



Plant Health Management in Coconut grown in littoral sandy soil of Odisha

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The versatile use of coconut palm (*Cocos nucifera* L.) in providing food, drink, medicine, fuel, fibre and shelter to the mankind has established its importance as "Kalpavriksha". In view of its importance, use and regularity in cropping, coconut is grown in many Asian and Pacific countries in the world. Coconut palm is a crop of future in view of its carbon sequestration potential in the context of climate change.

Coconut Scenario in Odisha

Coconut cultivation in Odisha has undergone tremendous transformation in the past few decades due to spread of cultivation from traditional area to non-traditional belts of the state. Coconut farming, however, in the state is frequently damaged by the cyclonic hits like Super cyclone in October 1999, Phailin in October 2013 and Hudhud in October 2014 as a result of which the area and production of coconut are considerably fluctuating. The cyclonic storm "FANI" with a wind speed of around 200-250km/hr wreaked massive damage to perennial

horticultural crops in the state on 3rd May 2019. Among all the horticultural crops, coconut plantations were severely damaged in six districts particularly in Puri, Khordha, Cuttack, Jagatsinghpur, Jajpur and Kendrapada. Due to "FANI" hit out of 26151 ha under coconut plantation in above six districts about 7930 ha plantation was affected comprising uprooted/broken trunk and palms with severe crown damage in 5544 ha and palms with partial crown damage in 2386 ha. Though the maximum area coverage and production are confined to ten coastal districts, the cultivation of coconut has now been extended to all the thirty districts of Odisha. The contribution of Odisha in coconut farming in the country is quite significant as it has occupied 5th position in area and 6th position in production in the national scenario. Now, coconut is being grown in an area of 50,910 hectares with an annual production of 342.1 million nuts and productivity of 6719 nuts/ha (2018-19).



Coconut Plantation in Littoral sand

A large chunk of coconut plantation in coastal Odisha stands on the littoral sand. The productivity status of such plantations maintain a low profile the reasons of which are: poor nutritional status, low CEC (0.4-0.54me/100g) and low organic carbon content of soil. The problem of low productivity is also aggravated by the loss of organic matter due to hot and humid climate. Besides Odisha, similar situation also occurs all along the coastal tract of the east and west coasts of the peninsular India lying mostly in Andhra Pradesh, Tamil Nadu, Kerala, Karnataka and Maharashtra. The normal weather condition prevailing along the coasts is fabulous for coconut farming. But the productivity of coconut in coastal sand is very low ranging from 20-40 nuts/palm/year. As coconut palm is committed to soil for many decades regular improvement of physico-chemical properties of such soil is absolutely necessary to improve the yield level of the palm. Some past studies, however, indicated that the productivity of littoral sand could be improved by adopting various methods for better health of palms which includes development of adequate drainage system, application of coir dust in palm basins, use of garden soil and sufficient organic manures along with inorganic manures through integrated approach in palm basis. Accordingly, attempts have been made to improve the health of coconut palms grown in littoral sand of Odisha at Coconut Research Station, Konark, and Puri presently functioning under AICRP on Palms. The physico-chemical properties of littoral sand of Coconut Research Station, Konark, and Puri depicted in table-1 clearly revealed the poor nutrient status of the soil. The low productivity of coconut (17.5nuts/palm/year) under littoral sand of Konark

during 1997-98 was mainly attributed to poor water holding capacity, excessive infiltration due to the porosity of sands, easy leaching of nutrients leading to low availability of NPK and micronutrients and low organic carbon content.

The results of the work carried out at Coconut Research Station, Konark, Puri to improve the health of palm and productivity are discussed here under.

Table 1: Physico-chemical properties of littoral sand of Konark

Content	Soil depth (cm)		
	0-30	30-60	60-90
Sand (%)	89.5	89.2	89.0
Silt (%)	3.4	3.6	3.9
Clay (%)	7.1	7.2	7.1
pH	5.58	5.50	5.30
Organic carbon(%)	0.12	0.09	0.04
Electrical conductivity (dsm-1)	0.076	0.071	0.064
Available nitrogen(kg/ha)	65.75	41.75	36.4
Available phosphorus(kg/ha)	32.70	28.10	27.50
Available potassium(kg/ha)	64.50	63.80	62.40
Soil moisture(%)	2.87	3.58	5.95
Bulk density(g/cc) (0-60cm)	1.68	-	-

1. Adoption of integrated nutrient management practices to improve soil and plant health in littoral sand

A study was conducted in littoral sandy soil at Coconut Research Station, Konark, Odisha to assess the effect of integrated nutrient management practices on local tall palms taking fifteen treatment combinations of organic manures (neem cake, mustard cake, FYM and poultry manure) and NPK fertilizers with or without *in situ* green manuring of cowpea and horse gram on equal nutrient basis. The studies revealed that the integrated manuring practices had no noticeable impact on the height and girth of adult bearing palms. The mean number of functional leaves per palm as well as the rate of production of leaves and inflorescences, however, significantly increased by the application of FYM

along with NPK fertilizers and also by in situ green manuring with cowpea in the palm basin. There was also significant increase in the production of number of female flowers (137.13/palm/year), fruit set (36.71%) and nut yield (44.0 nuts/palm/year) under the treatment wherein FYM and NPK fertilizers were applied along with *in situ* green manuring with cowpea compared to the corresponding values of 88.00/palm/year, 34.35% and 24.1 nuts/palm/year in the respective characters under NPK fertilizers alone treated as control. The integrated nutrient package also influenced the pH, organic carbon content, available N,P and K contents of the concerned soil and the leaf NPK contents of the palms under study.



