

PERFORMANCE OF FOUR VARIETIES OF BLACK PEPPER (*PIPER NIGRUM* L.) AS MIXED CROP WITH ARECANUT (*ARECA CATECHU* L.) UNDER DIFFERENT PLANTING DENSITIES

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ABSTRACT

A study was conducted to investigate the performance of four varieties of pepper as a mixed crop in arecanut garden with six planting densities. The results revealed that, in arecanut garden with a recommended spacing of 2.7 x 2.7 m, 43 per cent of sunlight is available to other component crops. Pepper as a mixed crop did not influence the yield of arecanut and Karimunda followed by Panniyur-I were found to be suitable pepper varieties in arecanut garden. The highest yield of pepper was observed with a spacing of 1.8 x 2.7 m with Karimunda variety. The results also indicated that pepper is a profitable mixed crop in arecanut garden.

INTRODUCTION

Arecanut, when raised as a sole crop adopting the recommended spacing, does not utilise fully the natural resources viz., the soil, air space and sunlight. Making use of these resources a number of crops can be grown in the interspaces of areca palms and pepper is one of the component crops. Pepper is sufficiently shade tolerant, ideal for intercropping with arecanut and can be conveniently trained to the palms once the stem reaches to certain height.

Nair (1982) and Abdul Khader (1982) found pepper as a profitable cash crop, suitable for mixed cropping in arecanut gardens. According to Singh *et al* (1982) pepper can be recommended as a mixed crop along with arecanut in North Bengal. Additional production through mixed cropping in areca have been reported by Abraham (1974), Roy (1974) and Muralidharan and Nayar (1979). However, informations on the effect of growing pepper on the yield of main crop of arecanut, the optimum spacing requirements, the quantity and pattern of light availability under different spacings, the varietal suitability of pepper for mixed cropping are lacking. The present investigation was carried out at the Central Plantation Crops Research Institute, Regional Station, Vittal for generating informations on varietal-cum-spacing require-

ments of pepper, its effect on the growth and productivity of main crop of arecanut and to evaluate the economic viability of such a cropping system.

MATERIALS AND METHODS

The experiment was laid out during 1977 in an existing 19 year old areca garden planted in 1958 in a split plot design with six replications. The main plots consist of six spacing treatments and the sub plots with four cultivars of pepper and a control plot without pepper.

S. No.	Main plots Spacing of arecanut (m)	Sub plots Pepper cultivars
1.	1.8 x 1.8	Panniyur-I
2.	1.8 x 2.7	Uddakare
3.	1.8 x 3.6	Malligesara
4.	2.7 x 2.7	Karimunda
5.	3.6 x 3.6	Control

Pepper was planted 75 cm away from the arecanut stem in 60 cm cube pits refilled with top soil. Rooted cuttings, two each per palm, were planted and trained to the stem (233.28 sq.m.). Border rows were provided in between main and sub plots (46.66 sq.m.)

The arecanut plants were manured @ 12 kg each of green leaf, and cattle manure in the form of organics and 100 g N, 40 g P₂O₅ and 140 g K₂O in the form of urea, super phosphate and muriate of potash as chemical fertilizers/palm/year. Pepper vines were given 100 g N, 40 g P₂O₅ and 140 g K₂O per vine. During summer (November to May) irrigation was given to a depth of 30 mm of water with IW/CPE ratio = 1. The recommended agronomic practices including weeding, base opening, providing drainage, forking the interspaces and covering the basins were performed. Plant protection measures against Máhali disease of arecanut and wilt disease of pepper were taken up.

Data on growth of both the crops were recorded and statistically analysed. The quantity of light available to the pepper vines after interception of arecanut canopy under different planting densities and the flowering behaviour of different varieties of pepper, were also recorded by using a Quantum Metre (Licor). The readings were recorded at 8.00, 10.00, 12.00, 14.00 and 16.00 hours under different spacing of arecanut palms and compared to that in open area. From the daily readings, monthly mean were computed and the percentage of light penetrated after intercepting by the crowns of arecanut palms were worked out. Number of vines affected by *Phytophthora* wilt and shade intensities were recorded.

RESULTS AND DISCUSSION

Quantity and pattern of light penetration

The maximum percentage of sunlight is found to be available under the widest spacing of 3.6 x 3.6 m (56.38 %) and the minimum under the spacing of 1.8 x 1.8 m (37.38%) (Fig. 1). The recommended spacing for arecanut was 2.7 x 2.7 m (Shama Bhat, 1978) and the quantity of light available under this treatment was 42.9%. Nair and Balakrishnan (1976) measured the intensity of light falling at the plantation floor of coconut during different seasons of the year. The authors considered 10-16 h as the peak bright period and during which 45% of light was available in the coconut plantation floor. In arecanut, like coconut the ori-

entation and structure of leaves permit about 42% of solar radiation incident on the foliage to pass through to lower profile and the ground and it was sufficient for the growth of black pepper.

