane resulting in an increased driving force of

K⁺ influx may be another possible reason. Increased K uptake at an optimum level of soil boron has been reported by Samet *et al.*, (2015) in pepper. With further increase in boron level, the leaf K content however, decreased substantially from 1.82 % to 1.31 % in the change from B₂ to B₃ level in 2014-15. This decrease was to the extent of about 28 % and must be due to the toxic concentration of boron in the soil at B₃ level of boron application. This negative effect between B and K might have been caused by K efflux out of the roots due to the differential effect of B toxicity on plasmalemma permeability. Similar findings have been reported by Samet *et al.*, (2015) and Mengel and Kirk by (2001) reported that excess supply of boron in growth medium reduced uptake of K and *vice versa*.

The results pertaining to the effect of K applications at different graded levels on the leaf K content are also depicted in Table 1 and Fig.2 revealed that with increase in the level of potassium from K₁ to K₂, there was significant increase from 1.12 to 1.74 % in the leaf K content in 2014- 15. The functions of potassium as already stated earlier might have contributed to the increased leaf K content at a higher potassium level. With further increase in potassium level, there was further increase in leaf K content from 1.74 to 1.99 in 2014-15 from K₂ to K₃ and it may be because of 'more than required absorption of K as coconut is a potassium loving plant as reported by Manicot *et al.*, (1980).

Increased requirement of K may also be due to its involvement in enzymatic activity, photosynthesis, stomatal movement, phloem transport, cation- anion balance and stress resistance (Marschner, 2012). The same trend of results was observed in 2015-16 and also in the case of pooled results for the two years. In any case, with increase in potassium supply, the nutrient continues to be increasingly absorbed as seen in increased leaf K content. This aspect is to be considered in coconut fertilisation for a high nut yield, since the absorbed K above a certain level does not give any additional yield. Venkitaswamy *et al.*, (2011) also reported results in similar lines.

Interaction effects of boron and potassium application on leaf K content

The results revealed that the leaf K content was the highest in B₁K₃ treatment followed by B₂K₃ and B₂K₂ treatments, being 2.32 %, 2.21 %, and 1.96 % respectively and it was lowest in B₃K₁ followed by B₁K₁ and B₃K₃ amounting in the order of 0.97 %, 1.10 % and 1.43 % in respective treatments in 2014-15 (Table 1 and Fig 3). The same trend was observed in the year 2015-16 and also for the mean of the two years. Boron-potassium interactions at the applied rates and combinations might have caused the differences in the leaf K content. The results of the study suggest that, there was synergistic interaction effect between K and B in the case of B₁K₃, B₂K₃, and B₂K₂ treatments resulting in increased K uptake. The interaction between these two nutrients was antagonistic also in B₃K₁ and B₃K₃ combinations. Findings in similar line in on leaf K contents in boron-potassium combinations have been reported by Mengel and Kirkby (2001).

The authors observed that B and K interaction was negative with an excess of boron; boron toxicity in case of excess boron application decreased the uptake of K. It may be mentioned in this connection that Reuter and Robinson (1997) suggested 0.6, 0.6 to 0.9, and 1.2 to 1.5 mg/kg leaf (14th leaf) K for confirming deficient, critical, and adequate ranges of potassium, respectively in coconut. Using these limits for ascertaining K deficiency or adequacy in coconut, it may be concluded that in the present study, the B₃ and K₁ levels and combined treatments of B₁K₁, B₂K₁, B₃K₁ were found to be in low range; further, B₁, B₂, K₂ K₃ levels and B₁K₂, B₂K₂ and B₃K₂ interactions were in sufficiency range, while, B₁K₃ and B₂K₃ interactions were found to be in the in excess or high range at 6 month after soil application of B and K.

It may also concluded that, all the levels of boron and potassium and their interaction effects pertaining to leaf K content were showed progressively decreasing trend from 6 month to 12 months after soil application of boron and

potassium, which might be attributed to consequent mobility of K ions from vegetative parts, such as the leaves, to the reproductive parts of the plants. These results are in tune with those of Harishkumar *et al.*, (1982).

Effect of application of boron and potassium and their interactions on leaf B content

Effect of boron application at different levels on leaf B content are presented in Table 2 and Fig.4 showed that with increase in the level of boron from B₁ to B₂, and from B₂ to B₃ there was significant increase in leaf boron content. B content in leaf increased from 14.09 to 22.58 and 22.58 to 30.79 mg/kg in respectively at 6 months after application in the year 2014-15. The results further revealed that the increases in leaf B content were in proportion to the increases in the rates of application of boron. Similar results have been reported by Moura *et al.*, (2013) in coconut.

The results with respect to the effect of graded levels applications of potassium on the leaf B content are also presented in Table 2 and Fig.5 revealed that there was high consistency in leaf B content between the results of the two years. With increase in the level of potassium from K₁ to K₂, there was little increase in the leaf boron content from 23.63 to 23.78 in 2015-16 at 6 months after application and it was statistically at *par* with each other. With further increase in potassium level, there was sharp decrease in boron content of the leaves from 23.78 to 21.05 in 2015-16 and it was statistically significant. This variation might be due to negative interaction between B and K at excess levels of available K due possibly to cation-anion imbalance as has been reported earlier by Samet *et al.*, (2015). The same trend was observed in 2014-15 and also in the case of pooled results for the two years. In any case, with increase in potassium supply, there was an increase in leaf boron content followed by significant increase at a certain boron level. This aspect is to be considered in coconut fertilisation so as to avoid boron toxicity in the coconut palms.

