ISSN–0974–0759 | ●●● Popular Article ●●● |Visit us : *www.researchjournal.co.in*|

Increasing profitability of arecanut plantation with intercropping of horticultural crops in North Eastern region of India

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Introduction: Arecanut is an important plantation crop grown in North Eastern region of India. It is mainly grown in Assam, Meghalaya, Tripura, Mizoram and Nagaland. The area under arecanut has been steadily increasing from 93.60 thousand hectare during 2011 to 118.62 thousand hectare during 2020. The technique of intercropping in arecanut plantation has been practiced for so many years. Theophrateus, among the greatest early Greek philosopher and natural scientist, notes that wheat, barley and certain pulses could be planted at various times during the growing season often integrated with vine and olives, indicating knowledge of the use of intercropping. The cropping system should be planned in such a way that under any unfavourable condition, at least one crop should have the competence to survive and produce economic yield. Any cropping system aims at producing higher yield per unit area through judicious use of available natural resources that would otherwise not utilized by a single crop, offers greater stability in production under any weather condition, meets the domestic need of the growers, offers opportunity for employment generation, offers effective weed suppression, pests and diseases control and use of soil resources under organic farming system. In North East region of India, the following states *viz*., Assam, Meghalaya, Tripura, Mizoram and Nagaland contributes much to the production of arecanut and forms an important belts for the region (Table 1). Lack of awareness to the scientific method of cultivation, price fluctuation, vulnerability to certain major pests and diseases, yield uncertainty are some of the points to ponder in the cultivation of arecanut by the farmers of North Eastern region. Such situation singly or combinedly results in a great economic loss to the farmers due to partial or total failure of arecanut. This situation necessitates adoption of cropping system in the same piece of land in order to achieve maximum productivity from a unit area of land. The long pre bearing period of the main crop, poor income from initial harvest, insecurity against diseases and pests, remoteness from market and lack of transport were considered some of the reasons that might have prompted the researchers to work out the feasibility of different intercrops in arecanut plantation in order to neutralize the above tribulations.

Scope for cropping system: The greater advantage of cropping system in arecanut is the ability to provide substantial increase in yield per unit area through better utilization of three limited natural resources like land, water and light. Bhat and Leela (1968) found that more than 80 per cent of the roots of arecanut are within a radius of 75 cm from the base of the palm spaced at 2.7 m x 2.7 m. The normal cultural operations were also confined within about 75 cm to 85 cm radius from the base. Thus arecanut palm exploits only 2.27 square meter of land area out of 7.29 square meter area available for each palm. This estimate indicates that 68.9 per cent of land is not effectively utilized by the root system of arecanut palm. Multiple cropping in arecanut garden can more effectively utilized this unused land volume. Muralidharan (1980) reported that 32.7 to 47.8 per cent incident light rays pass down the canopy of a 14 years old arecanut garden

Table 1: Area, production and productivity of arecanut in important North East region of India

State	Area ('000 ha)	Production (000 tonnes)	Productivity (kg/ha)
Assam	82.43	79.46	964
Meghalaya	18.23	24.01	1,317
Mizoram	12.04	8.25	685
Tripura	5.72	17.25	3,012
Nagaland	0.20	1.19	5,831

Source: DASD, Calicut, Kerala, 2020

depending upon the time of day. This light energy reaches the ground and gets wasted. Multiple cropping system can effectively utilize the natural resources. This tremendous potentiality of multiple cropping in arecanut plantation to generate employment opportunity for getting sustained income from small size farm holdings has been adequately demonstrated.

Suitable crops for cropping system: Compatibility of crops in cropping system is an important factor before setting up any cropping system. The important criteria for selection of component crops are it should be selected based on soil type, rainfall pattern, irrigation facilities and climatic condition of particular area, it should not be as tall as the main crop, crops should be selected according to the shade tolerance and amount of solar radiation available, subsidiary crops having the same insect pest to the main crop should be avoided, subsidiary crops should be chosen according to the market demand, subsidiary crops chosen should not have the same rooting systems and above all, while selecting the crop combination, care should be taken that the selected crops are compatible with the systems. A large number of anuuals, biennials and perennial crops have been screened for their suitability as component crops in arecanut garden at Regional Station and Research Centres of Central Plantation Crops Research Institute. Crops like banana, ginger, chilli, colocasia, turmeric, elephant foot yam, diascorea, flowers and vegetables can be grown as intercrop in the initial years of arecanut garden. However, as the age of the garden advances, only few crops like pepper, cocoa, banana, acid lime, betelvine, medicinal and aromatic plants and partial shade loving vegetables and flowers can be grown profitably as mixed and intercrops (Bhat *et al*., 2001). Cardamom is an important mixed crop in arecanut tract of North Kanara district of Karnataka and Wynad district of Kerala. There was perceptible increase in

