



## Performance of coconut varieties in sandy soil of coastal Orissa

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AICRP on Palms, OUAT, Bhubaneswar, Orissa

### Abstract

Performance of coconut varieties on growth, yield attributing characters and leaf mineral content of coconut palms was studied in sandy soil of coastal Orissa. The experiment was conducted at the AICRP on Palms, Konark with ten varieties. The yield attributing characters were significantly influenced by the variety and season. More number of leaves and spadices production was observed in rainy season. Maximum button shedding was observed within two months of spadix opening. Rainy season spadices experienced least button shedding percentage as compared to other seasons. The leaf N, P, K content was higher in rainy season.

**Key words:** Coconut, varieties, yield, leaf nutrients

### Introduction

The coconut palm is a tropical crop and grows best in a favorable warm and humid climate. A mean annual temperature of 27°C and a rainfall of 100-300 cm equally distributed are the best for its growth and productivity. The commencement of flowering is an important stage in the life of coconut. The annual production of spadices largely depends on the number of leaves produced. However, a few of the spadices fail to develop under unfavorable circumstances. This is specially so, when the initial formation of the spadix coincides with the dry period or when the palm continuously suffers from a short supply of nutrients.

The productivity of coconut palm is described in terms of nut yield per palm per year. The yield attributing characters in coconut are the number of inflorescences produced per year, number of female flowers per inflorescence and setting percentage which indicate the number of female flower developed out of the total female flower produced by the palm in an year (Satyabalan, 1992). The number of female flowers produced by an

inflorescence is a highly variable factor and is influenced by the season, soil condition, the variety and the inherent yield potential of the palm. An attempt has been made to study the seasonal influence on yield of coconut at AICRP on Palms, OUAT, Bhubaneswar.

### Materials and Methods

The experiment was carried out at All India Coordinated Research Project on Palms, Konark during 2002-04. The soil is of sandy nature having mechanical composition of sand-89.2%, silt-3.6% and clay- 7.2%. Studies were conducted on 10 varieties (4 dwarf: Malayan Green Dwarf, Chowghat Orange Dwarf, Gangabondam, Malayan Yellow Dwarf and 6 tall: Philippines Ordinary, Guam, Federated Malayan States, Laccadive Ordinary, Andaman Ordinary, Sakhigopal Local) and 3 seasons following split - plot design with three replications. The varieties were taken as main plot and the seasons for each variety were treated as sub- plot factors.

Observations for each character were recorded from selected two palms at monthly interval for vegetative characters (number of leaves produced per month) and

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reproductive characters (number of spadices, production of successive spadix, number of female flower, button shedding, percentage of fruit set and yield per palm). The average of four months of a season was worked out (February, March, April, & May as summer, June, July, August & September as rainy and October, November, December & January as winter season) for each character studied and subjected to statistical analysis.

Leaf samples were collected by taking six leaflets from the index leaf i.e. 14th leaf of adult palm following diagnostic criteria standardized by Chapman (1964) in every month. The leaf samples were oven dried, ground and analyzed for the Nitrogen, Phosphorous and Potassium contents.

### **Results and Discussion**

Maximum numbers of leaves (3.93) were produced during rainy season which was found statistically superior over other seasons. In summer season, variety MGD and GBD recorded the highest number of leaves (4.0) and Guam produced lowest number (2.0) of leaves. In rainy season MGD produced maximum number of leaves (4.5) which was followed by COD, GBD, PHO, MYD and LCO (4.0). In winter season MYD produced maximum number of leaves (3.83) and FMS produced minimum number of leaves (2.0).

The interaction of variety with season in leaf production was significant. Variety MGD in rainy season recorded the highest number of leaves (4.5). MGD and GBD in summer season; COD, GBD, PHO, Guam, LCO, SKL, and PHO in rainy season were found to be statistically at par with MGD in rainy season.

Production of spadix among the seasons and varieties are given in Table-1. The highest number of spadices opened per year (11.82) was recorded in MYD, followed by COD (11.01) while the variety FMS recorded least number of spadices (7.32) per year. Maximum number of spadix (3.82) was produced during rainy season which was statistically superior to all seasons where as in winter season the palms receded minimum spadices production (2.80). In rainy season MYD (4.17) produced the highest number of spadices. The interaction effects of COD and MYD in summer, GBD, FMS, MGD, PHO, COD in rainy season were statistically at par with MYD in rainy season.