Table.1 Effect of application of boron and potassium and their interaction on leaf K content (%) after 6 and 12 months of application

Levels of Boron	6 months (December)			12 months (June)		
	2014-15	2015-16	Pooled	2014-15	2015-16	Pooled
B ₁	1.72	1.73	1.73	1.03	1.03	1.03
B ₂	1.82	1.84	1.83	1.06	1.05	1.06
B ₃	1.31	1.31	1.31	0.86	0.86	0.86
SE(m)±	0.01	0.01	0.01	0.01	0.01	0.01
LSD (P=0.05)	0.02	0.01	0.01	0.02	0.03	0.02
Levels of Potassium	6 months (December)			12 months (June)		
	2014-15	2015-16	Pooled	2014-15	2015-16	Pooled
K ₁	1.12	1.12	1.12	0.86	0.85	0.86
K ₂	1.74	1.75	1.75	1.03	1.03	1.03
K ₃	1.99	2.00	2.00	1.06	1.05	1.06
SE(m)±	0.01	0.01	0.01	0.01	0.01	0.01
LSD (P=0.05)	0.02	0.01	0.01	0.02	0.03	0.02
Treatments	6 months (December)			12 months (June)		
	2014-15	2015-16	Pooled	2014-15	2015-16	Pooled
B ₁ K ₁	1.10	1.10	1.10	0.83	0.83	0.83
B ₁ K ₂	1.75	1.75	1.75	1.04	1.03	1.03
B ₁ K ₃	2.32	2.33	2.33	1.22	1.22	1.22
B ₂ K ₁	1.29	1.30	1.29	0.99	0.98	0.98
B ₂ K ₂	1.96	1.97	1.97	1.10	1.10	1.10
B ₂ K ₃	2.21	2.24	2.23	1.10	1.08	1.09
B ₃ K ₁	0.97	0.97	0.97	0.75	0.75	0.75
B ₃ K ₂	1.52	1.53	1.52	0.96	0.96	0.96
B ₃ K ₃	1.43	1.44	1.43	0.85	0.86	0.86
SE(m)±	0.01	0.01	0.01	0.01	0.02	0.01
LSD (P=0.05)	0.04	0.02	0.02	0.03	0.04	0.03

Table.2 Effect of application of boron and potassium and their interaction on leaf B content (mg/kg) after 6 and 12 months of application

Levels of Boron	6 months (December)			12 months (June)		
	2014-15	2015-16	Pooled	2014-15	2015-16	Pooled
B₁	14.09	14.52	14.30	8.932	9.034	8.983
B₂	22.58	22.67	22.62	11.785	12.045	11.915
B₃	30.79	31.27	31.03	14.766	14.61	14.688
SE(m)±	0.16	0.19	0.15	0.25	0.25	0.22
LSD (P=0.05)	0.48	0.56	0.43	0.72	0.73	0.63
Levels of Potassium	6 months (December)			12 months (June)		
	2014-15	2015-16	Pooled	2014-15	2015-16	Pooled
K₁	23.22	23.63	23.42	12.25	12.34	12.29
K₂	23.24	23.78	23.51	12.39	12.37	12.38
K₃	21.00	21.05	21.02	10.84	10.98	10.91
SE(m)±	0.16	0.19	0.15	0.25	0.25	0.22
LSD (P=0.05)	0.48	0.56	0.43	0.72	0.73	0.63
Treatments	6 months (December)			12 months (June)		
	2014-15	2015-16	Pooled	2014-15	2015-16	Pooled
B₁K₁	14.22	14.73	14.47	9.60	9.48	9.54
B₁K₂	15.73	15.98	15.85	9.98	10.26	10.12
B₁K₃	12.31	12.85	12.58	7.22	7.36	7.29
B₂K₁	22.08	22.32	22.20	11.39	11.76	11.58
B₂K₂	25.00	24.05	24.52	13.05	13.31	13.18
B₂K₃	20.67	20.05	20.36	10.91	11.06	10.99
B₃K₁	33.42	34.29	33.86	16.18	15.87	16.02
B₃K₂	28.93	29.28	29.11	13.72	13.45	13.58
B₃K₃	30.02	30.24	30.13	14.40	14.52	14.46
SE(m)±	0.28	0.33	0.25	0.43	0.43	0.37
LSD (P=0.05)	0.84	0.97	0.74	1.25	1.26	1.09

