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A Review on Plant Nutrients Correlation with Fruit Production of *Cocos nucifera L.*

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Abstract

Benefits and usefulness of the plants are directly connected to the nutrient composition of that plant. With growing population, the need for every commodities is going to increase in future years. The basic requirement of food (crops, fruits, vegetables, etc.) is of major concern, which should be looked on with utmost importance. To achieve this, high production yield from every plant with their adequate nutrients retained and without affecting the environment is highly desirable. Hence, keeping this as of major concern, various parameters that affects the nutrient content of *Cocos nucifera L.* (coconut palm) and its relation to production yield is discussed in the present article.

Keywords: Coconut production, Leaf nutrients, Plant nutrients, Soil fertility

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Introduction

Cocos nucifera L. (Coconut palm) is a perennial tree belonging to Arecaceae (palm) family,[1] giving continuous fruit growing mainly in coastal areas.[2] Coconut palm possesses global importance, grown in around 93 countries with approximately 62.4 million tons of production worldwide of which 85.7% production is from Asia region,[3] 2019, 2019. Coconut palm serves as a major plant in terms of every aspect of its usefulness to mankind related to its production yield.[4]

To acquire complete benefits of the fruit, water, and other products of the plant, its nutrient proportions should be sufficient. To achieve this, a correlation has been developed between the soil fertility and fruit production which in turn is obtained by analyzing the leaves of that plant.[5] Basically, soil analysis gives the availability of the nutrients for continuous and throughout growth of plants, whereas, leaf analysis gives the proportion of nutrients that are taken up or absorbed. Although, these are affected by various factors such as the climatic conditions, soil type, age of plant, and sampling time. Many experiments have been conducted to get the maximum production yield. Figure 1 & 2 shows image of *Cocos nucifera* L Soil nutrients and production yield:

Soil Nutrients and Production Yield

Fertilization and Watering Method

Bandyopadhyaya, Ghosh (LKN), Biswasb, Parameswarappac, and Timsina, 2019, carried out an experiment based on providing fertilizers in different ratios using drip irrigation method and conventional ring method at Mandouri, India. They studied the effects of fertilization for 6 years (2007-08 to 2012-13) providing water and fertilizer (N-P-K) as per the schedule. The climatic conditions varied between 22°C and 32°C and average humidity between 60% and 93% throughout the experimental study. Soil analysis, leaf analysis, production yield of fruit, microbial analysis, etc., were studied at regular intervals of time. They reported increase in the coconut yield in 75% recommended dose of fertilization (RDF) with drip irrigation, compared to others such as 25%, 50%, and 100% RDF with drip irrigation as well as 100% RDF using conventional ring basin irrigation method. Hence, overall it was concluded that there is a linear relationship between total soil nitrogen, phosphorous, and potassium and the fruit production which can be enhanced using 75% RDF using drip irrigation method.

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Soil Salinity

Silva *et al.*[6] conducted study to analyze growth of green dwarf young coconut plants under water stress[7] and salinity in soil. Using statistical analysis, studying various mathematical parameters, data obtained for the analysis of variance of leaf area showed that these green dwarf coconut plants can survive in moderate salinity conditions in soil if water is available sufficiently. Under restricted water supply, salinity affects more, and plants are moderately tolerant to this condition. However, in the higher salinity levels, though plant survives, the size of fruit is reduced to 50% even in adequate water availability, as the diffusion of nutrients gets reduced.[8]

Intercropping Methods Based on Soil

Based on the soil type and its maintenance, production of coconut palm can be enhanced. Although coconut palm shows its adaptability to varied soil types, the sandy soil found at most of the coastal regions, is predominant for cultivation of coconut. However, some deficiencies were found in the soil analyzed by physicochemical methods of selected regions in Kerala[9] that affected the coconut production. Various soil parameters were studied such as, pH of soil,

organic carbon content, and analysis of various nutrient contents. Among these, the soil pH of one sample was found to be highly acidic (below 5.5), which impairs the availability of essential nutrients and affects microbial action required for nitrogen fixation.[10-12] Along with this as the pH goes below 4.5, aluminum presents in soil solution starts affecting the root system of the plant, converts the soluble phosphates into insoluble one damaging the whole system that significantly constraints the production of coconut. Particularly for soil acidification, regular liming is suggested (using gypsum). In addition, intercropping methods as suggested by Subramanian *et al.*[13] proved to be a very useful method for very low coconut production. Intercropping is with various Glyricidia,[14] vegetable crops such as pumpkin, amaranthus, and ash gourd fodder grass and fruit crops such as banana and pineapple with sustained moisture conservations lead to increase in yield of coconut fruits, thereby maintaining the primary nutrients N, P, and K along with providing micronutrients such as B, Cu, and Zn.

