

RESPONSE OF HIGH YIELDING VARIETIES OF ARECANUT TO FERTILIZER LEVELS IN COASTAL KARNATAKA

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ABSTRACT

A field study (1985-1997) was conducted at Central Plantation Crops Research Institute, Regional Station, Vittal to determine the nutritional requirement of high yielding varieties of arecanut. Four varieties, viz. Mangala, Sumangala, Sreemangala and South Kanara Local as main plot treatments and five fertilizer levels, viz. 0:0:0; 50:20:70; 100:40:140; 150:60:210 and 200:80:280 g of N:P₂O₅:K₂O per palm per year, respectively as sub plot treatments were tried in a split-plot design. Both height and girth increments between first and ninth year of experimentation were found non-significant due to fertilizer levels indicating that application of higher dose of fertilizers would have no impact on growth. Yield (dried dehusked nut) varied significantly in different years. Pooled data (1993-97) revealed that both varieties and fertilizer levels significantly influenced the number of nuts and yield. Interaction effect of varieties and fertilizer levels was also found significant. The fertilizer level of 200 g N: 80g P₂O₅:280 g K₂O per palm per year was found to be optimum for Mangala. Application of 100g N: 40g P₂O₅: 140g K₂O per palm per year was found to be ideal for Sumangala and Sreemangala. Economic analysis indicated an appreciable increase in net income and benefit-cost ratio with increase in fertilizer dose. Maximum net income (Rs. 2,31,627/ha) and benefit-cost ratio (4.25) were obtained with a fertilizer level of 200g N: 80g P₂O₅: 280g K₂O per palm per year.

INTRODUCTION

Arecanut (*Areca catechu* L.) is an important commercial crop in coastal areas of Karnataka and Kerala and in parts of Assam and West Bengal. In recent years, the area under high yielding varieties of arecanut is gradually increasing because of their higher yields than local variety. It was reported that the average annual yield per palm of Mangala (2.02 kg.), Sumangala (3.28 kg) and Sreemangala (3.10 kg) is higher than that of the local variety (1.35 kg) (Murthy, 1990). Arecanut is mostly grown in laterite soils which are poor in native soil fertility and nutrient

retention capacity and in humid tropics with heavy and excess rainfall resulting in leaching of nutrients such as N and K (Tandon and Ranganathan, 1988). Therefore, fertilizer application becomes indispensable in realizing higher yields. The fertilizer requirement of local variety was standardised as 100 g N:40g P₂O₅: 140g K₂O per palm per year (CPCRI, 1976). It is expected that High Yielding Varieties (HYV) respond to higher fertilizer rates because of their higher yield potential. Therefore, a study was undertaken to determine the effect of fertilizers on yield and economics of high yielding varieties of arecanut.

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MATERIALS AND METHODS

A field study was initiated in 1985 at Central Plantation Crops Research Institute, Regional Station, Vittal. The trial was laid out in split plot design with four replications. The main plot treatments consisted of four varieties viz. Mangala, Sumangala, Sreemangala and South Kanara (S.K.) local. The subplot treatments included five fertilizer levels of 0:0:0 (F_0), 50:20:70(F_1), 100:40:140 (F_2), 150:60:210(F_3) and 200:80:280(F_4) g of N:P₂O₅:K₂O per palm per year. Seedlings, raised from inter-se mated crosses, were planted at a distance of 2.7m x 2.7m. Net plot size of main plot was 218.7m² and that of sub plot was 43.74m². Each sub plot consisted of six palms. The fertilizers as per the treatment schedule was applied in two split doses i.e., 1/3rd as pre-monsoon (May-June) and 2/3rd as post-monsoon (Sept.-Oct.) application every year. Growth observations were recorded in the month of November every year. Urea, rock phosphate and muriate of potash were used as sources of N, P and K, respectively. Uniform cultural practices were followed for all treatments.