Table.3

Effect of application of boron and potassium and their interaction on number of nuts per palm per year				Effect of application of boron and potassium and their interaction on number of nuts per ha per year		
Levels of Boron	2014-15	2015-16	Pooled	2014-15	2015-16	Pooled
B ₁	58.58	61.08	59.83	10384.25	10870.75	10627.50
B ₂	74.25	78.17	76.21	13142.25	13835.50	13488.88
B ₃	43.58	41.83	42.71	7714.25	7404.50	7559.37
SE(m)±	1.91	1.77	1.13	102.71	75.25	81.16
LSD (P=0.05)	5.60	5.18	3.30	301.57	220.94	238.01
Levels of Potassium	2014-15	2015-16	Pooled	2014-15	2015-16	Pooled
K ₁	51.92	53.67	52.79	9189.25	9499.00	9344.12
K ₂	68.17	69.75	68.96	12065.50	12404.75	12235.13
K ₃	56.33	57.67	57.00	9986.00	10207.00	10096.50
SE(m)±	1.91	1.77	1.13	102.71	75.25	81.16
LSD (P=0.05)	5.60	5.18	3.30	301.57	220.94	238.01
Treatments	2014-15	2015-16	Pooled	2014-15	2015-16	Pooled
B ₁ K ₁	55.00	58.50	56.75	9735.00	10354.50	10044.75
B ₁ K ₂	71.25	73.50	72.38	12611.25	13186.50	12898.88
B ₁ K ₃	49.50	51.25	50.38	8806.50	9071.25	8938.88
B ₂ K ₁	59.50	63.50	61.50	10531.50	11239.50	10885.50
B ₂ K ₂	86.25	90.50	88.38	15266.25	16018.50	15642.38
B ₂ K ₃	77.00	80.50	78.75	13629.00	14248.50	13938.75
B ₃ K ₁	41.25	39.00	40.13	7301.25	6903.00	7102.13
B ₃ K ₂	47.00	45.25	46.13	8319.00	8009.25	8164.13
B ₃ K ₃	42.50	43.75	43.12	7522.50	7301.25	7411.88
SE(m)±	3.30	3.06	1.95	177.90	130.33	140.40
LSD (P=0.05)	9.70	8.98	5.72	522.34	382.69	412.24

Fig.1 Effect of application of boron on leaf potassium content (%) after 6 and 12 months of application

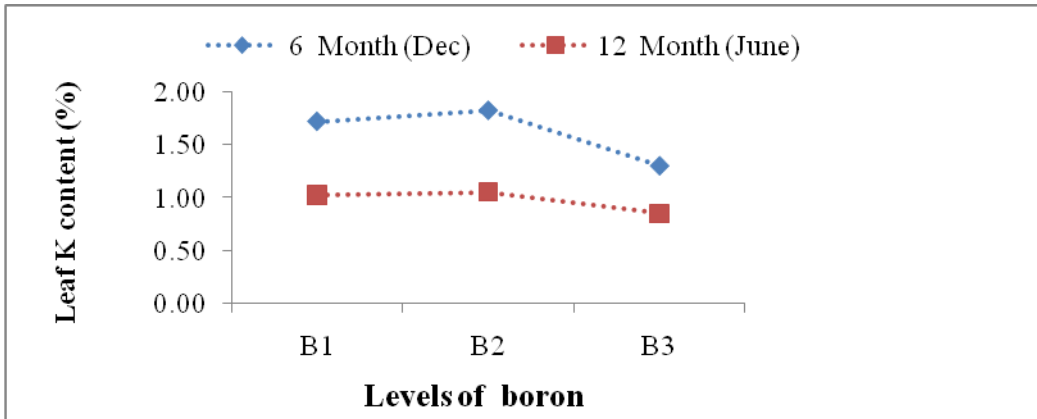


Fig.2 Effect of application of potassium on leaf potassium content (%) after 6 and 12 months of application

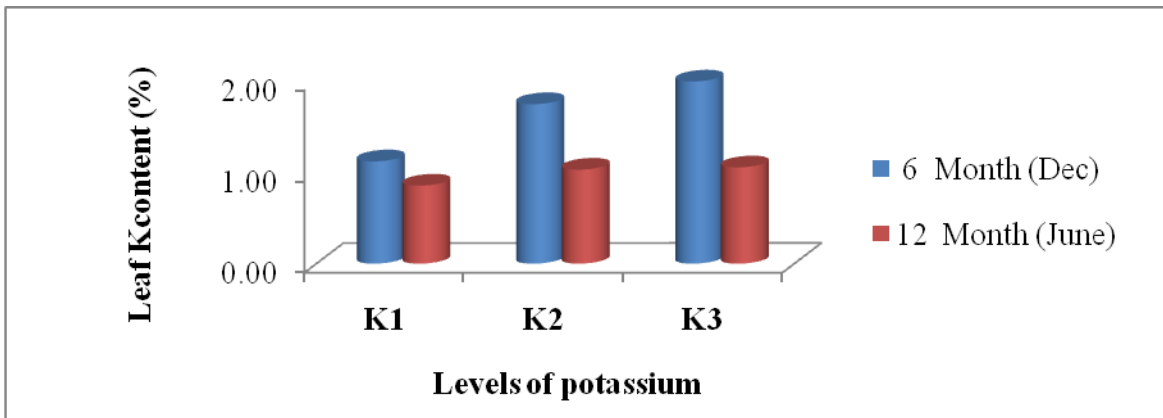


Fig.3 Interaction effect of boron and potassium on leaf potassium content (%) after 6 and 12 months of application

