ARECANUT BASED CROPPING SYSTEM: ALTERNATIVE PATHWAY TO ACHIEVE SUSTAINABILITY IN NORTH EASTERN INDIA

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Introduction

Restoration of on-farm biodiversity through more diversified cropping system is considered a key strategy for sustainable agriculture. On farm biodiversity, if correctly assembled, can lead to agro-ecosystem capable of maintaining their own soil fertility, regulating natural protection against diseases and pests and, sustaining productivity. Intercropping has been practiced for so many years. Theophrasteus, 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 a knowledge of the use of intercropping. The mixed cropping system needs to be designed in such a way that in case of any unfavorable condition, at least one crop should have the competence to survive and produce economic yield. Any mixed cropping system aims at- (i) producing higher yield per unit area through judicious use of available natural resources that would otherwise not utilized by a single crop, (ii) offers greater stability in production under any weather condition, (iii) meets the domestic need of the growers, (iv) offers opportunity for employment generation, (v) equitable distribution of farm resources and (vi) offers effective weed suppression, pests and diseases control and use of soil resources under organic farming system.

In North Eastern India, arecanut grows mostly in Assam, Meghalaya and parts of Mizoram, Tripura and Nagaland (Table 1). Lack of awareness to

Table 1: Area and production of arecanut in important NE states of India

State	Area ('000 ha)	Production ('000 MT)
Assam	70.0	62.7
Meghalaya	12.4	17.1
Mizoram	6.6	8.2
Nagaland	0.2	1.3
Tripura	4.4	8.4

* Indian Horticulture Database-2011, Published by NHB, Gurgaon

the scientific method of cultivation, price fluctuation, vulnerability to certain major diseases and pests in the growing phase, yield uncertainty are some of the points to ponder in the cultivation of arecanut by the farmers of north east. 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 mixed 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

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and lack of transport were considered some of the reasons that might have prompted the researchers to search for the feasibility of different intercrops in arecanut garden in order to neutralize the above tribulations.

Scope for cropping system:

The greater advantage of multiple cropping in arecanut is the ability to provide substantial increase in yield per unit area through better utilization of resources like land and light. Bhat and Leela (1968) found that more than 80 % 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 to 85 cm radius from the base. Thus, arecanut palm exploits only 2.27 sq. m of land area out of 7.29 sq. m area available for each palm. This estimate indicates that 68.9 % 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 % incident light rays pass down the canopy of a 14 years old arecanut garden depending upon the time of the day. This light energy reaches the ground and get wasted. Multiple cropping can advantageously utilize this waste energy in arecanut garden. 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.

In a study during 2003 - 2005 at CPCRI, Kahikuchi, Guwahati, various seasonal flowers and vegetables were grown with objectives of (i) to study the economic feasibility of seasonal flower crops and vegetables under pre- bearing arecanut palm, (ii) To observe the performance of different vegetables and flowers under arecanut and (iii) to help the growers to promote arecanut based vegetables cropping system. The average cost of production of vegetables ranged between Rs. 6750 and Rs. 12600 per ha in case of radish and potato, respectively. The highest gross return of Rs. 42750 was obtained by growing cabbage followed by brinjal (Rs. 40,600) and cauliflower (Rs. 38,000). Similarly, highest gross return of Rs. 123089 was obtained when gladiolus was grown as intercrop followed by chrysanthemum and marigold. The highest gross return in gladiolus was obtained due to sale of spikes and corms. It has also been studied that the value for return per rupee invested was maximum (15.77) for brinjal during 2003 -2004 followed by cabbage and radish. The study also revealed that the maximum economic efficiency is achieved in case of cabbage, cauliflower, radish among the vegetables and in gladiolus among the flowers (Ray *et al,* 2007) when grown as intercrop (s) under arecanut gardens.

Similarly in another trial in North East (CPCRI, Assam), different areca based cropping model were developed in order to achieve maximum utilization of natural resources and simultaneously obtaining higher benefit from a unit piece of land. These models are often termed as High Density Multi Species Cropping System (HDMSCS), basically designed to achieve sustainability and survival of arecanut growers in North East India, particularly in Assam. This experiment is in progress in the last 25 years for developing best mixed cropping system to be developed in arecanut depending upon the local dietary habit, consumer preference and marketability. Many different crop combinations were tried at different fertilizer levels (Plate 1). It

was observed that the model comprising arecanut, black pepper, banana and citrus were the best combination as per Assam is concerned. A data of last 11 years revealed that a net return of Rs 1,14,250 to Rs. 2,06,442 was obtained from one hectare land. These type of system opens different other approaches.

1. 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. Both Chennichampa and Malbhog variety of banana can be grown in arecanut and in case of lemon, both Assam and Gandharaj types can be adopted.

2. It has been observed that in certain cases, growing of intercrops enhanced the yield of monocrop (arecanut) as against the disbelief of farmers that growing of mixed crop reduce the yield of arecanut.

Plate 1:Arecanut based HDMSCS

Plate 2: Arecanut & vegetable mixed cropping

Plate 3: Arecanut & vegetable mixed cropping

Plate 4 : Arecanut & vegetable mixed cropping

Plate 5: Arecanut & vegetable mixed cropping

3. 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 it varied from 10.66 tonnes to 12.33 tonnes in different models at different fertilizer doses. 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. Practicing this type of cropping system models helps in maintaining soil health and other nutrient status of soil.

Similarly, in other vegetable intercropping trials, okra, amaranthus, ridge gourd and chilli in summer and cauliflower, carrot, French bean and spinach during winter have (Plate 2-5) shown positive results as far as the yield and economic is concerned in arecanut garden.

Conclusion:

The percentage utilization of cultivable area in the North Eastern Region is less because of hilly terrains constitute nearly 2/3rd of the region's geographical area. The average size of land holding is too small and is decreasing day-by-day due to increase in population. Little or no surplus is generated by practicing monocropping, which is the predominant method of cultivation in this region. In this context, productive cropping system can be pursed to achieve sustainability of food supply and regeneration of the production environment. Arecanut finds place in almost all house-holds of the region. Productive cropping system can be achieved through arecanut high density cropping model comprising different crops having marketability and consumer preference. However, research emphasis should be directed for development of location-specific and purpose-specific crop genotypes/varieties specifically suited for multiple and mixed cropping system.

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