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# Productivity enhancement of per unit area through Areca nut based multi storied cropping system in Dibrugarh district, Assam, India

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## ABSTRACT

Five Arecanut based multi-storied cropping system were considered for the present study under Krishi Vigyan Kendra, Dibrugarh during 2020-21 and 2021-22. Yield and income of five representative samples of Arecanuts main crop and the intercrops from all the five models including check were observed. Maximum mean yield of AEY was found to be 216.51 qtha<sup>-1</sup> in Model V (Arecanut + Blackpepper + Pineapple + Assam lemon), while minimum was 132.00 qtha<sup>-1</sup> in Model I (Arecanut sole crop). Productivity efficiency 59.32 kg ha<sup>-1</sup> day<sup>-1</sup> was found more in Model V (Arecanut+ Blackpepper + Pineapple + Assam Lemon) followed by Model-IV (Arecanut+ Blackpepper + Pineapple) (49.95 kg ha<sup>-1</sup> day<sup>-1</sup>), Model-II (Arecanut+ Blackpepper) (40.23 kg ha<sup>-1</sup> day<sup>-1</sup>), and Model III (Arecanut+ Pineapple) (38.65 kg ha<sup>-1</sup> day<sup>-1</sup>), respectively. The maximum return and B:C ratio of <sup>000</sup>Rs. 948.32/- and 1:5.08 were observed in Model-V (Arecanut+ Blackpepper + Pineapple + Assam Lemon) and Model-II (Arecanut+ Blackpepper), respectively, while minimum return<sup>000</sup>Rs. 307.30 and minimum B:C ratio of 4.46 was recorded in Model I (Arecanut sole crop). It can be revealed that Model V (Arecanut+ Blackpepper + Pineapple + Assam Lemon) was the most remunerative one and the farmers can adopt this model in this region as areca nut based multi-storeyed cropping system for more income per unit area of land.

**Key words:** Arecanut, Multistoried cropping, Yield, Return and B:C ratio

## Introduction

Multi storied cropping system is an approach for achieving sustainable productivity in perennial horticultural crops, more particularly in the plantation crops like Coconut and Areca nut. This system is more suitable to be adopted in tall growing perennials that are compatible with several semi-perennial and annual crops (Nimbolkar *et al.*, 2016).

Arecanut palm (*Areca catechu* L.), is important plantation crop in whole of India including Assam. Horticulture crops particularly fruit and plantation crops have self-sustainable system where solar en-

ergy can be harvested at different heights, soil resources are used efficiently and can increase cropping intensities. This modern approach is boon to small and marginal farmers who are major stakeholders in Indian Agriculture/ Horticulture system in present and future days. Due to various constraints, many areca nut growers are not able to adopt the multispecies cropping system to the desired level. Areca nut, as a sole crop does not fully utilize the natural resources such as soil, space, and light.

The compact nature of areca nut crown, raised well above the ground (10 to 15 m), allows more

sunlight to pass down to ground and maintain high humidity which in turn favours excellent growth of shade loving crops. So, multiple cropping in areca nut was the ability to provide substantial increase of diversified crops and income per unit area through better utilization of resources like land, space, light and nutrients.

Due to fluctuation of price, people are losing interest in arecanut cultivation. Arecanut is a perennial crop and it can produce fruits up to 40 to 50 years. Intercropping in plantation crop garden helps to meet the food requirement, besides increasing the net returns per unit area (Nair and Verghese, 1976). Areca nut based cropping systems have been developed for different places in order to increase the net return from the garden. Keeping in view, the present experiment was formulated to identify a suitable arecanut based model for the productivity enhancement from single piece of land.

## Materials and Methods

The field experiment was undertaken under Krishi Vigyan Kendra (KVK), Dibrugarh. Five different models (Table 1); Model I with Areca nut as mono crop; Model II with Areca nut + black pepper, Model III with Areca nut + Pineapple; Model-IV with Areca nut + black pepper + Pineapple; Model V with Areca nut + black pepper+ Pineapple + Assam Lemon were considered for the present experiment with four replications.

Spacing followed for Areca nut and Pineapple were 2.75m x 2.75m, 90cm x 60cm x 30 cm, respectively and Assam lemon were planted in every alternate inter-space of the Areca nut rows and pineapple being grown in the inter row spaces as per spacing. The package of practices recommended for the areca nut under Assam condition were accordingly followed (AAU PoP, 2021). Crops were supplied with recommended fertilizers and in case of intercrops, the recommended fertilizer doses were reduced by 25% and other intercultural operations were carried out as and when required. The yield data of different intercrops were recorded time to time.

The areca nut equivalent yield was estimated using the following formula given by Sujatha *et al.* (2006). For economic feasibility determination, cost of production, gross return and B: C ratio was estimated on the basis of prevailing local market price of Dibrugarh district. Finally collected data were

analysed statistically by following SPSS computer based software.