The soil of the experimental plot is sandy clay loam with a pH range of 5.8-6.2. The organic carbon content of the soil at 0-25cm and 25-50 cm depths ranged from 1.7-1.9% and 2.3-2.5% respectively. All the varieties started yielding by 6th year. However, yield data from 9th year i.e. after yield stabilization, was used for statistical analysis and drawing conclusions. Economics of different treatments was worked out using the prevailing market prices (CPCRI, 1985).

RESULTS AND DISCUSSION

Growth increment

Data presented in the Table 1, clearly indicated that varieties and fertilizer levels had no significant influence on height and girth increments between first and ninth year of experimentation. However, height increment was much less in Mangala (40 cm/year), a semi-tall variety, compared to other varieties (63-69 cm/year). It can be concluded that application of higher levels of fertilizers up to F_4 level would have no impact on growth, especially on height, which is considered as a negative factor in arecanut.

Yield (dried dehusked nut)

Yield significantly varied in different years. In general, average yields were found to be comparatively low in 1997 (2622 kg/ha) than in other years (ranged between 3300-3897 kg/ha). Heavy and continuous rainfall during June-August (3754

Table 1: Influence of varieties and fertilizer levels on growth increment of arecanut over eight year period (1986-1994)

Treatment	Height increment (cm/year)	Girth increment (cm/year)
Varieties		
Mangala	40	5.68
Sumangala	69	5.67
Sreemangala	63	5.91
S.K. Local	65	5.89
CD (5%)	NS	NS
Fertilizer levels		
F_0 (0:0:0)	57	5.78
F_1 (50:20:70)*	62	5.80
F_2 (100:40:140)*	59	5.94
F_3 (150:60:210)*	58	5.64
F_4 (200:80:280)*	60	5.78
CD(5%)	NS	NS

* g/palm/year N: P₂O₅:K₂O respectively

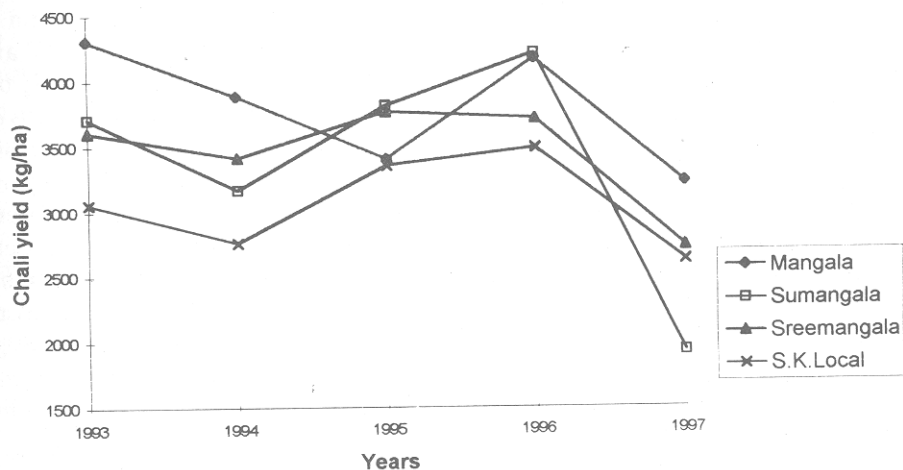


Fig. 1. Effect of varieties on yield of arecanut in different years

mm) which was equal to average annual rainfall, higher incidence of fruit rot (*Phytophthora meadii*) disease to the extent of 40 per cent and consequent nut drop had resulted in yield reduction in 1997. Despite higher incidence of fruit rot in 1997, yield was significantly higher with higher fertilizer levels over control indicating the favourable response of fertilizer nutrients in reducing the disease incidence.

