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Survey of pencil point disorder manifested coconut gardens of Pollachi taluk, Coimbatore Dt, Tamil Nadu

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Abstract
Coconut eulogized as 'Kalpa Vrisksha' is a crop of small and marginal farmers across the nation. The versatile crop is a sensitive victim to an array of biotic and abiotic stresses of which Pencil point disorder is emerging as a silent menace in the recent past. The disorder is generally attributed to micronutrient deficiency in the soils in which palm is cultivated. A survey was conducted in 48 Pencil point disorder manifested farmers' holdings of Pollachi taluk of Coimbatore district during 2017 employing a prelaid questionnaire for comprehending and correlating the incidence of the disorder to, crop management practices adopted by the farmers, soil fertility constraints, incidence of pests and diseases and drought events. It was observed that disease like root (wilt) and incidence of pests *viz*., rhinoceros beetle, red palm weevil and eriophid mite are not the reasons behind the occurrence of pencil point disorder. Senile palms ageing more than 60, depletion of Soil Organic Carbon (SOC) pool, paucity of organic manures, top soil erosion, moisture stress, high density cropping with perennial crops like cocoa, nutmeg and pepper leading to nutrient mining, imbalanced fertilization, lack of application of micronutrient fertilizers, soil borne micronutrients deficiencies especially zinc and copper are identified as the causes for pencil point disorder in coconut.

Keywords: Coconut, imbalanced fertilization, micronutrients, nutrient mining, pencil point disorder, survey

Introduction
Coconut is an important horticultural crop which has a significant bearing on the livelihood security of small and marginal farmers of the country and on the economy of the nation. India ranks third among the coconut growing countries of the world next to Indonesia and Philippines, with an area of 2.15 million hectares and average productivity of nearly 9,897 nuts per hectare. In India, Kerala stands first in acreage, accounting for 35.4 per cent of the total area followed by Karnataka and Tamil Nadu contributing 28.8 per cent and 20.3 per cent to the total coconut area of the country respectively. Tamil Nadu is one of the leading producers of coconut in the country with an area of 4.36 lakh hectares, production of 5370 million nuts and productivity of 12291 nuts per ha (CDB, 2019) [3]. The versatile crop, coconut, very often hits the headlines of mass media because of multitude of challenges like pest and diseases, scarcity of water, price fluctuations and multifaceted nutritional problems resulting in poor yields. Pencil Point Disorder is a great menace constraining coconut production worldwide. This disorder had sporadic occurrence in 1970s but in recent years, it is widely prevalent in almost all the coconut farms of Pollachi tract. In pursuit of the perplexity to identify the real cause of the disorder and because of the negligence of the farmers, Pencil Point Disorder is slowly emerging as a serious menace in the recent past. If this is unchecked, the sustainability of the coconut farming systems will be invisibly jeopardized in slow future.
Multitude of causes have been attributed to Pencil Point Disorder and the syndrome was named as Pencil Point Disease in 1970s caused due to a pathogen and later it was ascribed to nutritional disorders. Pencil point (disease) is a physiological disorder affecting coconut palms to a great extent. The onset of this disorder is brought about by blockage of vascular bundles which may lead to disruption in the translocation process. The typical symptom is characterized by the tapering of trunk towards the crown, the fronds become smaller, rigid and