As regard to the varietal variation on vegetative and reproductive characters, the varieties MGD, MYD, GBD produced more number of leaves per season. Leaf production varied from 8.5 to 12.18 per year.

A spadix is produced in every leaf axil. The annual production of spadices therefore, coincides with the number of leaves produced by the palm (Patel, 1938 and

Thampan, 1975). It is evident that the annual production of spadices exceeded the number of leaves produced only in COD and MYD, whereas in rest of the varieties, it was below the number of leaves produced per year. The absence of spadix in the leaf axils may be due to genetic and climatic factors causing abortion of young spadix at an early stage of development.

The interaction effect of growth and yield attributing characters revealed that leaf production was generally highest in rainy season in all the varieties. Variety MGD produced maximum number of leaves (4.50 in rainy season whereas Guam produced the lowest number of leaves (2.67) in winter. The interaction data also showed that MYD in rainy season gave maximum number of spadices (4.17), whereas FMS in winter produced the least number of spadices (1.5).

There was a significant difference in interval of successive spadix production for different season, and varieties (Table-1). The interval between successive spadix production was found to be minimum for rainy season (31.63 days) followed by summer (41.82 days) and winter (43.28 days). The average number of days taken for successive spadix production was minimum in MYD (30.44 days) followed by COD (33.67 days), GBD and MYD; maximum interval was noticed in Guam (47.00 days). In summer FMS took longest interval (59.83 days) and MYD recorded shortest interval (30.17 days) for successive spadix production. In rainy season MGD took 32.00 days, whereas in MYD the interval was shortest (28 days). In winter maximum interval was noticed by Guam (53.17 days) and shortest interval was recorded in MYD (33.17 days). Among the interaction of season and variety, interval between successive spadix production was minimum in MYD during rainy season (28 days) and maximum in FMS during summer season (59.83) days. The average number of days taken for successive spadix production was the lowest in MYD (28 days) in rainy season and the highest in FMS (59.83 days) in summer. If the interval between two successive spadix production increases and the rate of spadix production decreases thereby reducing the yield.

The interval between successive spadices was more in winter season (43.28 days) whereas the interval was less in rainy season (31.63 days). Similar fact was opined by Panda (1988) also. The interval between successive spadices range between 30.44 to 47.0 days in MYD and Guam, respectively. Menon and Pandali (1958) recorded 27.8 and 33.4 days interval at Kasaragod and Nileswar respectively. The varieties exhibited different interval days for successive spadix production which might be due to the genetic makeup of individual variety.

Table 1. Mean data for production of leaves, spadices of different varieties in different seasons

Variety	Mean number of leaves produced				Mean number of spadices produced				Mean numbers of days taken for production of successive spadix			
	SUMMER	RAINY	WINTER	MEAN	SUMMER	RAINY	WINTER	MEAN	SUMMER	RAINY	WINTER	MEAN
MGD	4.00	4.50	3.67	4.06	3.33	3.83	3.33	3.50	36.67	32.00	37.17	35.28
COD	3.17	4.00	3.33	3.50	3.67	3.83	3.50	3.67	34.50	31.83	34.67	33.67
GBD	4.00	4.00	3.50	3.83	3.50	4.00	3.17	3.56	35.00	30.00	40.83	35.28
PHO	3.97	4.00	3.17	3.61	2.67	3.83	2.33	2.94	43.67	31.00	52.00	42.22
GUAM	2.00	3.83	2.67	2.83	2.67	3.00	2.33	2.67	47.17	40.67	53.17	47.00
MYD	3.67	4.00	3.83	3.85	4.00	4.17	3.67	3.94	30.17	28.00	33.17	30.44
FMS	3.33	3.50	2.00	2.94	1.83	4.00	1.50	2.44	59.83	39.67	45.33	44.94
LO	3.50	4.00	3.00	3.50	2.67	3.83	2.83	3.11	46.50	31.50	44.67	40.89
AO	3.00	3.67	3.50	3.39	3.00	3.83	2.83	3.22	47.33	30.17	43.50	40.33
SKL	3.17	4.00	3.50	3.56	3.33	3.83	2.50	3.22	37.33	31.50	48.33	39.06
Mean	3.35	3.93	3.02		3.07	3.82	2.80		41.82	31.63	43.28	
	Var.	Season	Interaction (S x V)		Var.	Season	Interaction (S x V)		Var.	Season	Interaction (S x V)	
SE(m)+	0.137	0.061	0.193		0.132	0.057	0.18		2.568	1.298	4.104	
CD(5%)	0.41	0.17	0.55		0.039	0.016	0.051		7.63	3.71	11.71	

