R. P. F. III

(91)

FINAL REPORT

1. Institute Code No: Agr VI (131)

2. I. C. A. R. Code No:

3. Name and Address of Research Institute/Centre: Central plantation crops Research Institute Research centre, Mohitnagar 735101, N.B. West Bengal.

4. Project Title: Inter and mixed cropping trials 3. Assessment with other crops.

5. Name and Designation of Project Leader: M. Sannamadappa - Scientist-S2 — overall leader for the experiments running at different centres.

6. Name (s) and Designation(s) of Project Associates including Project Leader and work to be done:

Sl. No.	Name and Designation	Time spent	work done
	A R Roy	1974-1979	complete-in-charge of the experiment at Mohitnagar
	R K Singh	1977 - 1979, August	
	N. Yadukumar	1979 — 1982, May	

7. Location of Research Project with complete address (Division/Section/Sub-Centre)
Central plantation Crops Research Institute, Research Centre Mohitnagar, Jalpaiguri Dist., West Bengal 735101

8. Date of start 1971

9. Date of termination 1981

10. (a) Objectives (Not more than 150 words)

To find out suitable intercrops that can be grown in Arecanut gardens of North Bengal region without causing detrimental effect to the main crop.

(b) Practical Utility including background information (Not more than 150 words)

In some areas, particularly in North Bengal farmers are reluctant to take up intercropping since there is a widespread belief that the intercrop will affect the yield of the main crop adversely. A number of intercrops experiments were initiated in the early Sixties at CPCRI Kasaragod and other Research centers to assess the advantages of disadvantages of intercropping. The productivity and economics of intercrops had also been studied. Experiments showed that growing pepper, cacao, and various annual crops in Arecanut garden had no adverse effect on the performance of arecanut crop. On the contrary in most cases the mean yield per palm in mixed garden was higher than in monocrop showing complementary relationship. This concept of intercropping is not practiced in North Bengal region mainly because of poor economic condition of area growers and lack of knowledge of scientific methods of cultivation. Probably this experiment will reveal the beneficial effects of intercropping in Arecanut garden in North Bengal

CENTRAL PLANTATION CROPS RESEARCH INSTITUTE
(Indian Council of Agricultural Research)
Seed Farm, Kidu - 574230, Karnataka.

Agr.VI(131):- Inter and mixed cropping trials
3. Arecanut with other crops.

A Final Report:

At Mohitnagar this project was in progress since 1971. The main crop is arecanut. The main objective of this experiment is to find out suitable intercrop that can be grown in Arecanut gardens of North Bengal region without detrimental effect to the main crop. The experiment laid out in R.B. Design with following intercrops as treatments in four replications.

1. Ginger, 2. Pineapple, 3. Banana 4. Betelvine, 5. Control.

Arecanut as main crop was planted in 1961 with 2.44 mx 2.4 m spacing and intercrops raised in the space between Arecanut plants from 1971 onwards.

Each treatment consisted of 8 arecanut plants and the respective intercrops covering in a net plot size of 0.0048 hectre. Intercrops, ginger and pineapple were planted in five plants each. Betelvine was planted and trained on to the 8 experimental plams and 16 border plams. Yield was recorded from all the 24 vines.

During the first year of experiment, turmeric was included as one of the intercrops. Mainly due to poor market demand and also to avoid two tuber crops(Rhizome) turmeric was replaced by Banana. Banana was planted in 1974. Betelvine was planted along with other crops in 1971. But these vines did not establish properly and hence a fresh planting was done in 1976 and leaves first picked in 1977.

In the beginning two varieties of pineapple were grown i.e. queen and kew. Because of poor yield of queen variety it was replaced by kew in 1977.

1. During each year arecanut palms received the following schedule of manures per palm per year.

   Cattle manure - 10 kg. in september
   Nitrogen(N) - 100 g.(N)(Urea)-80 g. in September & 20 g. in March.
   Phosphorus(P205)-40 g. (As single superphosphate) in siggle dose applied in Septmmber.
   Potash(K20) - 140 g. (Muriate of potash) - 80 g. in September & 60 g. in March.

2. Ginger(per treatment i.e. 5 beds of each 1m x 6m size)

   Cattle manure - 200 kg. as basal dose.
   Nitrogen(N)- 108 g. as urea in two equal split doses in september and March respectively.
   Phosphorus(P205)-108 g. as single super phosphate as basal dose.
   Potash(K20) - 270 g. as Muriate of potash in two split doses.
   Entire ginger plot was mulched thrice with arecanut.

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3. Pineapple: Fertilizer dose per square meter.

Nitrogen(N)- 108 g. (as urea)in single dose.

P205 50g. (as S.S.P.) in single dose.

K20 20 g. (as M.O.P.) in single dose.

