RPF III Final Report

1. **Institute Code No.** : Gen.II (131)

2. **I.C.A.R. Code No.** : PI- 84/21-ICI-F80/2710

3. **Name & address of Research Institute/Centre** : Central Plantation Crops Research Institute
Kudlu Post, Kasaragod 671 124, Kerala

4. **Project Title** : Evolving high yielding varieties by selection and hybridization in Arecanut

5. **Name & designation of Project leader** : Dr. Anuradha Sane, Scientist

6. **Name(s) and designation of Associate(s) and establishment(s) on which borne**

Year	Principal Investigator	Associates
1987	B S Choudhary	K V J Mohan
1988	B S Choudhary	A Rekha
1989	B S Choudhary	B C Viraktamath and M Sannamarappa
1990	K S Ananda	B C Viraktamath and M Sannamarappa
1991	K S Ananda	B C Viraktamath and M Sannamarappa
1992	K S Ananda	M Sannamarappa
1993	K S Ananda	S N Sampath Kumar
1994	K S Ananda	S N Sampath Kumar
1995	K S Ananda	S N Sampath Kumar
1996	Anuradha Sane	K S Ananda and S N Sampath Kumar
1997	Anuradha Sane	K S Ananda and S N Sampath Kumar
1998	Anuradha Sane	K S Ananda and S N Sampath Kumar
1999	Anuradha Sane	K S Ananda and B Ramanujam
2000	Anuradha Sane	K S Ananda and B Ramanujam

7. **Location of research project with complete address Division/Section/Sub Station** : Genetics Division,
CPCRI (RS), Vittal 574 243
Dakshina Kannada, Karnataka

8. **Date of start** : 1987

9. **Date of completion** : 2000

10. **(a) Objectives (not more than 150 words)**

1. Secondary selection in released cultivars to bring out varietal purity and improved performance, if any.

2. Selection of elite palms from different agro-climatic regions.

3. Inter-varietal crosses among released cultivars for generating new hybrids possessing high yield and tolerance to major diseases and pests.

(b) Practical utility (not more than 100 words)

This project would help to identify high yielding areca varieties specific to different agro-climatic conditions and specific requirements. It also helps in generating hybrids with high yield potential. It would help to build up the breeder stock of released varieties.

11. **Technical programme (indicate briefly plan of procedure, techniques, instruments and special materials, organism, special environments etc.)**

Evaluation of arecanut varieties in Comparative Yield Trial, Vittal for growth and yield parameters

Evaluation of arecanut varieties in Comparative Yield Trial, CYT, Hirehalli for growth and yield parameters

Evaluation of arecanut varieties in Comparative Yield Trial, CYT, Thirthahalli for growth and yield parameters

Generating areca hybrids by crossing released varieties and evaluation of hybrids for growth and yield parameters in hybrid evaluation trial at Vittal

Establishment and Maintenance of compact blocks of Mangala, Sumangala, Sreemangala and Mohitnagar for seed nut production

12. Summary of the Project

Comparative Yield trial (CYT), Vittal

The trial was laid out during 1987 in CPCRI RS, Vittal with five arecanut varieties viz., Mangala, Sumangala, Sreemangala, Mohitnagar and Hirehalli Local cultivar, in RBD with five replications. Each treatment consists of 8 palms planted at a spacing of 2.7m x 2.7m. The cultivation practices recommended by the Station for arecanut cultivation were strictly adhered to. The data on palm height (cm), girth (cm),

no .of leaves, pre-bearing age, flowering, quantum of nuts produced and weight of nuts were recorded in different varieties. The mean yield of ripe nuts of the varieties for 1991-97 were recorded and analyzed statistically.

Results

The height of palms in different varieties in their third year of planting is statistically significant among varieties. The plant height ranged from 76.55 cm to 200.51 cm. The palms of Sreemangala were tallest (2m) followed by Mohitnagar (1.6 m).

The palms of Mangala recorded lowest height (0.76 m). The girth of the palm was statistically significant ranged from 34.75 cm to 44.18 cm among different varieties (Table 1). Hirehalli tall palms were sturdy with highest girth while Mohitnagar palms were tall and lanky growth with lowest girth. Mangala, Sumangala and Sreemangala recorded moderate values for girth. The leaf production among the varieties was statistically non-significant indicating that all the varieties produced almost equal number of leaves annually.