2. Basin management with application of coir dust, garden soil and inorganic & organic manures

Coconut Research Station, Konark, Puri operating under AICRP on Palms was shifted to Bhubaneswar during 2003 due to super cyclonic hit during 1999 and as a result the existing plantation was abandoned since the last 15 years. Again in the year 2014 attempt was taken to improve the health of coconut palms and to sustain the plantation in the littoral sand. Priority was given on management of basins with application of coir dust @ 25kg per palm. Coir dust was covered with garden soil around the palm basin. Adequate quantities of nutrients were added in two splits annually with neemcake @ 2.0kg/palm, FYM@50kg/palm, urea@1.0kg/palm, SSP@2.0kg/palm, OP@2.0kg/palm, MgSO₄@300g/palm and micronutrient mixture 200g/palm in the palm basin of 1.8m radius. *In situ* green manuring was practiced to supplement additional nutrients and to improve physical condition of the soil.

3. Water management through drip system

Drip irrigation system was installed in the Research Station for efficient management of water to irrigate palms in littoral sand. Daily 16 liters of water was provided to individual palm except during rainy season through 4 drippers placed around the trunk within 1.8m radius.

4. Development of drainage channels

Adequate drainage channels were developed in between each two rows of the plantation to avoid water stagnation during rainy season and to conserve moisture during post monsoon period. The effect was realized after three years of operation in terms of growth and gradual increase in yield (table-2).

Table 2: Performance of palms after adoption of integrated management practices in littoral sand

Characters	Local tall (41 years old)		Hybrids (25 years old) of packages	
	Before adoption After three years	After three years	Before adoption After three years	After three years
Number of functional leaves / palm	22.7	30.6	19	32
Number of inflorescences/ Palm/year	8.3	11.7	7.2	12.2
Number of nuts/ Palm/year	28	58	25	87



5. Development of coconut based cropping system in littoral sand

An attempt was taken to develop integrated cropping system in littoral sand with the objectives



to increase yield and income and sustain coconut farming in littoral sand. The crops like pineapple, sapota and cowpea as vegetable crop were raised in the interspaces available in the coconut plantation. The impact of raising cowpea (as vegetable), pineapple and sapota on coconut productivity revealed gradual complementary effect of intercrops.

The experiment was initiated in the littoral sand at Coconut Research Station, Konark during January, 2016. The cropping system was developed by planting intercrops like pine apple and sapota during rainy season in 2016. Besides sapota and pineapple the other intercrop, cowpea was raised only in rainy season. Observations on growth in terms of functional leaves and yield and yield attributing traits of coconut palms were recorded in all the treatments. The initial soil samples were analyzed for the nutrient contents at the beginning. The result revealed that after two years of imposition of treatments, there was significant variation among the palms under different cropping systems as well as under different nutrient management practices for number of leaves, rate of production of leaves, inflorescences, female flowers and nut yield. However, the interaction effect of cropping system and nutrient management was significant only for number of female flowers and nut yield (Table-3). Significantly maximum nut yield (57.7 nuts/palm/yr.) was recorded in cropping system plot. The intercrop, sapota was in vegetative stage. The yield of pineapple (10803.3kg/ha) as well as cowpea (4356.6kg/ha) was maximum in plots receiving soil test based NPK nutrients (N2). Except sapota, income was derived from all the crops in the system and maximum net return was Rs.1, 87,971/ha compared to Rs. 29450/- per ha from coconut monocropping.

Table 3: Economics of coconut based cropping system under littoral Soil

Cropping System	Gross return (Rs./ha)	Cost of production (Rs./ha)	Net return (Rs./ha)
Coconut +Sapota + Vegetable cowpea	1,73,816	96,021	77,931
Coconut +Sapota + Pineapple	2,83,587	1,12,767	1,71,441
Coconut (Sole crop)	79,056	49,340	29,750

Conclusion

Performance of coconut palms grown under littoral sand is generally low and they produce only 20-40nuts /palm/year. Such plantations can be made more viable and sustainable through adoption of different agro-techniques in an integrated manner to improve physical, chemical and biological conditions of soil. CPCRI, Kasaragod, Kerala has developed lot of technologies to improve production and productivity of palms grown in coastal sand including development of different cropping systems, conservation of moisture using husk or coir pith and alley cropping of Glyricidia. Adoption of above proven technologies is needed to maintain the health of coconut palm grown in littoral sand for more yield and income.

Coconut based cropping system with coconut+ pineapple +Sapota + Cowpea of multispecies intercropping under littoral sandy soil of Konark, Odisha is more remunerative in the yield stabilizing phase of coconut in costal Odisha condition with a net income of Rs.1.88 lakhs/ha/year. ■