erect with hollow nuts. Tapering or pencil-point disease of coconuts was investigated by the Coconut Research Scheme of Ceylon in 1950 and has been found to affect palms in full bearing under a wide range of environmental conditions. There was no evidence of a pathogen, and preliminary observations suggested that it may be the result of a nutrient deficiency, possibly of magnesium. NPK fertilizers have not checked the disease, but heavy dressing of cattle manure at an early stage of the disease was recommended for the stimulation of new root growth (Cooke, 1950) [4]. Repeated pruning in Christmas palm produced a phenomenon known as "Pencil top", a narrowed trunk just below the fronds due to the reduction in food manufacturing efficiency of the palms. To avoid problems associated with overpruning, removal of only dead leaves and not the fronds were recommended (Florida FHCP manual). Tapering of trunk with pencil pointing and a sharp reduction in growth rate was attributed to chronic situations of nitrogen deficiency and potassium deficiency (Broschat, 1984; Von Uexkhull and Fairhurst, 1991) [1, 2, 9]. In the research conducted at College of Tropical Agriculture, University of Hawaii, pencil pointing was attributed to potassium deficiency and the treatment requires broadcast application of sulfur-coated potassium sulfate at rates of 3 to 8 lbs. per tree 4 times a year plus one-third as much controlled release magnesium fertilizer to prevent a K-Mg imbalance (and resulting Mg deficiency) (Broschat, 1990) [1, 2]. Pencil pointing was ascribed to old age of palms, waterlogging of soil and due to disease (http://agroforestry.net/scps). Research at national and international levels have concluded that stem tapering, or narrowing of the stem, also called 'pencil point disease' can have different causes, all of them unfavourable to the growth and development of the palm, such as drought, disease, heavy pest attack, repeated fire damage, mineral deficiencies, inadequate drainage or general negligence and high weed growth. All these factors diminish the palm's vigour and affect its development. Recovery is possible when the causal factors are removed.

Pollachi often celebrated as the “Coconut city” has considerable area under coconut cultivation. It is imperative to comprehend the real cause of the disorder so as to eliminate the causal factors from the coconut production system and to develop management strategies for adoption by the coconut growers to curb the menace.

Material and Methods

GPS aided survey was conducted in 48 Pencil Point Disorder manifested palms of Pollachi taluk of Tamil Nadu during 2017. The taluk comprises of Anaimalai, Pollachi (South) and Pollachi (North) blocks. Intensive cultivation of coconut together with perennial intercrops like cocoa, pepper and nutmeg is adopted by the farmers of Anaimalai block. In Pollachi (South) and Pollachi (North) blocks, only coconut is monocropped by the growers. A prelaid questionnaire was laid out comprising of the details of acreage of coconut and variety, intercrops cultivated, age of the palms, details of macronutrients and micronutrients applied, intercultural operations practiced, irrigation water availability, pest and disease incidence and harvest particulars. Soil and index leaf samples were collected from the coconut gardens and parameters *viz*., pH, Electrical Conductivity, Organic carbon, KMnO4-N, Olsen / Bray P, 1NNH_4OAc-K, DTPA Fe, Mn, Zn, Cu and hot water soluble B were analysed. N, P, K and micronutrients were analysed in the leaf samples.

Results and Discussion

(i) Acreage and varieties

About 41.6% of the farmers possessed land holdings more than 10 acres to a maximum of even 50 acres, about 35.4% of the farmers had land holdings between 5 and 10 acres and < 23% of the farmers surveyed had less than 5 acres of coconut groves. A vast majority of the farmers did cultivate Tall varieties of coconut especially West Coast Tall and few Tiptur Tall, Arasampatti Tall (ALR (CN)1) in their farms. Only a very minimal proportion of the farmers have cultivated dwarf varieties, and D x T hybrids have been raised by 10.44% of the farmers. Reports reveal that in the neighbouring state Kerala, West Coast Tall is highly favoured by farmers, occupying atleast 95% of coconut groves (Roland *et al*., 2019) [5]. About 52.1% of the coconut plantations are more than 40 years old and some plantations have crossed even 70 years. Only a very meager percentage of the plantations were less than 10 years old (Table 1).

Table 1: Acreage and varietal particulars of the pencil point disorder affected gardens

S. No.	Parameters	Details and farm holdings under the category					
1.	Area of the holding (Acres)	< 5	22.9%	5-10	35.4%	> 10	41.6%
2.	Variety	Tall	85.4%	Dwarf	4.16%	Hybrid	10.44%
3.	Age of the palms	< 10 years	2.08%	10-40 years	45.8%	> 40 years	52.1%