All the forty palms under five replications of Mangala flowered in their third year reinforcing the earlier reports of its precocious flowering behaviour (Table 2). The flowering percentage of varieties other than Mangala ranged between 57 to 70%. Though cent per cent flowering was observed in Mangala, only 47% were carried till fruiting stage. Interestingly, though less number of Sreemangala palms produced inflorescence, 70% of them were carried till fruiting stage.

In the first bearing, the nut set and nut production was highest in Sumangala (139.5 nuts/palm) followed by Mangala (89.40 nuts/palm). Sreemangala produced lowest yield. In the second year of bearing, nut production got accelerated with mean nut production of 185.56 nuts/palm. Nut yield in terms of number of nuts and weight of nuts was highest in Sumangala (266.2 nuts; 6.58 kg). Sreemangala picked up its bearing potential and produced 195.8 nuts with 5.46 kg fresh nuts. Mangala produced lowest number of nuts per palm with relatively high nut weight (5.05 kg). Lowest nut weight was recorded in Hirehalli tall. In the third year of bearing, bearing momentum in all the varieties was more with mean number of nuts of 255.5 and mean nut weight of nuts of 7.18 kg.

Hirehalli local produced highest nut weight exceeding other varieties in bearing potential. It produced 529 nuts, which weighs 9.59 kg and 99.8% increase over check Mangala. Sumangala stood second with its palms producing 237.2 nuts weighing 7.28 kg. Mangala was least productive with 130 nuts. Mohitnagar recorded higher yield of 8.4 kg nuts, which is 73.9 % increase over the check. Nut yield in all varieties decreased with mean yield of 4.49 kg (Table 3). In the 4th year, Hirehalli local retained its bearing potential recording highest yield (5.47 kg) compared to others, which is 41% highest than check.

From the above study, during pre-stabilization period under coastal conditions, Sumangala followed by Sreemangala and Mohitnagar produced consistently higher yields. Mangala performed moderately throughout the period under study. Hirehalli tall was fluctuating in its yield potential.

Comparative yield trial,Thirthahalli

The comparative evaluation of high yielding varieties released by CPCRI was planted at Agriculture research station at Thirthahalli in 1988. The experimental area, which represents malnad area of Karnataka, is located at an elevation of 1200 m with an annual average rainfall of 2000mm. The experiment was laid out in Randomized Block Design with five treatments replicated five times. The treatments are Mangala, Sumangala, Sreemangala, Mohitnagar and Thirthahalli (local variety as check).

The Areca seedlings were planted during Oct.1988 with an inter plant and inter row distance of 2.7m x 2.7 m. Each plot consists of 8 palms. The observations were recorded on growth and yield parameters viz., Palm height (m), Diameter of the stem at 30 cms above ground level (cm), number of leaves produced / palm, number of nodes formed / palm, internodal length (cm), flowering percentage and weight of tender nuts per palm (kg/palm) .

Results

Growth parameters

Among the varieties, Mangala recorded significantly lower height compared to Mohitnagar. The variety Mohitnagar grew tallest compared to other varieties at the 5th year of planting (Table 4). The girth of the stem and number of leaves produced in

individual palm at the 5th year of planting in different varieties did not vary to any significant extent. However girth at 30 cms from ground level varied from 12.60 cm in Mohitnagar to 14.24 cms in Sreemangala.

The internodal length was shortest in Mangala (11.8 cm) which might have rendered the palm its typical semi tall nature. The lowest height and short internodal length observed in Mangala confirmed its semi tall nature even at higher elevations. However the internodal length was more in the variety Mohitnagar (15.2 cm) making it the tallest variety.

From the data on growth parameters, Mohitnagar appears to be vigorous interms of taller palms, more number of nodes per palm and large internode length while Sreemangala was vigorous with more diameter and produced more leaves per palm.