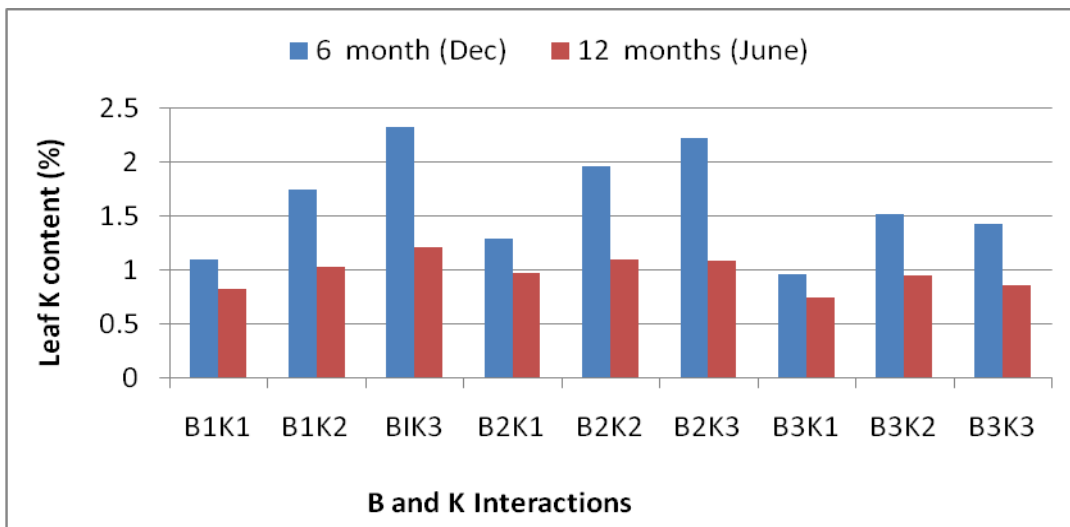


Fig.4 Effect of application of boron on leaf boron content (mg/kg) after 6 and 12 months of application

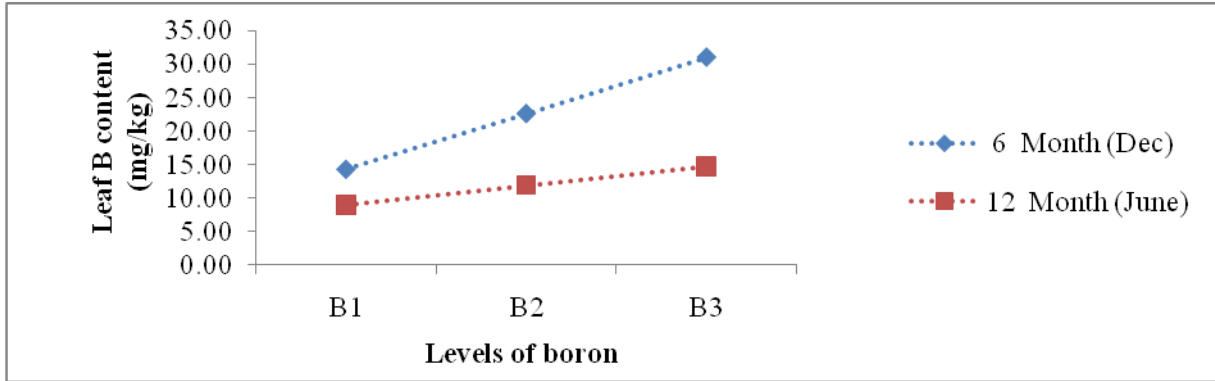


Fig.5 Effect of application of potassium on leaf boron content (mg/kg) after 6 and 12 months of application

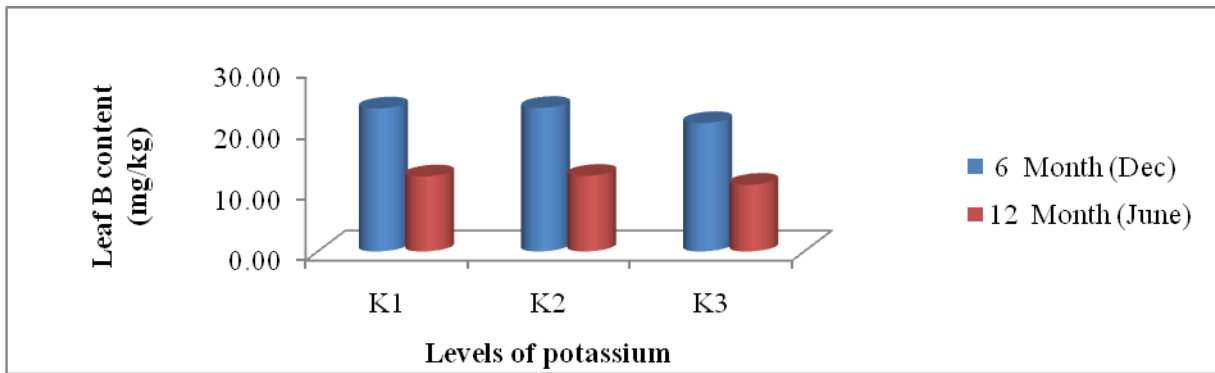


Fig.6 Interaction effect of boron and potassium on leaf boron content (mg/kg) after 6 and 12 months of application