Figure 1: *Coccous nucifera L*

Types of Fertilizers

A comparative study was done[15] to study the effects of organic with inorganic fertilizers to show the availability of nutrients to soil for microbial action and growth of plants as well as seedlings. Biofertilizers or organic fertilizers were recommended compared to inorganic fertilizers as they showed considerable increase soil microbial action required for transformation of essential nutrients so that they are well assimilated by plants through healthy soil. Although organic fertilizers proved to show good effects than inorganic fertilizers, it is required in larger amount. Hence, combination fertilizers should be used as per the requirements.

Leaf Nutrients and Production Yield

To study the relationship between the leaf nutrients and production of coconut fruit, a study was conducted on two major districts of Tamil Nadu, India growing coconut.[16] Analysis of macro and micro nutrients was carried out of 110 samples and Pearson product moment correlation c-efficient and stepwise multiple regressions were studied. It showed maximum correlation between Mg, N, and K in the decreasing order with production yield of coconut (positive and significant). Then after Mn, Zn, and B showed positive but non-significant correlation and very low and non-significant correlation is shown by P, S, Ca, Fe, and Cu. Stepwise multiple regression analysis showed variation in the yield due the influence of plant nutrients. The maximum influence in the yield of around 37% was found due to K in leaf, then after 34.1% variation by leaf N and 19% P present in leaf contributed with the yield of fruit. Hence, it was advised to study these analysis for further improving the fertility of soil and coconut production.

It was studied[17] that deficiency of micronutrient Boron in coconut leaves lead to decrease in the fruit production of coconut after potassium and calcium level in coconut at tropical climates. Boron deficiency lead to reduced root growth by 30%[18] that further affects the aerial growth of plants, necrosis in leaves, etc.,[17] that ultimately reduced yield of fruit. Hence, maintaining critical dose of B in soil is required for leaf and fruit production.[19,20]

Healthy Seedlings and Production Yield

As evaluated by the experiments done at Akure, rainforest zone in Nigeria,[21] for 2 years, suggested that if healthy coconut

Figure 2: *Coccous nucifera L.*

seedlings are planted, it will increase the total production yield of coconut fruit thereby reducing the cost of establishment also. They used different fertilizers to show the comparative efficacy of each one for the healthy growth of plant that included leaf growth with adequate nutrients, soil fertility enhancement, and improved performance in seedlings of coconut. It was concluded that organic fertilizers, poultry manure showed increase in various growth parameters such as leaf area, height of plant, leaf number, seedlings growth, and nutrient contents in soil as compared to NPK fertilizers. However, experiments conducted at Sri Lanka[22] suggested that, using plant material or animal manure continuously as a source of fertilizers enriches the soil, but along with that, accumulation of micronutrients such as, Zn, Cu, and Cd in the soil as ions or chelates that decomposes the organic matter cannot be overlooked. Further, these organic materials should be tested for its nutrient content calculation and be used as its source, but other nutrients have to be provided using chemical fertilizer as needed.

Conclusion

Plant growth and its fruit production depend on various parameters. Soil is considered to be the store of nutrients and the leaves are the kitchen providing food in the form of nutrients

to plants for the growth. Soil quality plays a major role for the growth of plants. Its salinity, water stress and the proportion must be in accordance for adequate supply of essential nutrients. Maintenance of soil directly affects the health of leaves that promote the assimilation of various nutrients leading to healthy and maximum production of fruit. Second, leaf analysis shows the absorbed nutrients that give health to plants and maintain the proportion for its continuous growth. Fertile seedlings also play an important role, which can be obtained by providing essential nutrients to them using organic fertilizer, which helps in economic development through increased fruit production. Further, all the required parameters for improving the plant growth as well as before growing a plant should be considered for healthy and continuous production of fruits.

Conflict of Interest

There is no any conflict of interest.

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