The reproductive growth as indicated by initiation of spadix started when the palms were 4 years old. The spadix emergence varied between 5 per cent (Mohitnagar) to 35 per cent (Thirthahalli) in the 4 th year of planting. Thirthahalli local with highest percentage of spadix emergence at 4th year appear to be precocious in bearing. While Mangala had only 20 per cent of its palms put forth spadix. In the 5th year of planting flowering was almost complete varying from 76 per cent in Sumangala to 96.8 per cent in Mangala.

Yield parameters

Mean yield from 1994-95 to 1998-99 revealed that Thirthahalli local and Mangala performed better than other varieties with tender nut yield of 11.84 and 11.53 kgs per palm respectively (Table 5). Sumangala with 9.79 kgs tender nuts and Mohitnagar 9.73 kgs tender nuts\palm were medium yielders while Sreemangala performed comparatively poor with 8.76 kgs tender nuts per palm.

The present study on growth and yield parameters of five high yielding varieties of arecanut under malnad region indicates that among the varieties evaluated, the performance of local variety and Mangala were better with high yields including initial as well as cumulative yields in the initial years of bearing. Besides, Mangala exhibited precocity in flowering and early linear trend in yield even under high altitude of malnad region.

Comparative yield trial, Hirehalli

The comparative evaluation of high yielding varieties released by CPCRI was carried out at CPCRI, RC, Hirehalli for 13 yrs from 1988-2001. The experimental area, which represents maidan area of Karnataka, is located at an elevation of 900 m with an annual average rainfall of 860 mm. The experiment was laid out in Randomized Block Design with five treatments replicated five times. The treatments are Mangala, Sumangala, Sreemangala, Mohitnagar and Hirehalli local (variety as check).

The soil of experimental area is clayey loam in texture, slightly acidic in reaction and low in fertility status with respect to organic matter, available N, P_2O_5 and K_2O. Areca nut palms were grown on clayey loam soil with limited irrigation through perfo irrigation (i.e.,100-150 liters/ palm/ day) at a frequency of 7-15 days. Palms were fed with recommended dose of N, P_2O_5, K_2O at the rate of 100, 40, 140 g/palm/yr. The Areca seedlings were planted during Oct.1988 with an inter plant and inter row distance of 2.7 m x 2.7 m. Each plot consists of 8 palms. The observations were recorded on growth and yield parameters viz., Plant height (m), Diameter of the stem at 30 cms above ground level (cm), number of leaves produced / palm, number of leaflets/frond, leaf length, leaf breadth, number of nodes formed / palm, internodal length (cm), flowering percentage, number of bunches/palm, number of nuts/palm and weight of tender nuts per palm (kg/palm). Arecanut is harvested for tender nuts when the nuts are 5-8 months old for further processing into different grades. Tender nuts are processed for two commercial grades namely Unde and Podi. Fruit component analysis was done for nut characters such as length (cm), breadth (cm), fresh weight of the nut (g), Husk weight (g) and Kernel weight (g). Processing is done by boiling the dehusked nut in water for 30-45 minutes. Boiled nuts are drained and dried in open Sun for a week.

Results

Growth parameters

The survival % of all areca nut varieties was good except Mohitnagar variety in the initial years. Growth parameters like height, girth, and number of leaves were recorded from 1st to 6th year of planting. Number of leaves did not record significant difference among varieties throughout the growing period indicating that all varieties put forth more or less equal number of leaves during the growth period.

Stem girth was more in Mangala in 1st, 2nd , 4th yr while in the 5th yr& 6th yr Hirehalli local (Table 6) recorded highest girth compared to other varieties. However Mohitnagar recorded lowest girth compared to other varieties. Though mangala is a semi tall palm its growth interms of height was vigorous with significantly more height in the 1st, 2nd and 4th yr. In the 6th yr Mangala had attained its typical semi tall nature by recording lowest plant height, lowest internodal distance and least number of nodes/palm. Mangala also had least number of leaflets/frond, lowest leaflet breadth, lowest leaf sheath length and lowest leaf sheath breadth. In the 6th yr, Hirehalli local recorded tallest palms with highest girth both at fixed mark and below crown. Besides height and girth, it also exhibited more no. of nodes/palm with leaf sheath length and breadth recording higher values.