Cattle manure @ 300 kg/treatment plot at the time of first planting of suckers.

4. Banana: Banana was manured as that of arecanut.

5. Betelvine: The vines were planted about 75 cm away from the base of arecanut palm and when grown was trailed on to the stem of arecanut palm. For palms having betelvines, in addition to the manure applied to arecanut palms 12 kg cattle manure was applied in September.

The yield data of main crop (arecanut) and inter/mixed crops for 8 years and 4 years respectively are given in Table I & II.

TABLE-I: The mean yield of arecanut (no.of nuts/palm) as affected by various inter/mixed crops for eight years from 1974 to 1981

Inter/ Mixed crops.	1974	1975	1976	1977	1978	1979	1980	1981	Mean
Ginger	118.6	139.4	186.4	174.6	195.5	252.5	187.4	336.3	200.94
Pineapple	170.7	148.0	172.7	191.6	138.8	245.6	172.5	322.6	184.05
Banana	138.2	130.1	186.0	140.9	172.7	266.3	169.9	282.5	190.93
Betelvine	148.5	127.3	196.6	185.1	192.7	258.6	238.2	328.5	207.88
Control	161.6	159.6	186.5	187.3	211.1	244.6	169.8	292.4	201.30
C.D.(0.05)	NS	NS	NS	NS	NS	NS	NS	NS	

The data clearly indicates that for the eight years (1974 to 1981) growing inter/mixed crops has not affected arecanut yield significantly. But, though it is not significant from the economic point of view, so far as arecanut alone is concerned growing pineapple and Banana as intercrops resulted in the reduced yield by 17.25 and 10.37 nuts/palm respectively (table)I: as compared to control(without any inter/mixed crop) While considering per hectare yield the above reduced yield would be 28980 nuts & 17421 nuts amounting to Rs.1698 x 1020 respectively which is fairly a big amount. Similarly an increased yield by 6.55 nuts/palm in case of Arecanut + Betelvine combination over control has given an increased yield of 1104 nuts/ha amounting to Rs.644/ha. The above data shows though not significant growing Betelvine as mixed crop in arecanut garden is benefical to Main crop fetching a net additional income of Rs.644/ha from arecanut alone.

Yield of Inter/Mixed crops per heatare for four years from 1978 to 1981

Intercrops	1978	1979	1980	1981	Mean	Value	Cost of cultivation	Profit & Less.
Ginger(kg)	955.37	999.37	797.84	565.52	829	2486.00	4519	- 2278
Banana(kg)	3861.33	2039.46	4631.56	2170.00	3175	6350.00	3499	2851
Pineapple	2226.93	2308.53	4756.46	3345.00	3202	3202.00	2465	737
Betelvine (nos)	137585	117372	714360	859670	648410	6484.00	3190	3293

Rate prevailing as on December 1981:

Ginger - Rs.3.00/kg
Banana Rs.2.00/kg
Pineapple Rs.1.00/kg
Betelvine Rs.10.00/1000 nos.

The above figures show that among all the inter/mixed crops maximum profit is achived from Betelvine (Rs.3293/ha) and next to this Banana and pineapple (Rs.2851 & 737 respectively). whereas ginger is not profitable.

It may be concluded that among four intercrops Betelvine gives the highest and uniform return. In this region arecanut is mostly grown in small pockets where only the family labour is used. If betelvine is grown in such plots it is really profitable as the income is very much distributed throughout the year which is an advantage for small farmers.

(N. Yadu Kumar)

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INTERCROPPING IN ARECA GARDENS IN NORTH BENGAL

R.K. Singh, N.Y. Kumar, K.N. Roy Burman and G.C. Roy.

India is the largest arecanut producing country in the world accounting for 75 percent of the world's production and employing nearly four million persons in the production, processing and marketing of arecanut In India it is mainly grown in the southern states and partly in Assam and in some parts of West Bengal. In West Bengal it is mainly grown in two districts, namely, Cooch Behar and Jalpaiguri which come under North Bengal region. West Bengal, with an area of about 3100 hectares under arecanut, accounts for about 1.4 per cent of the total cultivated area under arecanut in the country.

Arecanut is a perennial crop with sufficient solar radiation penetrating through its course and provides considerable scope for intercrops which can supplement the income of the arecanut growers without adversely affecting its production. In some areas, farmers are reluctant to take up intercroping since there is a widespread belief that the intercrop will affect the yield of the main crop adversely. A number of field experiments were initiated in the early sixties at the Central Plantation Crops Research Institute, Regional Station Vittal, and its Research Centre, located in various arecanut growing regions like Peechi(Kerala), Hirehalli(Karnataka), Palode(Kerala), Kahikuchi(Assam) and Mohitnagar(West Bengal) to assess the advantages or disadvantages of intercropping. The productivity and economics of intercrops had also been studied. Experiments with various annual crops like pepper, cacao and betel vine in arecanut gardens have shown that growing these crops had no adverse effect on the performance of areca; on the contrary in most cases the mean yield per palm in mixed crop plots(areca+intercrop) was higher than in monocrop showing complementary relationship. Thus, the farmers, especially of backward region of North Bengal, must be convinced and encouraged for adopting intercropping in their existing areca gardens.