Flowering behaviour

Data on the flowering behaviour of pepper varieties have been monitored under each spacing. At the third year of planting the vines started flowering and the percentage of vines flowered under each variety and the yield of dry pepper/vine obtained in the third year are given in the Table I. The data gave the indication of earliness of bearing of four pepper cultivars tried in the trial. Both Panniyur-I and Karimunda have shown earliness in bearing (48 and 43 per cent of vines respectively) at the third year of planting as against 4 and 7 per cent of vines in Uddakare and Malligesara. Since all the vines have not started giving yield at the third year, the mean yield of pepper per vine was worked out. The highest yield of pepper was obtained from Karimunda and Panniyur-I (100.4 and 99.3 g per vine respectively). It is evident from the results that cultivars have got potential of earliness in flowering and yield.

Disease incidence

At the third year of planting yellowing was noticed in some of the vines due to *Phytophthora* wilt disease. The mean number of vines affected by the wilt disease are presented in the Table II. In closer spacing significantly more yellowing was noticed compared to wider spacings. As the plant densities increase there will be more shade, low temperature and high humidity in the plantation which may be primarily responsible for the high rate

Table I. Flowering behaviour of Pepper

Cultivar	Percentage of vines flowered	Yield of dry pepper/vine (g)
Panniyur -I	48	99.3
Karimunda	43	100.4
Uddakare	4	14.2
Malligesara	7	10.3

Table II. Percentage of pepper vines affected by *Phytophthora* wilt disease under different spacings and cultivars

Spacing (m)	Pepper cultivars											
	Panniyur - I			Uddakare			Malligesara			Karimunda		
	1983	1984	1985	1983	1984	1985	1983	1984	1985	1983	1984	1985
1.8 x 1.8	20.45	27.27	29.54	20.45	36.36	32.27	18.18	36.36	-	11.13	22.72	-
1.8 x 2.7	16.66	20.83	25.00	8.33	37.50	50.00	18.75	25.00	-	8.33	20.83	-
1.8 x 3.6	6.25	12.50	25.00	-	12.50	12.50	18.75	28.75	-	25.00	31.25	-
2.7 x 2.7	-	6.25	6.25	6.25	6.25	12.50	-	31.25	-	-	12.50	-
2.7 x 3.6	-	-	-	-	-	-	-	8.33	-	8.33	8.33	-
3.6 x 3.6	-	8.33	12.50	-	-	-	-	8.33	-	-	8.33	-

of disease incidence in the closer spacing. Among the pepper varieties Uddakare and Karimunda had lesser incidence of the disease. The highest disease incidence was noticed in Panniyur-I.

Yield of arecanut

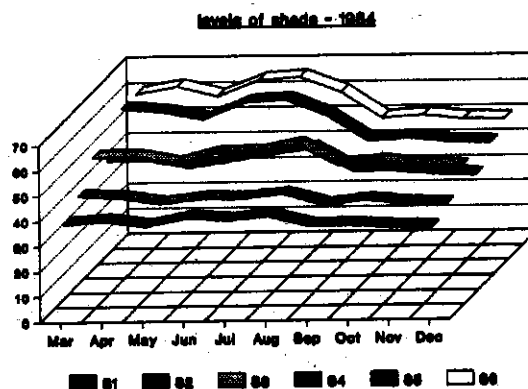
Yield data of arecanut was collected tree-wise and the plot yield was statistically analysed (Fig. 2). The highest yield was obtained from the spacing of 1.8 x 1.8 m which was statistically significant. The lowest yield was from the widest spacing of 3.6 x 3.6 m. In the case of sub-plots in which different cultivars of pepper have been planted with the arecanut there was no significant difference in the yield of arecanut. Similarly there was no significant difference between the plots where pepper was planted as intercrop and in the plot where arecanut was raised as a monocrop.

The yield of chali (marketable produce) nuts were worked out on hectare basis (Fig. 2). The highest yield of chali per hectare was obtained from the closest spacing of 1.8 x 1.8 m. The lowest yield was from 1.7 x 3.6 m and 3.6 x 3.6 m spacings

respectively.

The number of palms per hectare under 1.8 x 1.8 m spacing was 3080 while under 2.7 x 3.6 m and 3.6 x 3.6 m spacing the plant population were 1025 and 770 respectively. The total yield per unit area was more in closer spacings due to the higher number of plants. In arecanut the recommended spacing is 2.7 x 2.7 m (Shama Bhat and Khader, 1982). The arecanut palms under investigation have been planted during 1958 and the yield was related to 1981 to 1987. As arecanut palm is having tall stem and raised crown there is a possibility of more and more slant rays of sun falling as the age of palm advances and as a result in the older plantation closer spacings may be advantageous.