The reproductive growth as indicated by initiation of spadix started when the palms were 4 years old. The spadix emergence varied between 9 % (Mohitnagar) to 37.5% (Mangala). Mangala with highest percentage of spadix emergence at 4th year appear to be precocious in bearing.

Yield parameters

In the 1st yr of bearing, Mangala recorded 2.99 kgs yr/palm/yr followed by Sumangala with 1.98 kgs/palm/yr. In the 2nd yr, weight of yr recorded significant difference among varieties. Mangala produced 6.84 kgs palm/palm followed by Mohitnagar with 3.32 kgs/palm/yr. In the 3rd yr, Mangala recorded 8.2 kgs palm followed by Sreemangala and Hirehalli local respectively (Table 7). In the 4th yr of bearing, varieties produced an average of 4.78 kgs with Mangala recording consistently higher yield closely followed by Hirehalli local and Sreemangala.

In the 5th yr, Mangala registered highest yield (8.28Kgs) followed Sreemangala (7.47kgs). Mohitnagar and sumangala registered lowest yields compared to local. In the 6th yr due to drought, the yield of areca nut was low with an average of 5.88 kgs. In the 7th yr , Mangala registered 9.37 kgs followed by Hirehalli local.

Fruit component analysis revealed that Sreemangala produced bigger size nuts with high kernel weight. Mohitnagar, Sumangala and Mangala produced medium sized nuts. Kernel weight was least in Sumangala.

Recovery of processed nuts

The ~~palm~~ nuts are dehusked and cut into small pieces, boiled and finally dried The dehusked nuts of all varieties were processed for commercial grades namely Unde and Podi.. The recovery of unde was more in case of Mangala (14.87%) followed by Hirehalli local (14.25%).The recovery of podi was more in Hirehalli (14. 15%) followed by Mangala (12.38%). The processing outturn was lowest in Sumangala for Unde and Podi (Table 8). The processed products of different varieties of areca nut are shown in Fig.1.

Year wise yield data from 1993-94 to 2000-2001 revealed that Mangala gave consistently higher yield than other high yielding varieties. Mangala exhibited linear trend in yielding behavior from 1st to 7th yr of bearing. However in the 6th ye the yield in general was low (5.88 kgs/palm) owing to drought and scarcity of water. Hirehalli local was the next best variety, which has consistently produced better yields. Mohitnagar was good yielder in the initial three years of bearing whereas Sumangala and Sreemangala were moderate yielders.

The yield potential of the genotypes and their stable performance over diverse environments can be judged by carrying out multi location trials. Genotype x environment interaction plays a major role in realizing full potential of the varieties. In the present study, Stability performance of four Arecanut varieties over three different locations of Karnataka has been presented.

Data was analyzed using Stability analysis proposed by Eberhardt and Russel (1956) model.

Yield difference among varieties were statistically significant over different locations. This revealed that yield performance was modified by the environmental conditions prevailing over different locations. Pooled analysis of variance showed that Variety x environmental effects were non significant, indicating that the yield behavior of Arecanut varieties did not vary significantly between locations. This suggested that the nut yield to be unstable and varieties interacted considerably with environmental conditions prevailing at various locations.

Stability performance of four Arecanut varieties over three different environments of Maidan region of Karnataka has been presented. Pooled analysis of variance showed

that Variety x environmental effects were non significant, indicating that the yield behavior of Arecanut varieties did not vary significantly between different environments (Years)

Hybrid evaluation trial

The experiment was started at CPCRI, RS, Vittal in September 1995 involving five parents and sixteen hybrids laid out in Randomized Block Design with three replications. Crosses were made among five parents namely Mangala, Sumangala, Sreemangala, Mohitnagar and Shrivardhan. Mangala, Sumangala and Sreemangala are selections from exotic collections while Mohitnagar and Shrivardhan are indigenous selections. The hybrid nuts obtained from each cross combination were sown and seedlings raised under identical conditions. Each replication had 8 palms spaced at 2.7m x 2.7m. Observations were recorded on six important characters namely, plant height (cm) and girth at the collar (cm), number of leaves / palm, no. of nodes / palm, stem height unto the top node (cms), number of leaflets, leaf breadth, leaflet breadth, number of nuts and weight of ripe nuts (kg/palm). Shreevardhan and Mangala followed by Mohitnagar x Mangala recorded significantly higher number of nuts/palm and weight of nuts in the first year of bearing. Observations on growth parameters and yield parameters upto 2001 have been recorded and statistically analyzed.