North Bengal has a considerable potential for introducing intercropping or multistorey cropping. At present the research and cultivation of these crops are largely confined to southern tropical region of the country which has caused regional imbalance also. However, the concept of intercropping or multistorey cropping is not practised in the North Bengal region mainly because of poor economic condition of areca growers and lack of knowledge of Scientific methods of cultivation.

Arecanut occupies an important place in the rural economy of North Bengal because of its large-scale domestic uses. In spite of this, efficiency of arecanut production and marketing in the region is still low. A sample survey

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study was made by the CPCRI, Research Centre, Mohitnagar (1978-81) of Jalpaiguri district to analyse the economics of arecanut and cultivation of intercrops and to estimate the area available for extending intercropping in existing arecanut garden. It was found that arecanut cultivation is profitable in the region. Regarding intercrops pineapple, banana, turmeric, ginger and betelvine were common intercrops. Except betelvine none of the intercrops is profitable. Data presented in Table 1 reveal that among the intercrops betelvine occupied maximum proportion of the total area under arecanut(5.62 per cent) followed by banana (4.29 per cent), and pineapple (1.68 per cent). It is further observed that all the five intercrops together accounted for only 14.19 per cent while 85.81 per cent of the area was without any intercrop. Thus there is a vast scope for extending intercropping in existing gardens in this region.

Further, the above study revealed that all the five intercrops are grown traditionally in the region and are not being replaced by comparatively more profitable intercrops such as balck pepper, elephant yam, arrow root, cinnamon, etc. Although five crops were commonly grown, as intercrops or mixed crops in areca garden, it was not a common practice either to grow more than one crop in the same unit area or to grow all these intercrops by every farmer. It is evident from Table 1 that even those who grow intercrops in the garden did not grow them in the whole of the area covered by the garden but only a part of the garden. This is mainly due to lack of modern technical knowhow and also because of the limitations of irrigation and other inputs including planting materials. There is a great demand for rooted cuttings of the high yielding hybrid pepper 'Panniyur-1' in the region.

A feasibility trial is in progress at the CPCRI, Research Centre, Mohitnagar, Jalpaiguri on intercrops with a view to selecting suitable intercrops for this region and also to determine their suitablility in multistorey cropping system in areca garden. The multistorey cropping system in a new agronomic practice for this region although it is very popular in the southern states. In this system the optimum use of land, water, solar energy and nutrients can be made by using both the horizontal and vertical space available. In this system crops having different stature and rooting pattern may be selected from comptible combinations. The results of the above trial so far obtained have been given in Table 2 and 3. The trial had given very encouraging results although it is still in primary stage of observation. It can be observed from the data presented in Table 2 that among various crop combinations with arecanut, elephnat yam+black pepper registered highest net profit per hectare followed by arrowroot + pepper, betelvine, pepper, pineapple and banana.

The combination with pineapple and ginger actually incurred loss. The effect of intercrops on the yield of arecanut presented in Table 3 indicate the highest increase

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over control in the plot growing arecanut with pepper and arecanut with pepper+elephant yam (18.42 per cent) followed by arecanut+betelvine (14.99 per cent). arecanut+arrowroot+pepper(17.54 per cent) and arecanut+ ginger (10.18 per cent). Intercrops of banana and pineapple actually indicate decline in the yield over the control plot, but this decline is marginal.

Multi-storey Cropping:

One notable point of pepper yield is that it has produced 400 gms of dried berries per vine which is about 60 per cent above the country's average yield of 250 gms per vine though vines are only 6 years old. Thus it can be recommended safely to bring more area under pepper cultivation in existing arecanut garden in this garden region.

The foregoing analysis indicates that black pepper, arrowroot, elephant yam and betelvine are paying companion crops in arecanut gardens rather than the traditional intercrops like banana, ginger, turmeric and pineapple which are less profitable. Thus there is a need to shift the cropping pattern. Further, it is observed that about 85 per cent area in garden land is without any intercrop, there is an urgent need to utilise it by popularising intercropping system. The intercrops should be selected according to the suitability in the region keeping in view the soil fertility, irrigation water and marketing facilities.