Yield differences among varieties were found to be non-significant in all five years (Fig. 1). Mangala was the highest yielder in 1993, 1994 and 1997. While, Sumangala was the highest yielder in 1995 and 1996. Lowest yield was observed with South Kanara local in all years except in 1997. In contrast, fertilizer levels influenced the yields significantly in all five years (Fig. 2). In general, there was a consistent trend of yield increase with increased fertilizer

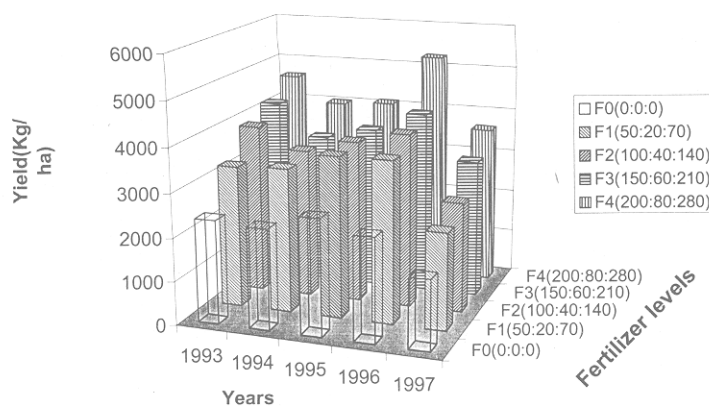


Fig. 2. Influence of fertilizer levels on yield of arecanut in different years. CD (P=0.05) values for different years were 584 (1993), 766 (1994), 794 (1995), 731 (1996) and 720 (1997).

rates over control in all years. However, no significant yield increase was observed between F_3 and F_4 levels during all years except in 1996. Interaction effect of varieties and fertilizer levels was not found significant in all years.

Yield (dried dehusked nut), Number of nuts and Nut weight

Pooled yield data of five years (1993-97) indicated that there was significant yield differences both among varieties and fertilizers levels (Table 2). Maximum yield was obtained with Mangala (3797 kg/ha), which was 24.4 per cent more than S.K. local (3052 kg/ha). The yields of Sumangala and Sreemangala were on par with each other. While, yield differences were not significant between Sumangala and S.K. Local.

Among fertilizer levels, there was significant improvement in yield with F_4 over other fertilizer levels. The increase in yield with F_1 , F_2 , F_3 , F_4 over

control (F_0) was 43, 56, 66 and 92 per cent, respectively. There was an yield increase of 23 per cent with F_4 over F_2 , which is a recommended fertilizer dose at present. However, only 6.6 per cent yield gain was noted with F_3 over F_2 . The yield increase with increased fertilizer level was a direct result of significant increase in number of nuts. This suggests that the increased fertilizer rate up to 200 g N: 80g P_2O_5 : 280g K_2O per plant per year could be effective in improving the yield.

Similar trend as that of yield was observed with number of nuts. Abdul Khader (1990) reported significant increase in nut production and relative nut weight with 100g N:40g P_2O_5 :140g K_2O . Ripe nut weight did not vary significantly among varieties. In contrast, different fertilizer rates had a significant and positive effect on weight of ripe nut. Among fertilizer levels, maximum nut weight was observed with F_2 (37.1 g) followed by F_4 (35.9g).

Table 2. Mean yield, number of nuts and ripe nut weight as influenced by varieties and fertilizer levels in arecanut (Five year average)

Treatment	Yield (dried dehusked nut) (kg/ha)	% increase over control	Number of nuts	Ripe nut weight (g/nut)
Varieties (V)				
Mangala	3797	24.4	330	35.7
Sumangala	3358	10.0	318	33.2
Sreemangala	3439	12.0	314	33.4
S.K. Local	3052	-	253	36.2
CD(5%)	369	-	48	NS
Fertilizer levels(F)				
F_0 (0:0:0)	2254	-	234	30.1
F_1 (50:20:70)*	3229	43.2	292	35.2
F_2 (100:40:140)*	3507	55.6	296	37.1
F_3 (150:60:210)*	3740	65.9	320	34.7
F_4 (200:80:280)*	4327	92.0	378	35.9
CD(5%)	304	-	34	2.7
VxF				
CD(5%)	609	-	68.8	NS

* g/palm/year N: P_2O_5 : K_2O respectively

Effect of varietal and fertilizer interaction on yield

Interaction effect of varieties and fertilizer levels was found significant. There was linear and significant response up to F_4 fertilizer level in case of Mangala. In case of Sumangala and Sreemangala, response was linear but there were no significant yield differences among last three fertilizer levels. While, the response was not consistent in case of S.K. Local (Fig. 3). Mangala responded to highest fertilizer level by recording 90 per cent yield enhancement with F_4 over F_0 with significant yield difference between F_3 and F_4 levels. Sumangala and Sreemangala recorded an yield increase of 104 per cent and 117 per cent, respectively with F_4 over F_0 . However, significant yield differences were not observed between F_2 , F_3 and F_4 levels. In case of S.K. local, the yield increase with F_4 over F_0 was only 63 per cent and yield difference was not significant between F_3 and F_4 .