This experiment will continue in Gen III (131) project.

Compact blocks of high yielding varieties such as Mangala, Sumangala, Sreemangala and Mohitnagar have been laid out for seed production and distribution to farmers.

13. Progress of work in relation to the time targeted for completion of work and reasons for non achievement of targets, if any.

14. **Publications**

a) **Research papers** : 3

1.Ananda K.S., Anuradha Sane, and B.C.Virakthmath,1999.Growth and yield performance of Arecanut varieties under malnad region. ***J.plantation crops.*** **28(2)**:105-109

2. Anuradha Sane, K.S.Ananda, S N Sampath Kumar, S Sannamarappa and B Ramanujam. 2001. Yield performance of high yielding Arecanut varieties in maidan region of Karnataka. ***J.plantation crops*** (Accepted for publication)

3. K.S. Ananda, Anuradha Sane and B S Choudhary 2001. Initial bearing tendency of arecanut varieties in coastal region of Karnataka. ***Diamond jubilee symposium on hundred years of Post-Mendelian Genetics and Plant Breeding-Retrospect and prospects held in November 6-9, 2001 at IARI, New Delhi, pp112, PS IV-96***

b) **Popular articles** : 4

1. Ananda,K.S and Anuradha Sane,1997. High yielding Arecanut varieties (Kannada), ***Thotagarike, 23 (3-4)*** : 22-26

2. Ananda,K.S and C Thamban,1997. High yielding Arecanut varieties, **Kisan world,26(6) : 62-63.**

3. Thamban C and K.S., Ananda,1997. High yielding Arecanut varieties Malayalam Manorama. (Malayalam)

4. Ananda, K.S. and Anuradha Sane, 1999. Arecanut germplasm in India. ***Tree world*** **8(9)**

c) **Reports** : Annual reports, CPCRI from 1988-2001

d) **Seminars and workshops** (Relevant to the project) in which the scientists have participared

Project assosciate participated in the Diamond jubilee symposium on hundred years of Post-Mendelian Genetics and Plant Breeding- Retrospect and prospects held in November 6-9, 2001 at IARI, New Delhi.

e) Material developed (Such as new varieties of crops, implements etc.)

Mohitnagar Variety, an indigenous collection was developed and released for cultivation. Compact blocks of released varieties will serve as breeders seed for distribution to the farmers.

15. Details (Nos.etc) of Field/Laboratory note books and their final location

The field note books and yield registers connected to all the experiments have been maintained in the Genetics section,Vittal while those of CYT, Hirehalli and Thirthahalli have been maintained at Hirehalli research center and Kuruvalli farm, Thirthahalli respectively.

16. Comments/Suggestions of project leader regarding possible future line of work that may be taken up arising of this project

Hybrid evaluation trial and CYT,Vittal will be continued in Gen.III (131) project.

17. Signatures with name of project leader and associates

Anuradha S 23/11/02 Project leader
(ANURADHA SANE)

18.Signature of Head of Division/Section/Station

A. Balasubramanian

19.Signature of Director

V. Prasad

Table1.Mean performance of varieties for growth parameters in CYT at Vittal during 1990-91

Variety	Girth (cm)	No.of leaves	Height (cm)	Flowering (%)
Sumangala	38.87	8.10	134.23	---
Sreemangala	37.78	8.20	200.51	---
Mohitnagar	31.14	7.81	161.55	---
Hirehalli Local	44.18	7.59	154.40	---
Mangala	34.75	7.90	76.55	100
SE	4.5	0.88	41.67	
GM	37.34	7.91	145.45	
CV (%)	12.05	11.10	28.66	
CD P =0.05	6.03	----	55.89	

Table 2. Flowering details of areca palms in CYT at Vittal (1991-92)