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(N. Yadukumar)

TABLE - 1. ARECANUT AND INTERCROPS (Area in hectares)

Sl. No.	Size group	Arecanut	Poneapple	Banana	Ginger	Turmeric	Betelvine	Total area without intercrops	Area without intercrops
1.	Small	0.22	0.0003 (1.60)	0.02 (7.58)	0.0002 (1.16)	0.0005 (2.32)	0.02 (6.68)	0.05 (19.34)	0.07 (80.66)
2.	Medium	0.36	0.01 (2.36	0.02 (4.86)	0.004 (1.44)	0.006 (1.69)	0.02 (5.23)	0.06 (15.58)	0.03 (84.42)
3.	Large	0.69	0.008 (1.37)	0.02 (3.27)	0.01 (1.56)	0.002 (0.60)	0.04 (5.57)	0.08 (12.37)	0.61 (87.63)
4.	All farms	0.45	0.009 (1.68)	0.02 (4.29)	0.006 (1.47)	0.005 (1.13)	0.35 (5.62)	0.07 (14.19)	0.38 (85.81)

Figures in parentheses indicate the percentage of the total area under arecanut.

(N. Yadukumar)

TABLE-2: ECONOMICS OF INTERCROPS IN ARECANUT GARDEN (Rs. per hectare)

Sl.No.	Arecanut and Intercrops	Gross return from arecanut	Cost of cultivation of arecanut	Gross return from intercrops	Cost of cultivation of intercrops	Joint returns	Joint cost	Joint net profit
1.	Arecanut (Control)	22,444	7,673	-	-	-	-	14,771
2.	Arecanut+ginger	23,949	7,673	2,486	4,519	26,435	12,192	14,243 (-3.57)
3.	Arecanut+banana	22,050	7,673	6,350	3,500	28,400	11,113	14,287 (+17.04)
4.	Arecanut+pineapple	21,558	7,673	3,202	2,465	24,760	10,138	14,622 (-1.01)
5.	Arecanut+betelvine	25,102	7,673	6,484	3,190	31,586	10,863	20,723 (+40.30)
6.	Arecanut+pepper	21,800	7,673	8,864	2,360	30,664	10,003	20,631 (+39.67)
7.	Arecanut+elephant foot yam+pepper	21,540	7,673	13,000	4,400	36,540	12,073	24,467 (65.64)
8.	Arecanut+pepper+arrowroot	21,650	7,673	12,500	4,600	34,150	12,273	21,877 (+48.10)
9.	Arecanut+pineapple+pepper	21,559	7,673	11,100	4,797	32,650	12,470	20,180 (+36.62)

NB: Figures in parentheses indicate per cent increase or decrease over control (mono-crop). Cost and returns have been computed on 1981 prices

(N. Yadukumar)

TABLE-3: MEAN YIELD OF ARECANUT AND INTERCROPS

Sl. No.	Crop combination	Yield of arecanut per palm(number)	Yield of intercrops kg/hectare
1.	Ginger	243(+10.18)	829
2.	Banana	224(-2.77)	3175
3.	Pineapple	219(-6.00)	3202
4.	Betelvine	255(+17.99)	648400 nos.
5.	Pepper	270(+18.42)	415*
6.	Elephant yam+pepper	270(+18.42)	4500**
7.	Arrowroot+pepper	268(+17.54)	430**
8.	Arecanut(control)	228	

* Yield of elephant yam and
** Arrowroot processed powder

NB: Figures in parentheses indicate per cent increase or decrease over control plot(arecanut without intercrops).

C.N. Jadhav

13. Approximate expenditure incurred in the Project: (Give reasons for variation, if any, from original estimated cost)

Rs 2.5 lakh

14. Publications and material (one copy each to be supplied with this proforma)

a) Research papers —

b) Popular articles One

c) Reports —

d) Seminars and workshops (Relevant to the Project) in which the Scientists have participated:

—

e) Material developed such as new varieties of crops or breeds of farm animals, implements, products, etc.)

Among four intercrops Laird Berseem gave the highest and uniform return. In North Bengal agreement is mostly grown in small pockets where only the family labour is used. If berseem is grown in such plots it is really profitable as the income is evenly much distributed throughout the year which is an advantage for small farmers

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

Log book
Field note books
Observation Register No - I, II, III & IV } All item are available at CPCRI(RC), Mohitnagar

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

The following crop combinations can also be tried in North Bengal.

Arecanut + Elephant foot yam + pepper & Betelvine
Arecanut + papaya + pepper & Betelvine
Arecanut + coffee + pepper & Betelvine
Arecanut + Tea + pepper & Betelvine
Arecanut + pepper + Arrowroot etc.

17. Signatures with name of Project Leader and Associates:

Associate

(N. Yadukumar)

18. Signature (with comments, if any) of Head of Division/Section/Station :

19. Signature (with comments, if any) of Director :