(ii) Nutrient management

About 43.75% of the farmers surveyed have resorted to intercropping with cocoa, nutmeg and pepper in the coconut plantations. Some of them have cultivated vegetables and tuber crops like tapioca. About 56.25% of the farmers apply urea as the nirogen source and nearly 8.33% of the farmers apply complex fertilizers owing to the ease of application. About 37.5% of the coconut growers apply DAP as the source of phosphorus whilst 39.6% employ single super phosphate as the phosphatic fertilizer. A vast majority of farmers to the tune of 75% apply potash to the coconut palms at a rate of 1.5 -2 kgs per palm per year. Farmyard manure mostly generated in their own farms is recycled to the palms by 87.5% of the coconut growers at the rate of 20 – 30 kgs per palm per year and 16.7% of the farmers buy poultry manure from hatcheries and apply @ 5 -10 kgs per palm per year. In the perspective of the farmer, poultry manure application generates heat (ammonia volatilization) which affects the coconut palms when applied in huge quantities. A very meager percentage (4.17%) of the farmers apply goat manure to the palms in the alternate years. Vermicompost is applied by 4.17% of the coconut growers only and neem cake by only 12.5% of the farmers. Of the farmers surveyed, only 6.25% of them apply micronutrient fertilizers and an equal percentage of them practice organic farming (Table 2). Top soil erosion especially in the coconut gardens located in the foot hills of mountains were found to suffer from Pencil point disorder.

Table 2: Nutrient management options of the pencil point manifested gardens

S. No.	Crop management and plant protection	Adoption rate
1.	Intercropping	43.75%
2.	Urea application	56.25%
3.	Complex fertilizers	8.33%
4.	DAP application	37.5%
5.	SSP application	39.6%
6.	Potash application	75.0%
7.	FYM application	87.5%
8.	Poultry manure application	16.7%
9.	Goat manure application	4.17%
10.	Vermicompost application	4.17%
11.	Neem cake application	12.5%
12.	Micronutrient application	6.25%
13.	Organic farming	6.25%

(iii) Biotic stress

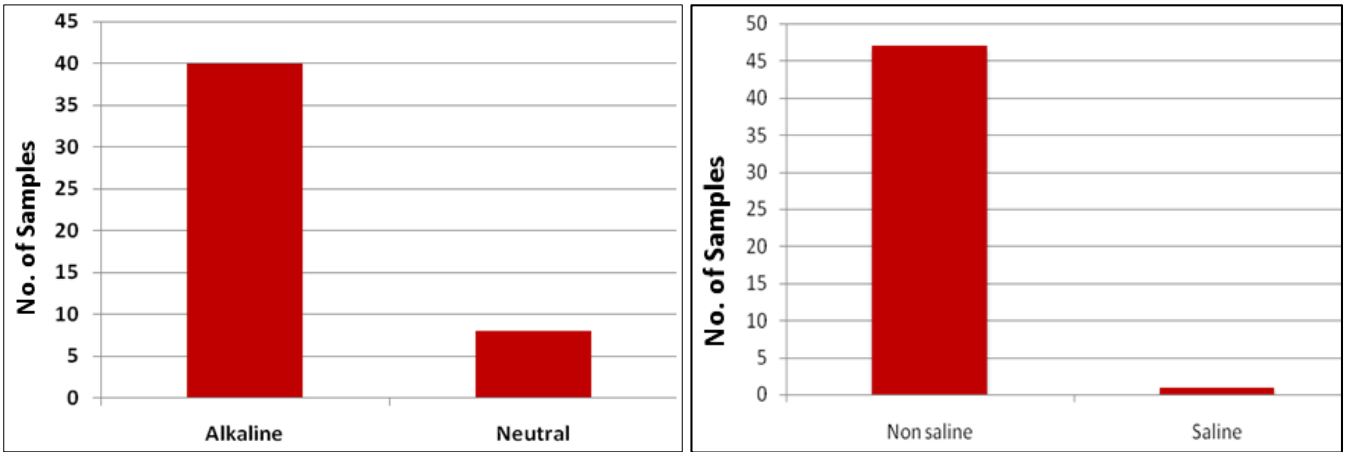
Moisture stress was witnessed in 25.0% of the total area surveyed. Water stress triggered by the poor monsoon in the key growing areas of Southern Karnataka and the Pollachi region of Tamil Nadu had impacted coconut production, with growers putting the output loss as high as 30-40 per cent (Sajeev Kumar *et al.*, 2017) [6]. Incidence of Rugose Spiraling Whitefly was recorded in 25.0% of the farm holdings surveyed. Dry spell during June to September 2016 after deficit rainfall (69%) coupled with decreased relative humidity favoured the spread of the pest in coconut plantations of Pollachi tract of Tamil Nadu (Srinivasan *et al.*, 2016) [7]. Rhinoceros beetle incidence was observed in 18.75% of the palms, Eriophid mite incidence across 27.08% and Red Palm weevil in 20.8% of the coconut gardens. No garden was reported to have infestation of black headed caterpillar (Table 3).