Variety	No. of flowering palms	Flowering (%)	No. of bearing palms	% of bearing to flowering palms
Sumangala	28/40	70.00	11/40	39.29
Sreemangala	23/40	57.50	17/40	73.91
Mohitnagar	24/40	60.00	6/40	25.00
Hirehalli Local	27/40	67.50	12/40	44.44
Mangala	40/40	100.00	19/40	47.50

Table 3. Yield performance of Arecanut varieties in CYT,Vittal over the years

Variety	1991-92		1992-93		1993-94		1994-95		1995-96		1996-97	
	No. of nuts/palm	Wt.of nuts/palm (Kg)	No. of nuts/palm	Wt.of nuts (kgs/palm)	No. of nuts/palm	Two nuts (kgs/palm)	No. of nuts/palm	Wt.of nuts	No. of nuts/palm	Wt.of nuts	4.93	
Sumangala	139.50	3.61	266.20	6.58	237.19	7.28	214.64	4.62	197.31	5.57	4.55	
Sreemangala	56.80	1.70	195.80	5.46	219.80	6.58	231.88	4.92	174.37	4.81	4.49	
Mohitnagar	79.70	2.60	181.60	5.89	261.08	8.40	219.11	4.55	151.87	4.20	4.23	
Hirehalli Local	86.50	2.03	149.60	3.39	529.11	9.59	325.73	5.47	187.31	3.92	3.69	
Mangala	89.40	3.51	134.60	5.05	130.17	4.80	181.67	3.87	96.61	2.43	4.37	
GM	90.38	2.69	185.56	5.27	255.47	7.18	234.61	4.49	161.49	4.18	10.48	
CV (%)					51.72	40.4	41.05	36.91	49.21	38.87	----	
CD(P=0.05)					77.13	----	---	---	---			

Table 4. Mean palm height, girth, number of leaves, number of nodes and Internode length of Arecanut varieities in CYT,Thirthahalli in the 5th year of planting

Varieties	Height (m)	Girth (cm)	No.of leaves	No.of nodes	Internode length (cm)
Sumangala	2.93	13.76	9.0	24.6	14.2
Sremangala	2.62	14.24	9.9	21.4	14.7
Mohitnagar	3.75	12.60	9.3	24.9	15.2
Thirthahalli	2.83	14.13	9.4	24.0	13.5
Mangala	2.17	13.29	9.0	20.0	11.8
GM	2.86**	13.60	9.3	23.0	13.9
CD (P = 0.05)	0.7	NS	NS	NS	NS

Table 5. Mean annual yield of tender nuts during 1994-99 in five areccanut cultivars in CYT,Thirthahalli.

Varieties	1994-95	%↑↓	1995-96	%↑↓	1996-97	%↑↓	1997-98	%↑↓	1998-99	%↑↓	Mean yield (Kgs/palm)
Sumangala	3.30	106.3	11.14	5.59	10.09	-22.21	12.55	-15.35	11.90	-38.08	9.796
Sreemangala	1.63	2.0	9.84	2.46	8.18	-36.93	11.89	-19.93	12.27	-36.16	8.76
Mohitnagar	2.31	44.4	9.13	13.46	11.07	-14.65	11.27	-24.11	14.85	-22.74	9.73
Mangala	4.13	158.1	8.88	-15.83	12.84	-1.0	19.22	29.42	12.57	-34.60	11.53
Thirthahalli local	1.60	-	10.55	-	12.97	-	14.85	--	19.22	----	11.84
GM	2.60	-	9.91	-	11.03	-	13.96**	---	14.16		----
CD(5%)	NS	-	NS	-	NS	-	01.53	-	4.33		----

Note: %↑↓=% increase or decrease over the local variety, Thirthalli Local

Table 6. Mean performance of Varieties for growth characters recorded in the 6th year after planting (1993-94) in CYT, Hirehalli