Economic analysis of different treatments

Mangala recorded maximum net returns (Rs. 1,98,122/ha) and B/C ratio (3.90) followed by Sreemangala and Sumangala (Table 3). While, the net income (Rs. 1,47,445/ha) and B/C ratio (3.21) were found to be lower in case of S. K. local. It is also evident from the data that there was an appreciable increase in net income with increased fertilizer levels. Net income (Rs. 2,31,773/ha) and benefit-cost ratio (4.25) were highest with F_4 level among different fertilizer levels. Benefit-cost ratio ranged from 2.52 in control (F_0) to 4.25 in F_4 level, suggesting investment on fertilizer input being financially sound. The findings of this study indicated that in coastal Karnataka, application of 200g N:80 g P_2O_5 :280g K_2O per palm per year for Mangala would not only enhance the arecanut yield but also increases the net income and benefit-cost ratio. In case of Sumangala and Sreemangala, application of 100g N: 40g P_2O_5 :140g

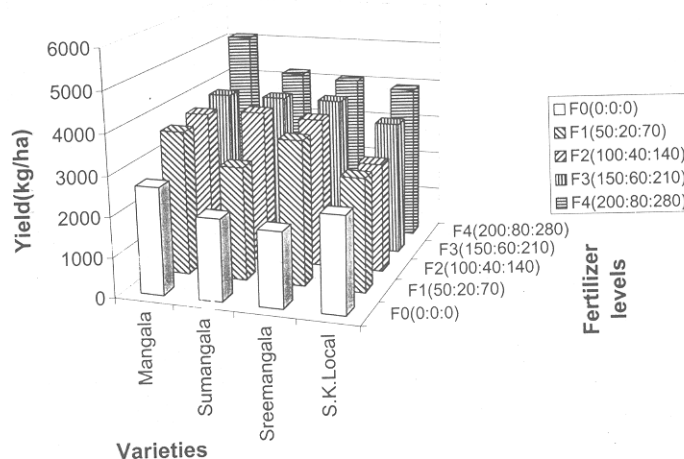


Fig. 3. Interaction effects of varieties and fertilizer levels on yield of arecanut.

Table 3. Economic analysis under different arecanut varieties and fertilizer levels.

Treatments	Gross returns (Rs./ha)	Cost of cultivation (Rs./ha)	Net returns (Rs./ha)	Benefit-Cost ratio
Varieties				
Mangala	2,65,819	67,697	1,98,122	3.90
Sumangala	2,35,059	67,018	1,68,042	3.48
Sreemangala	2,40,735	67,320	1,73,415	3.54
S.K.Local	2,13,627	66,182	1,47,445	3.21
Fertilizer levels				
F ₀ (0:0:0)	1,57,836	62,374	95,462	2.52
F ₁ (50:20:70)*	2,26,049	65,541	1,60,507	3.44
F ₂ (100:40:140)*	2,45,508	67,316	1,78,192	3.64
F ₃ (150:60:210)*	2,61,796	68,951	1,92,845	3.80
F ₄ (200:80:380)*	3,02,861	71,088	2,31,773	4.25

Price of nut yield (dried dehusked): Rs. 70/Kg. * g/palm/year N : P₂O₅:K₂O respectively

K₂O per palm per year was found to be optimum considering the yield levels. However, from economic point of view, it is profitable to apply 200g N: 80g P₂O₅:280g K₂O per palm per year to all varieties as it resulted in appreciably higher net income and benefit-cost ratio.

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