Table 3: Biotic stress in the pencil point disorder affected gardens

S. No.	Stress	Incidence rate
1.	Moisture Stress	25.0%
2.	Rugose Spiraling Whitefly	25.0%
3.	Leaf Blight	8.33%
4.	Rhinoceros Beetle	18.75%
5.	Eriophid mite	27.08%
6.	Black headed caterpillar	0%
7.	Red Palm Weevil	20.8%

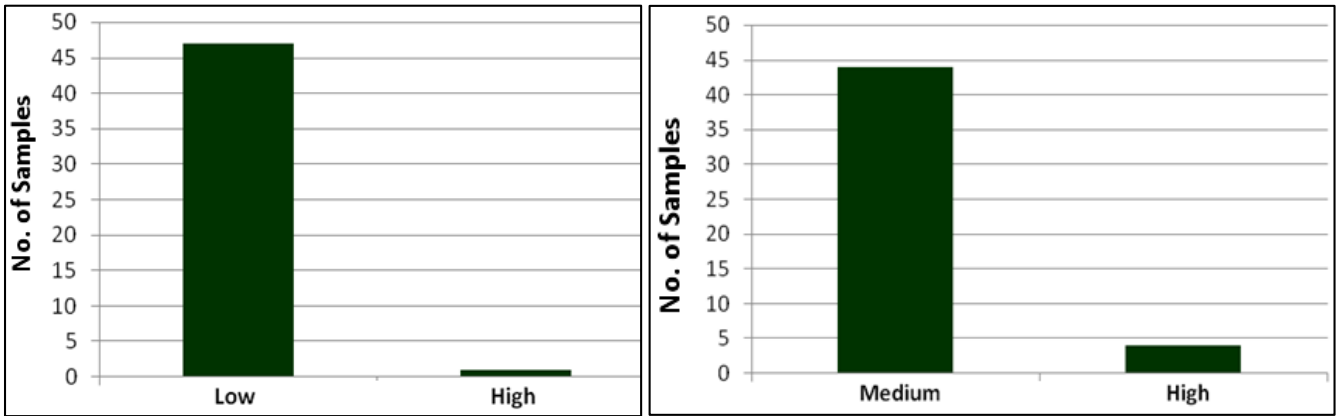
(iv) Soil fertility

About 83.3% of the soil samples surveyed were alkaline and 16.7% of the samples were neutral in reaction. Selvamani and Duraisami, 2014 [8] reported 70% of the coconut growing soils of Coimbatore district to be in alkaline range. About 97.9% of the soil samples were non saline and only 2.08% were saline in nature (Fig. 1). About 97.9% of the soil samples had low status of $KMnO_4$-N and 2.08% of the samples had high status. Olsen phosphorus was medium in 91.7% of the samples 8.33% of the samples had high content (Fig. 2).