Varieties	Height (cm)	Girth at 30cms (cm)	Girth at last node	Internodel ength at 30cms (cm)	Internodel ength below crown (cm)	No. of nodes	Length of oldest leaf(cm)	No. of leaflets	Leaflet length (cm)	Leaflet breadth (cm)	Leaf sheath Length (cm)	**Leaf sheath breadth (cm)**
Sumangala (VTL-11)	473.20	39.93	32.03	**18.02**	**15.49**	14.82	132.37	109.13	70.67	4.63	75.41	38.42
Sreemangala (VTL-17)	577.90	40.77	35.49	16.4	14.99	15.79	160.59	**116.40**	70.16	4.24	78.55	41.07
Mohitnagar	465.90	40.52	36.88	15.34	12.99	15.49	**186.05**	114.72	**73.27**	4.15	77.16	39.93
Hirehalli local (chk)	**600.90**	**43.98**	**37.25**	16.47	14.15	**17.05**	146.43	113.39	70.43	**4.59**	**79.45**	**41.66**
Mangala (VTL-3)	380.60	40.45	32.72	14.50	11.62	13.95	145.98	108.42	70.84	4.09	71.08	36.62
Grand Mean	556.83	41.13	34.87	16.15	13.85	15.42	154.29	112.41	71.07	4.34	76.33	39.54
CV (%)	21.18	13.53	13.55	21.81	21.12	13.21	17.92	10.26	9.07	10.96	11.77	14.68
CD at 5%	158.10	7.46	6.33	4.72	3.92	2.73	37.08	15.46	8.64	0.64	12.04	7.78

Table 7. Mean Yield performance of arecanut varieties over the years in CYT, Hirehalli

Varieties	1993 - 94	%↑↓	1994 - 95	%↑↓	1995-96	%↑↓	1996-97	%↑↓	1997-98	%↑↓	1998-99	%↑↓	1999-2000	%↑↓	**2000-2001**	%↑↓
Sumangala (VTL-11)	1.98	19.28	3.06	39.73	3.89	-34.25	3.09	-9.32	4.54	**-47.8**	5.03	228.99	3.12	-55.81	4.020	-57.63
Sreemangala (VTL-17)	0.87	-47.5	2.31	5.48	5.18	-16.34	7.47	20.75	4.05	26.18	6.40	193.48	5.17	-26.77	6.010	-36.67
Mohitnagar	1.60	-3.61	3.32	51.60	3.61	-24.18	3.86	-15.85	3.91	-34.8	5.80	183.33	4.71	-33.29	6.652	-29.93
Hirehalli local	1.66	-	2.19	--	4.29	---	5.92	---	1.38		7.65	----	7.06	---	**9.488**	----
Mangala (VTL-3)	**2.99**	**80.12**	**6.84**	**212.33**	**6.52**	**7.58**	**8.28**	**51.98**	**4.14**	39.86	**8.23**	**200.00**	**9.37**	32.72	8.250	-13.07
GM	1.82		3.54		4.70		5.72		3.60	----	6.62		5.89	----	6.884	
CD at 5%	2.21		3.15		----		4.92		1.86		---		3.36		2.710	

Note: %↑↓=% increase or decrease over the local variety, Hirehalli Local

Table 8. Recovery of final processed products from one kilogram of tendernuts (CYT,Hirehalli)

Varieties	Unde				Podi	
	Weight of fresh kernel (g)	Weight of processed Kernel(g)	Recovery Unde / Kg of tender nuts (%)	Weight of fresh kernel podi (g)	Weight of processed Podi (g)	Recovery of Podi /Kg of tender nuts (%)
Sumangala (VTL-11)	360	126.7	12.67	290	79.2	7.92
Sreemangala (VTL-17)	345	138.3	13.83	340	99.1	9.91
Mohitnagar	310	137.1	13.71	370	79.4	7.94
Mangala (VTL-3)	350	148.7	**14.87**	410	123.8	12.38
Hirehalli local	350	142.5	14.25	415	141.5	**14.15**
Mean	343	138.66	13.87	365	104.6	10.46

Table 9. Mean performance of parents and hybrids for growth parameters in Hybrid Evaluation trial (5th year after planting)