Observation on number of female flowers produced in different seasons revealed significant difference among the seasons, varieties and their interaction (Table-2). The maximum number of female flowers (59.58) recorded in rainy season was significantly superior to rest of the season. The minimum number of female flowers (45.07) was developed in summer season. Among the varieties,

The influence of button shedding and final nut retention revealed that maximum button shedding (45.7%) within two months was observed in case of spadices those opened during the summer season. Minimum button shedding (27.60%) was recorded by those spadices opened in rainy season. There was a significant difference as regard to shedding percentage among rainy, summer

Table 2. Mean data for production of female flower and retention of buttons of different varieties in different season

Variety	Numbers of female flower produced				% of button shedding after two months of spadix opening				Number of nut retained till maturity			
	SUMMER	RAINY	WINTER	MEAN	SUMMER	RAINY	WINTER	MEAN	SUMMER	RAINY	WINTER	MEAN
MGD	36.00	53.50	42.33	43.94	39.46	22.78	42.94	35.06	11.67	22.33	12.50	15.5
COD	32.83	63.00	54.33	50.06	38.45	20.80	49.65	36.30	13.00	24.33	12.17	16.5
GBD	106.5	142.00	75.17	107.89	56.77	35.13	41.12	44.34	23.17	25.83	17.83	22.28
PHO	37.67	47.83	56.67	47.39	42.22	22.84	50.67	38.58	5.83	17.33	10.17	11.11
GUAM	25.33	30.17	32.83	29.44	38.84	24.07	23.71	28.87	8.00	11.50	7.50	9
MYD	49.83	53.33	57.50	53.56	43.53	33.28	34.00	36.94	12.17	17.17	11.50	13.61
FMS	23.33	45.00	23.33	30.56	51.52	21.27	55.00	42.60	5.33	14.17	4.00	7.83
LO	48.00	62.50	42.83	51.11	51.80	25.32	36.33	37.82	9.50	14.83	6.17	10.17
AO	41.83	47.83	41.50	43.72	52.61	26.31	45.54	41.49	10.50	17.83	7.33	11.89
SKL	49.17	50.67	31.83	43.89	41.78	44.22	47.05	42.60	12.67	17.33	5.67	11.89
Mean	45.07	59.58	45.83		45.70	27.60	42.60		11.18	18.27	9.48	
	Var.	Season	Interaction (S x V)		Var.	Season	Interaction (S x V)		Var.	Season	Interaction (S x V)	
SE(m)+	3.682	1.874	5.93		1.58	0.791	2.501		0.98	0.483	1.527	
CD(5%)	10.94	5.36	16.93		4.7	2.26	7.15		2.91	1.38	4.36	

total number of female flowers was (323.67) recorded in Gangabondam and was significantly superior to all other varieties.

Production of female flowers was significantly higher in case of GBD in rainy season (142) and the lowest was recorded by FMS in winter season (23.33). In general, female flower production was higher in rainy season in all the varieties as compared to other seasons.

and winter seasons within first two months of spadix opening (mean data). There was significant difference in percentage of drop within two months among the varieties and among the interaction. The maximum (44.34%) drop was noticed in Gangabondam, followed by Sakhigopal Local (42.60%), the minimum percentage was observed in Guam (28.87%). In summer season maximum drop within two months of spadix opening was recorded in GBD (56.70) and minimum by COD (38.45%), in rainy

Table 3. Mean data for leaf nutrient content of different varieties in different season