**Table 1.** Cropping system models with different treatment combinations

Cropping system Model	Treatment combination
Model I (Check)	Arecanut sole crop
Model II	Arecanut + Black pepper
Model III	Arecanut + Pineapple
Model IV	Arecanut + Blackpepper + Pineapple
Model V	Arecanut + Blackpepper+ Pineapple + Assam Lemon

## Results and Discussion

The average crop yield of areca nut was maximum as a sole crop (132.00 qt ha<sup>-1</sup>), whereas the average yield of areca nut reduces by 20% when grown as an intercrop yielding 105.60 qt ha<sup>-1</sup> of fruits (Table 2). The reduced production of 20% is supplemented by the yield of intercrop and results in higher income generation and thereby adding to the high net income generation per unit area. The findings of Nair and Verghese, (1976) that intercropping in plantation crop garden helps to meet the food requirement, besides increasing the net returns per unit area confirms the present results. Considerably significant difference in the areca nut equivalent yield per hectare could be observed among all the cropping systems which was maximum in Model V (216.51 qt ha<sup>-1</sup>), followed by Model IV (182.38 qt ha<sup>-1</sup>), Model II (146.85 qt ha<sup>-1</sup>), Model III (141.08 qt ha<sup>-1</sup>) and Model I (132.00 qt ha<sup>-1</sup>), respectively (Table 2). The present finding is in conformity with the result of Kakaty *et al.*, (2002) that high yield, gross return and net profit along with higher benefit: cost ratio in both cases of bearing and pre-bearing areca nut based multi stored cropping system in Assam.

While considering productivity efficiency (kg ha<sup>-1</sup>day<sup>-1</sup>), highest productivity efficiency could be found in case of Model V (59.32 kg ha<sup>-1</sup>day<sup>-1</sup>), followed by Model IV (49.95 kg ha<sup>-1</sup>day<sup>-1</sup>) which are significantly higher than the rest of the cropping system models. Model I, II and III were found with productivity efficiencies of 36.16 kg ha<sup>-1</sup>day<sup>-1</sup>, 40.23 kg ha<sup>-1</sup>day<sup>-1</sup> and 38.65 kg ha<sup>-1</sup>day<sup>-1</sup>, respectively and no significant difference could be encountered among these three treatments considering this parameter. This may be due to the proper utilization of

vertical space in the aceranut with proper crop components combination.

From the economic analysis of the different models, significant levels of differences could be observed considering the net return per unit area (ha), which is the highest in case of Model V, followed by Model-IV, II, III and I, respectively (Table 3). Net return, thus can be positively correlated with the Areca nut Equivalent Yield obtained from each model. While considering the B:C ratio of the models, a very good range of 4.46 to 5.08 could be observed over two years of the study period. The finding of Nair (2000) that found higher benefit: cost ratio in coconut based intercropping system in Kerala support the present result. The maximum income per hectare was obtained from Model V, which is 208.6% higher as compared to the Areca nut grown as sole crop (Model I), followed by 141.78% in case of Model-IV, 69.01% in Model-II and 51.76% in Model-III and presented in Table 3. Nath *et al.*, (2002) also reported that coconut multi storied crop-

ping system was the most remunerative one with highest net return, while the minimum net return was obtained from coconut mono cropping system that confirms the present findings. Kakaty *et al.*, (2002) opined that the combinations of banana + pineapple + arecanut and pineapple + cowpea + French bean + areca nut were effective in increasing yield, gross return and net profit along with higher benefit: cost ratio in both cases of bearing and pre-bearing areca-based multistored cropping system in Assam is also in support of the present findings.

## Conclusion

It can be concluded that, Model V (Areca nut+ Blackpepper + Pineapple + Assam Lemon) was the most remunerative one with comparative high yield and net return as compared to the all other studied intercropping system. Farmers can adopt this Module in areca nut based multi-storeyed cropping system under prevailing climatic condition of Assam

**Table 2.** Yield of different cropping systems with Areca nut Equivalent Yield (AEY) considering the production year

Treatments	Mean crop yield (qt ha <sup>-1</sup> )				AEY (qt ha <sup>-1</sup> )	Productivity efficiency (kg ha <sup>-1</sup> day <sup>-1</sup> )
	Arecanut	Blackpepper	Pineapple	Assam lemon		
Areca nut sole crop (Model I)	132.00	0.00	0.00	0.00	132.00 <sup>e</sup>	36.16 <sup>c</sup>
Areca nut + Black pepper (Model II)	105.60	33.00	0.00	0.00	146.85 <sup>c</sup>	40.23 <sup>c</sup>
Areca nut + Pineapple (Model III)	105.60	0.00	189.20	0.00	141.08 <sup>d</sup>	38.65 <sup>c</sup>
Areca nut + Blackpepper + Pineapple (Model IV)	105.60	33.00	189.20	0.00	182.38 <sup>b</sup>	49.95 <sup>b</sup>
Areca nut + Blackpepper + Pineapple + Assam Lemon (Model V)	105.60	33.00	189.20	151.93	216.51 <sup>a</sup>	59.32 <sup>a</sup>
CD (5%)	-	-	-	-	3.23	4.22

(Data are the mean of four replication, numbers are converted to kg)

**Table 3.** Economics of different cropping systems

Treatments	Gross Cost (000' Rs.)	Gross Return (000' Rs.)	Net Return (000' Rs.)	B:C ratio	Increase in net income over check (%)
Areca nut sole crop (Model I)	88.70	396.00	307.30	4.46	-
Areca nut +black pepper system(Model II)	127.43	646.80	519.37	5.08	69.01
Areca nut + Pineapple system (Model III)	134.24	600.60	466.37	4.47	51.76
Areca nut + black pepper + Pineapple system (Model IV)	187.61	930.60	742.99	4.96	141.78
Areca nut + black pepper + Pineapple + Assam Lemon (Model V)	255.76	1204.08	948.32	4.71	208.60
CD (5%)	4.21	4.12	3.88	-	

Data are the mean of four replication, selling price of Areca nut @Rs. 8000/-qt<sup>-1</sup>, Black pepper @Rs. 10000/-qt<sup>-1</sup>, Pineapple@Rs. 1500/-qt<sup>-1</sup>, Assam Lemon @Rs. 1800/-qt<sup>-1</sup>

for more income per unit area of land.

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