There was no significant difference in the yield of arecanut in the control plot where pepper was not intercropped and in the plots where pepper was raised indicating that pepper as an intercrop did not influence the yield of arecanut. The additional income obtained from pepper was without losing the

**Fig. 1. Light intensities (%) under different levels of shade - 1984**

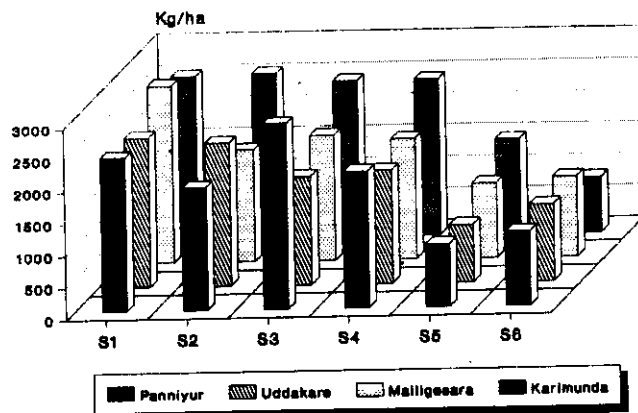


Fig. 2. Yield of arecanut for 6 years (kg/ha) (1981-82 to 1986-87)

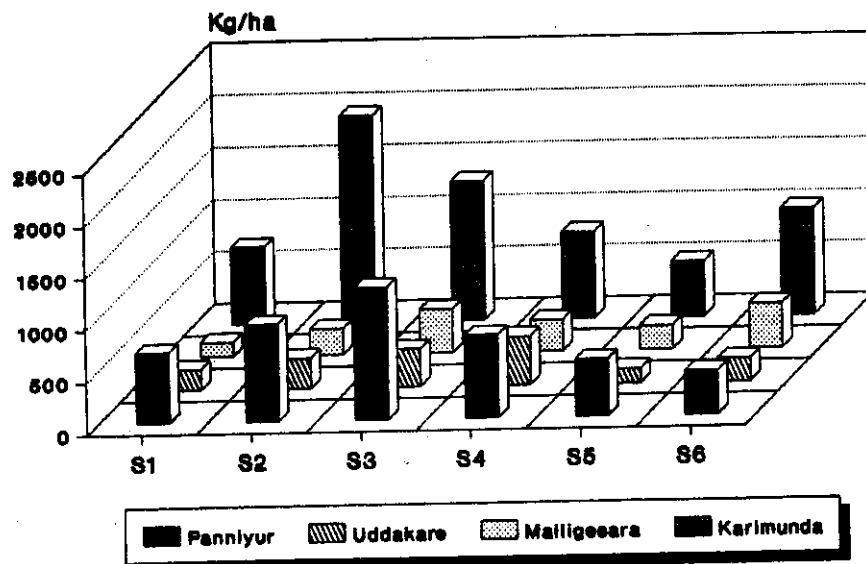


Fig. 3. Yield of pepper for 6 years (kg/ha) (1981-82 to 1986-87)

income from the core crop. This suggests that pepper is one of the compatible intercrops in arecanut garden.

Yield of pepper

As regards the yield of pepper, 1.8 x 2.7 m had given significantly more yield per plot (7.09 kg of green berries) followed by 1.8 x 3.6 m spacing (Fig. 3). The lowest yield was obtained from 2.7 x 3.6 m spacing (3.14 kg/plot). Among the cultivars of pepper, Karimunda

gave the highest yield (8.92 kg/plot) followed by Panniyur- I (6.68 kg/plot). The cultivars Uddakare and Malligesara had resulted in poor yield viz., 2.37 and 2.50 kgs per plot respectively. Among the different treatment combinations, the spacing of 1.8 x 2.7 m with Karimunda pepper was found to be superior to the rest of the treatment combinations. Arecanut with a spacing of 1.8 x 2.7 m and training Karimunda gave the highest yield of 15.48 kg/plot followed by 1.8 x 3.6 m spacing (10.37 kg/plot). The yield of pepper on hectare basis are presented in the

Fig. 2. The Karimunda pepper with a spacing of 1.8 x 2.7 m gave the highest yield of 1973 kg of dry pepper per hectare. In the case of Panniyur-I the yield obtained from the above spacing was 1264 kg/ha. The results indicated that Karimunda is more shade tolerant and performs better with closer spacings while Panniyur-I requires more light and its performance was better in wider spacing i.e., in 1.8 x 3.6 m.

In arecanut garden growing of black pepper is a profitable proposition and Karimunda is the most suitable cultivar. The optimum spacing for pepper was found to be 2.7 x 1.8 m where 40.38 per cent sunlight is available for pepper. Pepper as an intercrop did not influence the yield of arecanut.

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DISCUSSION

A.K. SADANANDAN: You are recommending a closer spacing for increasing yield, but what is per vine yield of pepper under closer spacing. Please elaborate.

K.B. ABDUL KHADER: In this study per vine yield is not considered as important. Yield per unit area is taken as an index and highest yield was obtained in 1.8 m x 2.7 m.

K. JAGANNATHAN: Was it not possible to contain the diseases of pepper with recommended control measures? You require an improved recommendation for containing diseases. What is the instrument used for light measurement?

K.B. ABDUL KHADER: We could not achieve 100 per cent control with the present package of control measure. Light measurement was made with a steady state porometer (Li-cor, USA) attached with light sensor.