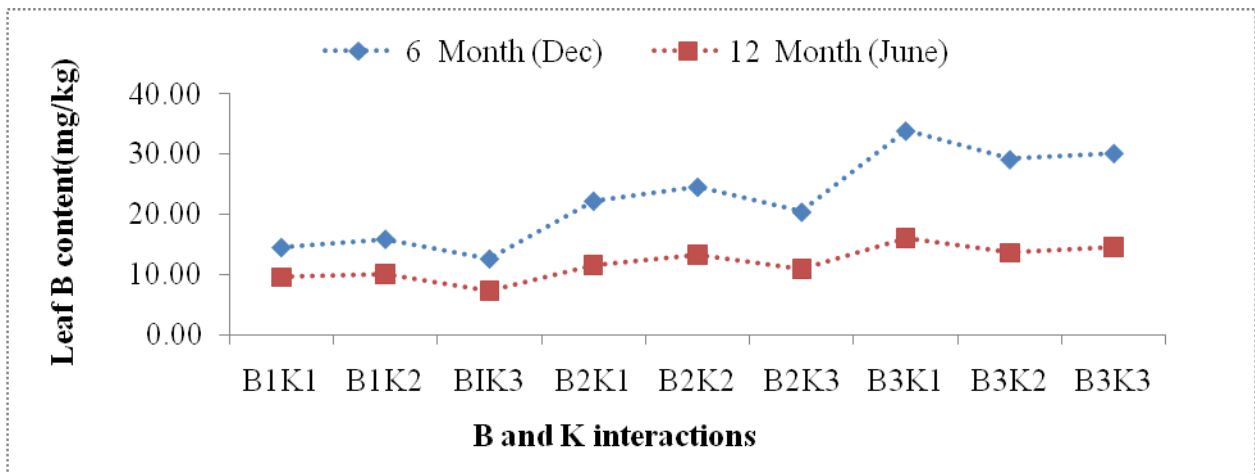


Fig.7 Effect of boron on number of nuts per palm per year

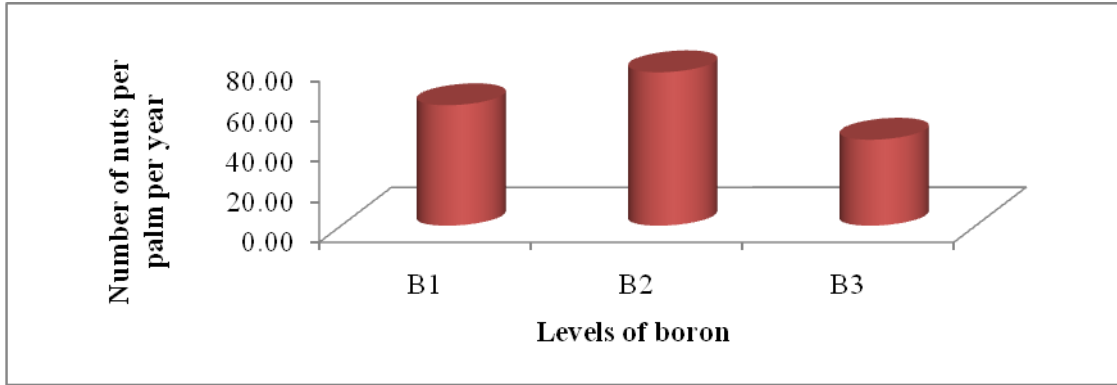


Fig.8 Effect of potassium on number of nuts per palm per year

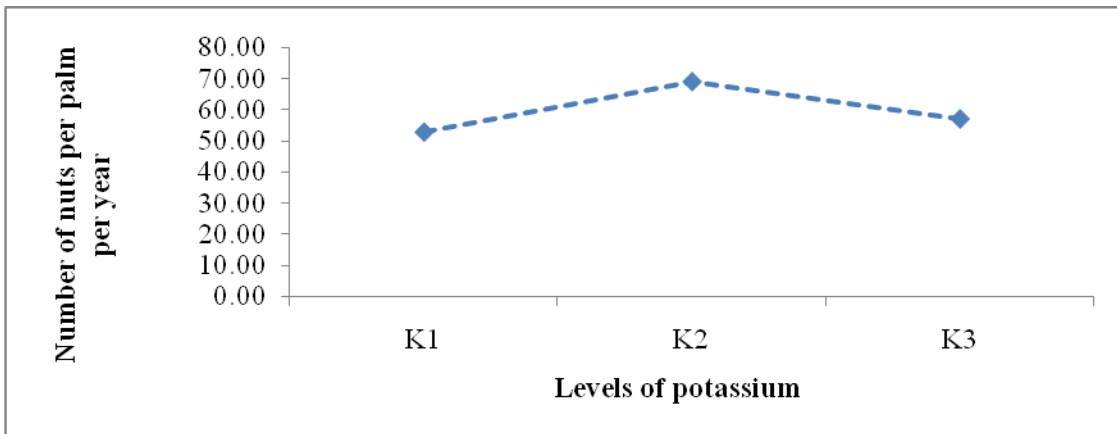
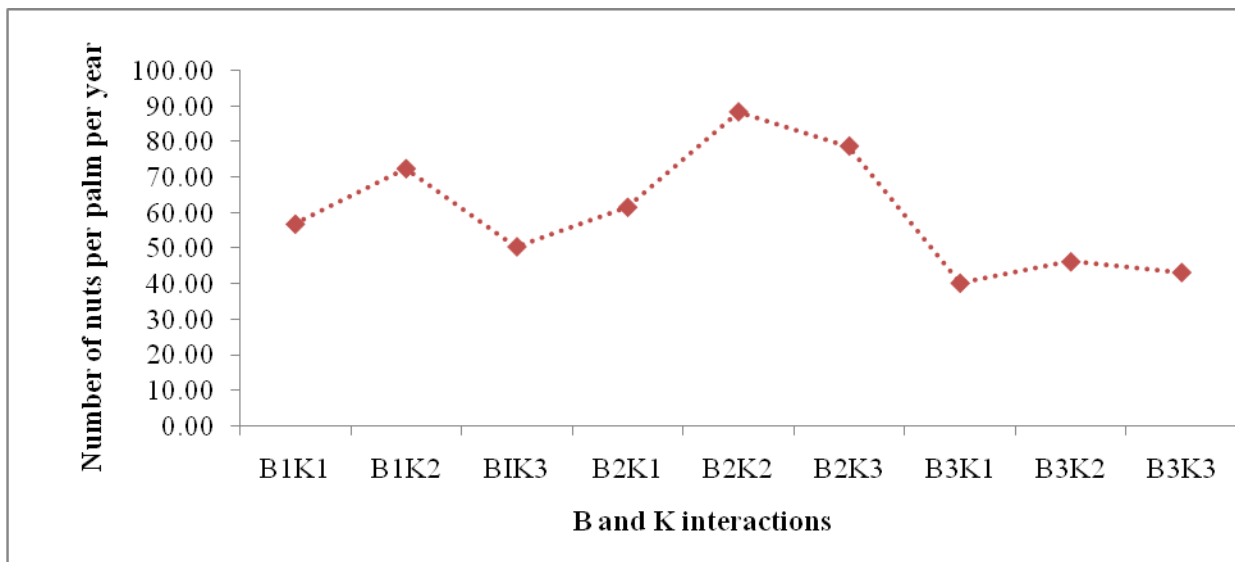


Fig.9 Interaction effect of boron and potassium on number of nuts per palm per year



Interaction effects of boron and potassium on leaf B content

A perusal of data presented in Table 2 and Fig.6 showed that the leaf B content was the highest in B₃K₁ treatment followed by B₃K₃ and B₃K₂ treatments the leaf B content being 33.42, 30.02, and 28.93 mg/kg respectively and it was lowest in B₁K₃, followed by B₁K₁ and B₁K₂ treatments respective leaf boron content was 12.31, 14.22, and 15.73 mg/kg in 2014-15. The same trend was observed in the year 2015-16 and also for the mean of the two years. B and K interactions at the applied rates and combinations might have caused the differences in the leaf B content. This type of effect may be due to excess application of potassium caused to decrease in leaf B content. The results of the study suggest that as regards to leaf B content, there was synergistic interaction effect between potassium and boron in certain cases and antagonistic interaction in some cases. The synergistic combinations are to be adopted, and antagonistic combinations are to be avoided in applying fertilizers in coconut for maximising the nut yield of the plantation crop in *terai* region of West Bengal. The results of the study are in agreement with those of present findings confirmed the findings of Ranade-Malvi (2011). Considering the leaf (14th) boron content ratings in coconut as suggested by Reuter and Robinson (1997), B₁K₁, B₁K₂ and B₁K₃ combination treatments were in low range, while, B₂K₁, B₂K₂ and B₂K₃ treatments were in adequate or sufficiency range at 6 month after soil application of B and K. At the same time period, the soils under the treatments viz. B₃K₁, B₃K₂ and B₃K₃ were in excess or high range of boron at 6 month after application of boron and potassium, suggesting that in such soils, boron reached toxic levels which cause toxicity effect, and boron should not be applied in coconut at such high rates. Further, it appears that the individual effects of boron and potassium and also their interaction effects pertaining to the leaf boron content had a decreasing trend from 6 to 12 months after soil application of boron and potassium. The continued decrease in leaf B content may because of the fact that during this period (6 to

12 months), boron might have been utilized in fruit setting, boosts up pollination, seed development, synthesis of cell wall, lignifications maintenances of cell wall structure integrity nitrogen metabolism, and protein biosynthesis. A similar result was also reported by Ahmad *et al.*, (2009).