Soil pH Soil Electrical Conductivity

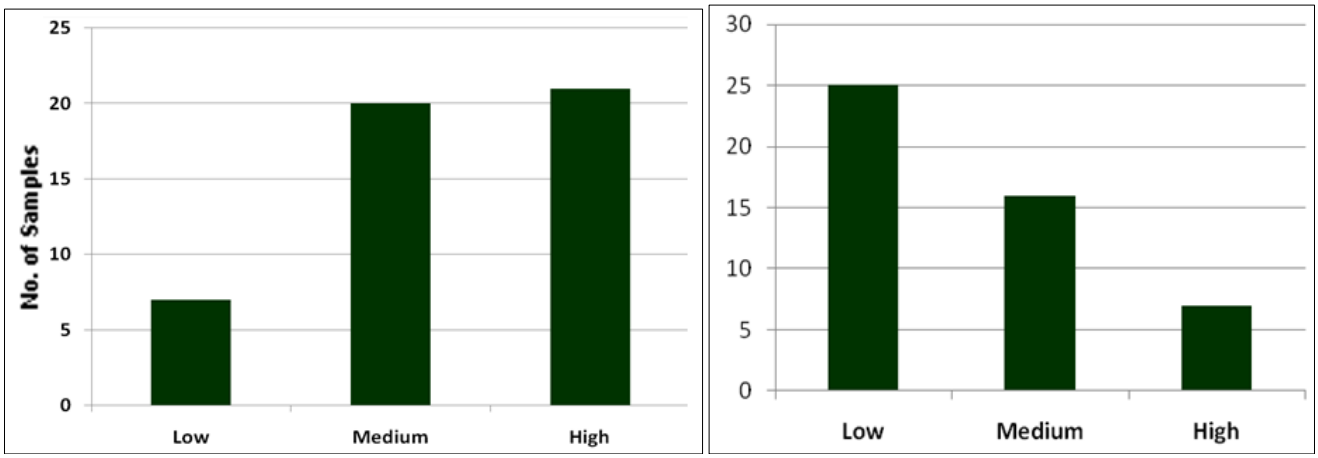
Fig 1: Soil pH and electrical conductivity in pencil point disorder affected gardens



$KMnO_4$- N Olsen - P

Fig 2: $KMnO_4$- N and Olsen - P status in pencil point disorder affected gardens

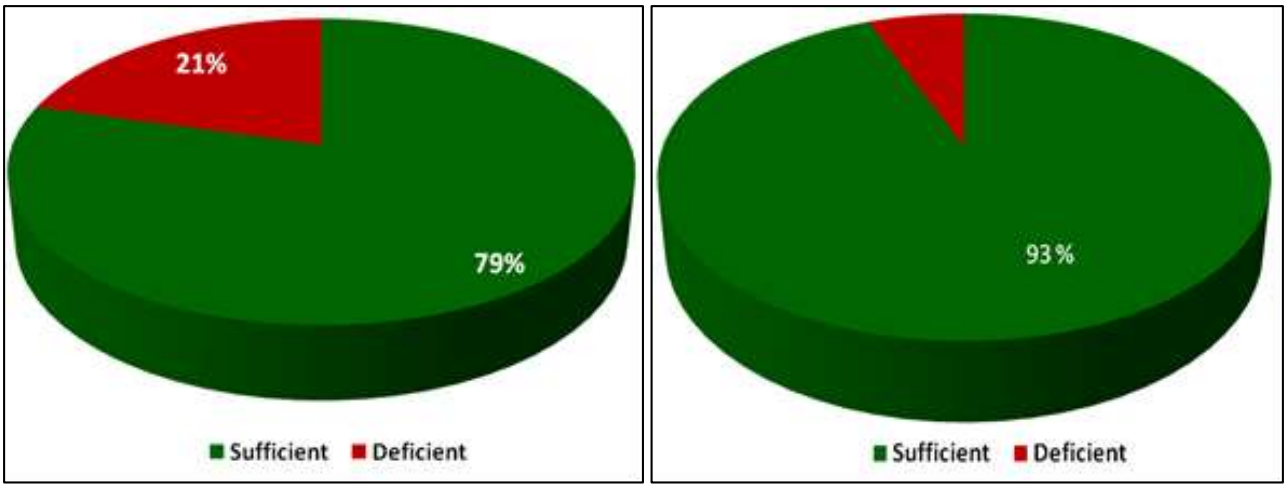
$1NNH_4OAc$ – K was low in 14.6% of the farmers' holdings, medium in 41.7% of the samples and high in 43.75% of the samples analysed. Low status of organic carbon was witnessed in 52.8% of the samples analysed, medium status in 33.3% of the samples and high status in 14.6% of the samples analysed (Fig. 3).