Hybrid combination	Plant Height (m)	Girth (cm)	Girth (cm)	Inter nodal distance (cm)	Inter nodal distance (cm)	No. of nodes	No. of leaves	No. of leaf lets	Leaf length (cm)	Leaf breadth (cm)
Mangala x Sreemangala	6.08	47.17	38.17	13.75	14.58	15.00	9.58	72.92	173.42	81.00
Mangala x Sreevardhan	6.59	50.97	38.70	11.45	14.72	18.37	9.55	85.10	193.70	87.87
Sumangala x Mangala	6.17	47.26	36.40	13.00	16.53	16.23	8.98	67.27	181.03	72.50
Sumangala x Sreemangala	5.49	46.50	32.80	14.42	14.10	13.40	8.65	67.17	176.78	82.52
Sumangala x Mohitnagar	6.88	47.88	42.60	15.07	17.88	17.00	8.25	79.75	171.13	88.25
Sumangala x Sreevardhan	6.03	46.71	37.25	12.96	13.54	16.33	9.17	69.08	174.92	86.08
Sreemangala x Mangala	6.41	51.33	41.00	14.46	17.42	18.67	9.67	61.92	195.92	96.98
Sreemangala x Sumangala	6.04	53.00	41.22	13.14	12.33	16.86	9.71	75.00	202.50	82.14
Sreemangala x Mohitnagar	5.88	44.88	33.96	13.38	14.83	15.33	9.00	60.86	178.67	89.00
Sreemangala x Sreevardhan	5.88	41.17	31.75	11.13	14.25	17.08	8.83	79.58	178.58	97.81
Mohitnagar x Mangala	7.54	43.50	33.33	15.92	18.46	16.75	9.25	76.42	171.58	88.55
Mohitnagar x Sumangala	7.60	43.17	31.67	16.34	19.83	18.83	9.17	83.50	185.67	88.92
Mohitnagar x Sreemangala	6.33	46.77	35.19	16.28	17.97	14.11	9.64	76.25	156.64	88.69
Mohitnagar x Sreevardhan	7.09	40.08	32.08	14.13	16.17	19.50	9.67	83.50	185.58	86.92
Sreevardhan x Mangala	6.49	56.49	42.46	11.36	11.71	21.33	9.39	89.17	203.06	105.17
Sreevardhan x Sumangala	6.12	47.67	38.50	11.42	12.67	20.86	9.92	82.92	177.83	88.42
Mangala	7.31	53.33	41.67	12.63	14.59	22.67	9.17	85.25	207.56	122.40
Sumangala	7.37	56.83	46.10	14.05	16.17	19.92	9.73	77.92	209.92	101.70
Sreemangala	9.01	52.64	34.75	16.63	18.81	21.69	9.34	91.11	232.94	108.33
Mohitnagar	8.49	47.78	41.06	16.85	18.39	23.69	9.69	82.89	204.47	83.28
Sreevardhan	7.59	55.25	45.17	17.59	18.92	17.17	9.08	84.33	195.58	99.77
CV (%)	17.70	9.42	13.16	12.75	17.46	18.65	8.09	11.50	13.44	9.81
CD at 5 %		7.55	8.23	2.96	4.580	5.58	----	14.75	----	14.85

Table 10. Mean performance of parents and hybrids for yield in the 5th year of planting in Hybrid Evaluation Trial

No.	Hybrid combination	No. of nuts/ Palm	Weight of ripe nuts (kgs/palm)
1	Mangala x Sreemangala	96. 505	0. 892
2	Mangala x Sreevardhan	216. 014	1. 903
3	Sumangala x Mangala	101. 020	0. 781
4	Sumangala x Sreemangala	173. 890	1. 247
5	Sumangala x Mohitnagar	59. 270	0. 444
6	Sumangala x Sreevardhan	1. 270	0. 006
7	Sreemangala x Mangala	59. 900	0. 584
8	Sreemangala x Sumangala	80. 510	0. 940
9	Sreemangala x Mohitnagar	16. 760	0. 164
10	Sreemangala x Sreevardhan	52. 260	0. 464
11	Mohitnagar x Mangala	287.180	2. 974
12	Mohitnagar x Sumangala	278. 250	2. 672
13	Mohitnagar x Sreemangala	19. 010	0. 248
14	Mohitnagar x Shreevardhan	58.135	0. 600
15	Sreevardhan x Mangala	**580.135**	**3. 587**
16	Sreevardhan x Sumangala	116.250	0. 897

Unde

Podi

Fig.1 Processed tender nuts