Effect of B and K application and their interaction on Nut yield

Effect of boron and potassium on nut yield

Data presented in Table 3 and Figure 7, clearly showed significant variation in respect to number of nuts per palm per year as well as nut yield/ha/year among different treatments in both the years also in pooled analysed data. In the present study, based on the pooled data the results showed the nut yield was the highest at B₂ level of boron was 76.21 nuts per palm per year and 13488.88 nuts/ha/year. There was a substantial increase in nut yield when boron level was increased from B₁ to B₂ (59.83 to 76.21 nuts per palm per year and 10627.50 to 13488.88 nuts/ha/year). Similar line findings have been reported by Santos *et al.*, (2003), Pinho *et al.*, (2008 a.), Kamalakshamma *et al.*, (2001) and Moura *et al.*, (2013) in coconut and Lakshmi pathi *et al.*, (2015) in cashew. With further increase in boron to B₃ level, the nut yield was drastically reduced from 76.21 to 42.71 nuts per palm per year and 13488.88 to 7559.37 nuts/ha/year. At B₃ level, there must have been toxic effect causing a decline in nut yield. Results in similar line have earlier been reported also Kamalashima *et al.*, (2001), Moura *et al.*, (2013) in coconut and Lakshmi pathi *et al.*, (2015) in cashew. Application of boron in coconut at B₃ level therefore must be avoided.

The data presented in Table 3 and Figure 8 with respect to the effects of graded levels of potassium applications on nut yield. From the pooled data it was revealed that the nut yield was the highest at K₂ level of potassium (68.96 nuts per palm per year and 12235.13 nuts/ha/year). There was a substantial increase in nut yield when level was increased from K₁ to K₂. Similar trend have been reported earlier

also by Venkitaswamy *et al.*, (2011), Loganathan and Balakrishnamurthi (1980), Hameed Khan *et al.*, (1986), Reddy *et al.*, (2002) and Maheswarappa *et al.*, (2014). With further increase in the levels of potassium to K_3 , the nut yield was substantially reduced from 68.96 to 57.00 nuts per palm per year and 12235.13 to 10096.50 nuts/ha/year. Though potassium is not reported to cause any toxicity even at a higher rate of application. It is possible that potassium at the level is reducing the uptake of boron as evident from Table.13 and 15. It was reported earlier that at high potassium level, the uptake of boron is often reduced (Mengel and Kirkby, 2001 and Ranade-Malvi, 2011). Magat *et al.*, (1976) and Venkitaswamy *et al.*, (2011) were also noticed that decreased nut yield with increasing levels of potassium application.

Interaction effect of boron and potassium application on nut yield

The results pertaining to boron-potassium interaction effects on nut yield are presented in Table 4. The nut yield was the highest B_2K_2 followed by B_2K_3 and B_1K_2 levels (88.38, 78.75 and 72.38 nuts per palm per year) and it was also reflected in number of nuts per ha per year (Table 4 and Figure 9). The nut yield was the highest B_2K_2 followed by B_2K_3 and B_1K_2 levels (15642.38, 13938.75, and 12898.88 nuts/ha/year). From the result, it can be concluded that when the leaf boron content around 25 (mg/kg) and potassium content 1.97 (%) were favour towards higher nut production (Table14 and 15). Similar findings from Grunder (1960) and Bachy (1963) observed that K content should be 1.8 % and 1.95 % respectively in 14th frond of coconut. Therefore, for reaching the maximum nut yield, B_2K_2 level should be recommended.

References

Ahmad, W., Niaz, A., Kanwal, S. R. and Rasheed, M. K. (2009). Role of boron in plant growth: A review. *Journal of Agricultural Research*, 47: 329-338.

Berger, K. C. and Truog, E. (1939). Boron

determination in soils and plants. *Ind. Eng. Chem*, 11: 540-545.

Bray, R. H. and Kurtz, L. T. (1945). Determination of total, organic and available forms of phosphorus in soils. *Soil Science*, 59: 39-45.

De Silva, M. A. T. (1968). Recommended methods of fertilizer application for coconut palms. *Ceylon Coconut Planters*, 3:108-111.

Grunder, C. (1960). The role of potassium in the nutrition of the oil palm. *Wild Crops*, 12 (11): 433- 437.

Hameed Khan, H., Gopalasundaram, P. and Joshi, O. (1986). Effect of NPK fertilization on the mineral nutrition and yield of three coconut genotypes. *Fertilizer Research*, 10:185-189.

Harishkumar, P., Nair, B. P., Rakhiappan, P., Nagabhushanan, S. and Moham, E. (1982). Variation in mineral composition of leaves of cashew (*Anacardium occidentale* L.) as effected by season, position and age. *Indian Cashew Journal*, 14 (1): 7-10.

Jackson, M. (1973). *Soil chemical analysis*. Prentice hall of India private limited, New Delhi.

Jackson, M. L. (1967). *Soil Chemical Analysis*. Prentice-Hall of India, New Delhi.

Kamalakshamma, P. G., Prema, D. and Shanava, M. (2001). *Boron Deficiency in Coconut (Cocos nucifera* L.). Technical Bulletin No.40. CPCRI, Kasaragod.