$1NNH_4OAc$ –K Organic Carbon

Fig 3: $1NNH_4OAc$ -K and organic carbon status in pencil point affected gardens

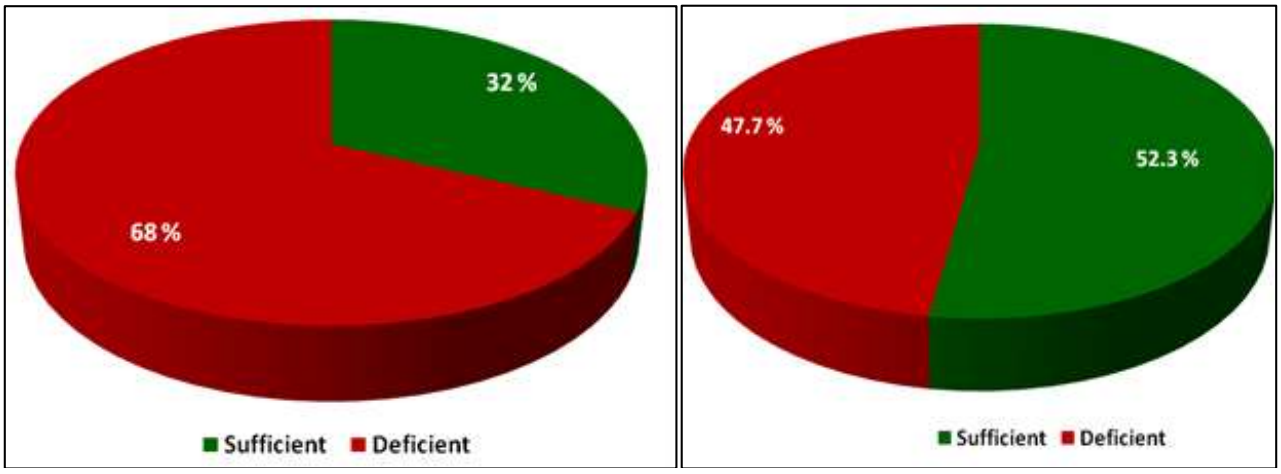
DTPA Fe was sufficient across 79% of the soil samples and deficient in 21% of the farm holdings whilst DTPA Mn was sufficient in 93% of the soil samples and deficient over 07% of the samples analysed (Fig. 4).



DTPA Fe DTPA Mn

Fig 4: Status of DTPA Fe and DTPA Zn in pencil point disorder affected gardens

DTPA Zn was sufficient across 68% of the soil samples and deficient in 32% of the farm holdings whilst DTPA Cu was sufficient in 52.3% of the soil samples and deficient over 47.7% of the samples analysed (Fig. 5).



DTPA Zn DTPA Cu

Fig 5: Status of DTPA Zn and DTPA Cu in pencil point disorder affected gardens

(v) Nut yield

Nut yield of the Pencil point disorder affected palms ranged from 20 nuts per palm per year to 80 nuts per palm per year depending upon the severity of infestation. Many farmers have culled out the palms which have less than ten coconut fronds. Palms which are prone to the disorder continuously for five years are not remunerative in the perspective of the farmer.

Conclusion

From the survey, an array of causes have been arrived at for the occurrence of Pencil Point Disorder in coconut. Disease like root (wilt) and incidence of pests *viz*., rhinoceros beetle, red palm weevil and eriophid might do not contribute for pencil point disorder. Senile palms ageing more than 60 years, deficiency of organic carbon in soil, depletion of soil organic carbon pool, paucity of organic manures, top soil erosion, moisture stress, high density cropping with cocoa, nutmeg leading to nutrient mining, imbalanced fertilization, lack of application of micronutrient fertilizers, deficiencies of micronutrients in soil especially zinc and copper are identified as the causes for Pencil point disorder in coconut.

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