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Impact of soil available nutrients on yield of coconut under Dindigul and Erode districts of Tamil Nadu

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Abstract
The coconut palm (*Cocos nucifera* L.) is known as kalpavriksha which mean tree of heaven for its various valuable uses. Coconut palms are grown under various countries irrespective of soil and climatic factors. The yield of coconut is varied hugely which may be attributed to the level of soil available nutrients and various other factors. Soil samples were collected at 153 geo referenced points at three different depths at coconut cover and analysed for organic carbon and soil available nutrients such as N, P, K, S, B, Fe, Mn, Zn and Cu. The data on yield (nuts points^{-1} years^{-1}) was also collected and correlated with nutrients. The study was revealed that all the above nutrients are positively correlated with coconut yield in which N, K, B, Fe, Mn, Zn and Cu were significantly correlated with yield and P & S were non-significantly correlated with yield.

Keywords: soil available nutrients, yield of coconut and coconut palms

Introduction
The coconut palm is (*Cocos nucifera* L) is grown under various soil and climatic condition through the world. India is the largest producer of the coconuts with a production of 22.17 billion nuts year^{-1}(APCC, 2017). The productivity of coconut is varied from 14,038 nuts^{-1} ha^{-1} year^{-1} (Andhra Pradesh) to 4,743 nuts^{-1} ha^{-1} year^{-1} (Maharashtra) (CDB, 2017-18. Tamil Nadu ranks third in both area (4, 41, 490 ha) and production with 6.02 billion nuts year^{-1} (CDB, 2017-18). The productivity of coconut is varied from 21,033 nuts^{-1} ha^{-1} year^{-1} (Cuddalore district) to 1,695 nuts^{-1} ha^{-1} year^{-1} (The Nilgiris district) in Tamil Nadu (CDB, 2017-18).
These variations may be attributed to climatic factors, irrigation water quality, variation in cultivation practices and various soil factors. Hence, to study the impact of soil available nutrients on coconut yield, a study was conducted at coconut land cover at Dindigul and Erode districts of Tamil Nadu. Soil available nutrients were correlated with coconut yield and it was found that N, K, B, Fe, Mn, Zn and Cu were significantly positively correlated with yield whereas P and S were non-significantly positively correlated with yield. Also, the nutrient status of the soil from this study can be taken to plan for site specific nutrients management to augment the coconut yield.

Results
Soil organic carbon and other available nutrients at the depth of 0-30cm, 30-60cm, 60-90cm and soil depth weighted average were correlated with coconut yield (Table 1). In all the depths, no nutrients were significantly negatively correlated with coconut yield.

Table 1: Correlation coefficients (r) between soil available nutrients and coconut yield (nuts palm^{-1} year^{1}) at different depths

	0-30 cm	30-60 cm	60-90 cm	0-90 cm
OC	0.448**	0.344**	0.323**	0.418**
N	0.156*	0.188*	0.054*	0.142*
P	0.054^{NS}	0.045^{NS}	0.070^{NS}	0.060^{NS}
K	0.288**	0.261**	0.275**	0.290**
S	0.063^{NS}	0.033^{NS}	0.035^{NS}	0.047^{NS}
B	0.214**	0.241**	0.183*	0.229**
Fe	0.437**	0.426**	0.418**	0.433**
Mn	0.420**	0.394**	0.406**	0.412**
Zn	0.154^{NS}	0.206*	0.229**	0.209**
Cu	0.366**	0.304**	0.310**	0.352**

N=153, ** Correlation is significant at 0.01 level. * Correlation is significant at 0.05 level

At 0-30cm depth, coconut yield was significantly positively correlated with organic carbon (0.448**) nitrogen (0.156*), potassium (0.288**), boron (0.214**), iron (0.437**), manganese (0.420**) and copper (0.366**) and phosphorus (0.054), sulphur (0.063) and zinc (0.154) were non-significantly positively correlated with yield.

Coconut yield was significantly positively correlated with organic carbon (0.344**), nitrogen (0.188*), potassium (0.261**), boron (0.241**), iron (0.426**), manganese (0.394**), zinc (0.206*) and copper (0.304**) at the depth of 30-60cm. Phosphorus (0.045) and sulphur (0.033) were positively non-significantly correlated with yield at 30-60cm depth.

At 60-90cm, organic carbon (0.323**), nitrogen (0.054*), potassium (0.275**), boron (0.183**), iron (0.418**), manganese (0.406**), zinc (0.229**) and copper (0.310**) were significantly positively correlated with yield.

In soil depth weighted average, organic carbon (0.418**), nitrogen (0.142*), potassium (0.290**), boron (0.229**), iron (0.433**), manganese (0.412**), zinc (0.209**) and copper (0.352**) were significantly positively correlated with yield.

Phosphorous was non-significantly positively correlated with yield at all the depths as 0-30cm (0.054), 30-60 cm (0.045), 60-90 cm (0.070) and SDWA (0.060). Coconut yield was non-significantly positively correlated with sulphur at all the depths of 0-30cm (0.063), 30-60(0.033), 60-90(0.035) and SDWA (0.047).

Discussion

In all the depths, soil organic carbon had positive relation with coconut yield. The positive effects of organic carbon from organic waste on coconut growing soils were reported in several studies (Odlare *et al*., 2007; Jedidi *et al*., 2004) [3]. Santhi and Selvakumari (2000) [8] also evidenced that the addition of organic sources could increase the fertilizer use efficiency and there by yield through improving soil productivity.

Nitrogen and potassium were significantly positively correlated with yield whereas phosphorus was non-significantly positively correlated. Malhotra *et al.,* (2017) [4] found that the soil nitrogen supply is directly related to the soil organic fractions and there by coconut yield whereas, soil phosphorus level does not pose a serious problem to coconut yield and adequate potassium supply must be ensured for higher coconut productivity. On the other hand Hameed *et al.*, (1986) [2] stated that large yield responses were seen to applied NPK fertilizers to coconut.

Even though zinc had non-significant positive correlation with yield at 0-30 cm, zinc at the depth of 30-60cm, 60-90cm and soil depth weighted average and all other micronutrients at all the depths had significant positive correlation with coconut yield. Pawar *et al.,* (2017) [7] stated that the application of RDF along with Micronutrients in three splits (*i.e.* June, October and February) was beneficial for increasing the yield of coconut with maximum profit.

Srinivasa Reddy *et al*., (2002) [9] opinioned that nutritional equilibrium is essential for high and sustainable productivity of the coconut palm. Pawar *et al.,* (2017) [7] found that the coconut yield was increased by increased level of boron-carbon ratio (B:C ratio) with application of boron. Boron deficiency affects the leaf production and ultimately yield and the nuts palm^{-1} was increased with boron application (Moura *et al.,* 2013) [5]. The beneficial effects of boron are evidenced by Prado *et al*., as boron enhances cell wall formation and pollen tube growth and thereby increase the yield.

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