Variety	Nitrogen (%)				Phosphorous (%)				Potassium (%)			
	SUMMER	RAINY	WINTER	mean	SUMMER	RAINY	WINTER	mean	SUMMER	RAINY	WINTER	mean
MGD	36.00	53.50	42.33	43.94	39.46	22.78	42.94	35.06	11.67	22.33	12.5	15.5
COD	32.83	63.00	54.33	50.06	38.45	20.80	49.65	36.30	13.00	24.33	12.17	16.5
GBD	106.50	142.00	75.17	107.89	56.77	35.13	41.12	44.34	23.17	25.83	17.83	22.28
PHO	37.67	47.83	56.67	47.39	42.22	22.84	50.67	38.58	5.83	17.33	10.17	11.11
GUAM	25.33	30.17	32.83	29.44	38.84	24.07	23.71	28.87	8.00	11.50	7.50	9.00
MYD	49.83	53.33	57.50	53.56	43.53	33.28	34.00	36.94	12.17	17.17	11.5	13.61
FMS	23.33	45.00	23.33	30.56	51.52	21.27	55.00	42.60	5.33	14.17	4.00	7.83
LO	48.00	62.50	42.83	51.11	51.80	25.32	36.33	37.82	9.50	14.83	6.17	10.17
AO	41.83	47.83	41.50	43.72	52.61	26.31	45.54	41.49	10.50	17.83	7.33	11.89
SKL	49.17	50.67	31.83	43.89	41.78	44.22	47.05	42.60	12.67	17.33	5.67	11.89
Mean	45.07	59.58	45.83		45.70	27.60	42.60		11.18	18.27	9.48	
	Var.	Season	Interaction (S x V)		Var.	Season	Interaction (S x V)		Var.	Season	Interaction (S x V)	
SE(m)+	3.682	1.874	5.93		1.58	0.791	2.501		0.98	0.483	1.527	
CD(5%)	10.94	5.36	16.93		4.7	2.26	7.15		2.91	1.38	4.36	

season highest drop was recorded by SKL (44.22%) & lowest by COD (20.8%) and in winter season FMS recorded maximum drop (55%) where as Guam recorded minimum (34.71%) Similar findings were reported by Sayeed (1955) and Ganguly *et al.*, (1956) who observed that most of the shedding took place within six weeks after stigmatic receptivity.

However, the above trend slightly changed within 4 months of spadix opening. The maximum button shedding (76.66 %) was observed for winter season inflorescence which is significantly higher when compared to other two seasons. Varietal variability has been found to exist in the extent of button shedding. A close look the data revealed that severity of button shedding was more in Philippine Ordinary within two months of spadix opening. However there was no consistency of shedding among the varieties as the process of maturity advanced, which was evident by FMS with maximum button shedding. Menon and Pandalai (1958) observed maximum shedding in Fiji and Cochin-China.

Existence of variation in button shedding for a variety in different seasons was observed. Andaman Ordinary had least button shedding percentage in the inflorescences those opened during the rainy season. Whereas maximum shedding occurred in the winter for variety. This may be due to long spell of moisture stress and dry weather (Mathes, 1988). Maximum number of nuts could be harvested from rainy season spadices which attributed to more number of female flowers.

The nut retention has also been influenced by varieties, which varied from 19.79 per cent to 35.17%. Better nut production Gangabondam was observed to be due to production of more number of spadices and more number of female flowers per spadix.

Number of nuts retained till maturity revealed that there was significant difference among the seasons and varieties. Highest number of nut retention till maturity was observed for rainy season spadices (18.27) followed by summer (11.18) and winter season (9.48). Among the varieties, GBD recorded the highest (22.28) nuts till maturity in season, and was significantly superior to all other varieties, whereas FMS recorded minimum maturity (7.83) per season.

#### Influence of season on leaf mineral content

The pattern of variation in levels of leaf mineral content differs in different seasons. Leaf nitrogen, phosphorous and potassium content was and the highest in rainy season which was in conformity with the work conducted by Ramanandan and Pillai, (1974). Generally leaf nitrogen, phosphorus and potassium increased following fertilizer application in August- September, then decreases there after. Maximum N, P, K content was estimated during rainy season which coincides with the maximum nut harvested. N and K content of the leaves were higher in high yielder compared to the poor yielder. However, the phosphorus content of the leaves did not show any trend. The nitrogen content was higher in MYD and GBD whereas it was low in Guam, which is a low yielder.

Variety MYD had maximum nitrogen and phosphorous content in rainy season, whereas potash content was higher in COD. This may be due to the combined effect of variety and season which individually had the highest nitrogen content. On an average, nitrogen, phosphorus, potassium content of leaves varied from 1.25- 2.27 per cent, 0.113- 0.165 per cent and 96 - 1.42 per cent, respectively. Ollagnier and Wahuni (1984) reported optimum N, P, K levels in the 14th leaf as 2.2, 0.12, and 1.4 per cent.

A careful analysis of the data on growth and yield attributing characters as influenced by season clearly revealed that significantly more number of leaves, spadix and female flower production was observed during rainy season. Significantly less number of leaves, spadix production and female flower has been recorded during summer season. This might be due to low moisture content of soil or water stress.

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