Lakshmipathi, D., Dinakara, A. J., Kalaivanan, D., Mohanan, G. S. and Meena, R. K. (2015). Effect of foliar application of micronutrients on reproductive growth of cashew (*Anacardium occidentale* L.) under South West coast region of Karnataka, India. *Trends in Biosciences*, 8 (2): 447- 449.

Loganathan, P. and Balakrishnamurthi, T. S. (1980). Effect of NPK fertilizers on young coconut (*Cocos nucifera* L.) on a sandy soil in Sri Lanka. *Experimental Agriculture*, 16 (1): 41-48.

Magat, S. S., Cadigal, V. L. and Habana, J. A. (1976). Yield Improvement of Coconut in an Elevated Inland Area of Davao by Potassium Chloride Fertilization. *Philippine Journal of Crop Science*, 1: 60 - 63.

Magat, S. S., Cadigal, V. L. and Habana, J.A. (1976). Yield Improvement of Coconut in an Elevated Inland Area of Davao by Potassium Chloride Fertilization. *Philippine Journal of Crop*

- Science*, 1: 60-63.
- Maheswarappa, H. P., Thomas, G. V., Gupta, A., Bhat, R. and Palaniswami, C. (2014). Productivity and nutrient status of coconut (*Cocos nucifera* L.) as influenced by integrated nutrient management with vermi composted by coconut leaves. *Indian Journal of Agronomy*, 59 (3): 455 - 459.
- Manciot, R. Ollagnier, M. and Ochs, R. (1980). Mineral nutrition and fertilization of the coconut around world. *Oleagineux*, 35 (1): 23-27.
- Marschner, H. (2012). In: *Mineral Nutrition of Higher Plants*. 3rd edition. Academic Press, London. pp: 178-189.
- Mengel, K and Kirkby, E. A. (2001). Principles of Plant Nutrition. 5th edition. Dordrecht: *Kluwer Academic Publishers*, pp: 849.
- Mengel, K. (1985). Dynamics and availability of major nutrients in soils. *Advances in Soil Science*, 2: 65-115.
- Moura, J. Z., Prado, R. M., Benvindo, R. N. and Chaves, A. L. (2013). Applying boron to coconut palm plants: effects on the soil, on the plant nutritional status and on productivity boron to coconut palm trees. *Journal of Soil Science and Plant Nutrition*, 13 (1): 79 - 85.
- Muhr, G. R., Datta, N. P., Sankarasubramoney, H., Leley, V. K. and Dunabha, R. L. (1965). Soil testing in India. Second edition, USAID-Mission to India, New Delhi.
- Ranade-Malvi, U. (2011). Interaction of micronutrients with major nutrients with special reference to potassium. *Karnataka Journal of Agricultural science*, 24 (1): 106-109.
- Pinho, L. G. R., Monnerat, P. H., Pires, A. A., Marciano, C. R. and Soares, Y. J. B. (2008a). Distribution of nutrients and visual symptoms of boron deficiency in green dwarf coconut roots. *Journal of Soil Science*, 32: 2581-2590.
- Reddy, D. V. S., Upadhyay, A. K., Gopalasundaram, P. H. and Khan, H. (2002). Response of high yielding coconut variety and hybrids to fertilization under rain fed and irrigated conditions. *Nutrient Cycling in Agroecosystems*, 62: 131-138.
- Reuter, D. J. and Robinson, J. B. (1997). *Plant Analysis: An Interpretation manual* (2nd edition). CSIRO Publishing
- Samet, H., Cikili, Y. and Dursun, S. (2015). The role of potassium in alleviating boron toxicity and combined effects on nutrient concentrates in pepper (*Capsicum annuum* L.). *Bulgarian Journal of Agricultural Sciences*, 21 (1): 64-70.
- Santos, A. L., Monnerat, P. H. and Alves, E. A. B. (2003). Leaf boron content due to the application of borax in leaf axil of green dwarf coconut in the North Fluminense. *Agricultural Research Sustainable Development*, 26: 330 – 334
- Subbaiah, B. V. and Asija, G. L. (1956). A rapid procedure for the determination of available Nitrogen in soils. *Current Science*, 25: 256-260.
- Venkitaswamy, R., Hameed Khan, H. and Palaniswami, C. (2011). Effect of graded levels of NPK on the reproductive characters and yield of hybrid coconut (COD X WCT). *Tropical Agriculture*, 86:13-20
- Walkley, A. and Black, I. A. (1934). An examination of the different method for determining soil organic matter and a proposed modification of the chromic acid titration method. *Journal of Soil Science*, 37: 93 - 101.

How to cite this article:

Sathi Babu, N., P. S. Medda, Himadri Bhattacharjee, A. Kumar Sinha and Ghosh, A. 2022. Impact of Potassium-Boron Content of Leaf on Nut Yield of Coconut (*Cocos nucifera* L.) in terai Region of West Bengal. *Int.J.Curr.Microbiol.App.Sci*. 11(07): 282-294. doi: <https://doi.org/10.20546/ijcmas.2022.1107.034>