Intercropping of vegetable and flower crops in arecanut garden

Table1: Economics of vegetables and flower crops intercropping in arecanut garden

Crop	Cost of production (Rs.)	Gross return (Rs.)	Net return (Rs.)	B:C ratio
Radish	6,850	27,675	20,825	4.05
Knolkhol	7,350	14,735	7,385	2.00
Cabbage	9,150	42,750	33,600	4.68
Cauliflower	8,950	38,000	29,050	4.24
Tomato	12,713	32,750	20,037	2.57
Potato	12,765	28,925	16,160	2.26
Brinjal	8,045	40,600	32,555	5.05
Gladiolus	68,850	1,23,089	54,239	1.78
Chrysanthemum	12,300	29,850	17,550	2.43
Marigold	10,950	22,425	11,475	2.05

Source: Ray *et al*., 2007

arecanut yield (7-21%) with intercropping. This can be attributed to the favourable microclimate created within the system and recycling of huge quantity of biomass.

Economic benefit of intercropping horticultural crops: In a study conducted during 2003 to 2005 at ICAR-Central Plantation Crops Research Institute, Kahikuchi, Guwahati, Assam, various vegetables crops and seasonal flowers were grown with an objectives to study the economic feasibility of seasonal flower and vegetables crops and performance of different flowers and vegetables under pre-bearing arecanut palm. The study showed that maximum economic efficiency was obtained when cabbage was intercropped with arecanut followed by cauliflower and radish among vegetables and in gladiolus among the flowers (Ray *et al*., 2007).

In another trial in North Eastern region, different arecanut based cropping system model were developed to enhance maximum utilization of natural resources and to obtained maximum benefit from a unit piece of land. These models are often termed as High Density Multi Species Cropping System (HDMSCS), basically design to achieve sustainability for arecanut growers of North Eastern region of India, particularly in Assam. Many different crop combinations were tried with different level of fertilizer doses. It was observed that the model consisting of arecanut, black pepper, banana and citrus were the best combination as per Assam is concerned. Application of 2/3rd recommended dose of fertilizer to arecanut and other components crops was sufficient to get maximum yield of different intercrops except banana which usually perform better at full dose of fertilizer owing to its root system and growth habit. Chennichampa variety of banana can be grown in arecanut and in case of lemon both Assam lemon and Gandharaj types can be adopted (Acharya and Singh, 2014). A net return of Rs. 1,14,250/- to Rs. 2,06,442/- could be obtained from one hectare land. It has been observed that in certain cases, growing of intercrops enhanced the yield of arecanut as against the disbelief of farmers that growing of mixed crop reduce the yield of arecanut. This type of cropping system opens different other approaches. The cropping system model helps in production of larger biomass which in turn can be composted and applied to the field and therefore act as a substitution to the chemical fertilizer. This is one of the most important approaches of cropping system especially in North East region where people prefer mostly the organic type of farming. The amount of biomass collected from such a system was calculated and was found to vary from 10.66 tonnes to 12.33 tonnes in different models at different fertilizer dose. This biomass with the help of a specific earthworm, *Eudrillus* sp. produces approximately 7.79 to 9.09 tonnes of vermicompost with a recovery percentage of 72.4 to 73.4. This type of cropping system helps in maintaining soil health and other nutrient status of the soil.

Conclusion: In a state like Assam arecanut is mainly cultivated in the backyards. It is rather essential that suitable mixed cropping systems should be followed in order to increase the net profit and socio-economic status of the farmers. Little or no surplus is generated by practicing monocropping which is the predominant method

High density multi species cropping system

of cultivation. In this context, productive cropping system can be adopted to achieve sustainability of food supply and regeneration of the production environment. Productive cropping system can be achieved through arecanut based intercropping with consumer preference and marketability of the local places. The income can be further increased from the waste recycling in the form of vermicompost and other activities like mushroom cultivation from arecanut leaf. Apart from that, by adopting the mixed cropping system, there is always enough scope for generation of farm employment. The scientist/ researchers should make efforts to disseminate the proven technologies among the farmers to make it more successful.

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Received : *04.04.2020* ***Revised :*** *29.04.2020* ***Accepted :*** *30.05.2020*