

Arecanut-based cropping system fetches more return

Small and marginal holdings of less than one ha dominate in arecanut tract. Despite its commercial status, profitability is not assured for farmers due to recurrent problems like price fluctuations, pests and diseases, waterlogging and drought resulting in considerable yield losses. So, emphasis should be given to increase the productivity per unit area per unit time. The practice of well-planned and executed inter/mixed cropping is fundamental for increasing the productivity and income per unit area. Therefore, economically and environmentally-viable cropping models to empower small and marginal farmers are discussed.

ARECANUT (*Areca catechu*) is an economically important plantation crop predominantly grown in West coast and North East regions of India. The economic part of the palm is called as 'betel nut' and is mainly used for masticatory purpose in many parts of Asia. It has several alternate uses and all parts of the palm are useful. It is cultivated in 0.42 million ha in India with a total production of 0.52 million tonnes and productivity of 1249 kg/ha.

The compact nature of arecanut crown, raised well above the ground (10–15 m), allows more sunlight to transmit to ground and maintains high humidity which, in turn, favours excellent growth of shade-loving intercrops/mixed crops. The space occupied by component crops (47 per cent) is higher than that occupied by arecanut (16 per cent). Thus, arecanut as a sole crop does not utilize fully the natural resources such as soil, space and light. There is an excellent opportunity for temporal and spatial distribution of crop species in arecanut gardens for achieving higher resource-use efficiency with increased income. The assured irrigation in arecanut gardens has greater potential for multiple cropping.

CROPS FOR MULTIPLE CROPPING

Compatibility of different crops is an important factor in the success of any cropping system. The criteria for selection of component crops are: 1) ability of crop to grow under shade, 2) ability to withstand heavy dripping during monsoon, 3) availability of local market and 4) local weather condition. A large number of annuals, biennials and perennial crops like banana, ginger, chilli, colocasia, turmeric, elephant-foot yam, dioscorea, flowers and vegetables can be cultivated as intercrop during the initial years in arecanut garden. However, as the age of the garden advances, only a few crops like pepper, cocoa, banana, acid lime, betel vine, medicinal and aromatic plants and shade-loving flowers can be grown profitably as mixed crops. Cardamom is an important mixed crop in arecanut tract of North Kanara district of Karnataka and Wynad district of Kerala. There is increase in arecanut yield (7-21 per cent) with intercropping.

Multiple Cropping System is Beneficial

Evaporation, air and soil temperatures are lower in mixed cropping than in sole arecanut and open conditions. The least diurnal variation in microclimate



Areca+cocoa



Areca+cocoa+ banana



Areca+banana



Areca + banana + cocoa + black pepper

within the mixed cropping is an important feature besides lower evaporative demand, reduced wind velocity and higher soil moisture content. This is very important as the synergistic effects of wind and solar radiation can cause mechanical injury in shade plants like cocoa. The arecanut palms provide excellent protection to the intercrops against wind and vice versa. Crops like cocoa and banana limit the damage of sun scorching effect in initial years.

The high-density multispecies cropping system involving arecanut, pepper, cocoa and banana indicates that recycling of organic matter could meet 50 per cent each of N and P requirement. Similarly, a six-year study to

Increased root proliferation in arecanut due to intercropping increases organic matter content in soil. Intercropping legumes increases nitrogen and other nutrients in arecanut plantation. Fixation of N, recycling of nutrients in soil profile, prevention of soil erosion and improved soil fertility are advantages of intercropping with leguminous green manure crops or cover crops in arecanut. The cover crops with *Pueraria javanica* and *Mimosa invisa* in arecanut gardens could add on an average 10 kg green manure per palm which could meet 69–89 per cent of N requirement, 28–43 per cent P and 29–38 per cent of K. Maximum biomass recycling in the form of pruned biomass and litter fall is possible in arecanut + cocoa mixed cropping system. Increase in soil pH is due to inter/mixed cropping. Thus, cropping system approach is important for soil acidity management of laterite soils in arecanut belt.

quantify the feasibility of economising the fertilizer use in the cropping model involving arecanut-banana-cocoa-pepper reveals that fertilizer requirement could be scaled down to 66 per cent of the recommended dose. Generally, mixed cropping/multiple cropping does not increase the water requirement. The transpiration losses may increase in mixed cropping but evaporation and run-off losses are likely to be reduced because of crop cover and presence of residues with increased soil moisture storage and water-use

efficiency. No serious pest and disease problems are observed due to inter/mixed cropping in areca plantations.



Areca + cocoa + black pepper



Areca + cocoa + banana



Asparagus



Basil

Arecanut + Cocoa Mixed Cropping System

For optimum productivity of both arecanut and cocoa in mixed cropping system, ideal spacing and pruning regime are important to avoid competition. Combination of 2.7 m × 2.7 m for arecanut and 2.7 m × 5.4 m for cocoa is preferable over 2.7 m × 2.7 m for both the crops in view of the operational advantages. Pruning regime of 16-20 m³ canopy is recommended for grafts for yield. Productivity increase by growing cocoa with arecanut is about 650-900 kg/ha. The net returns per rupee invested in arecanut+cocoa cropping system is 1.66-1.83.

Arecanut + Banana Intercropping System

Banana is usually grown as nurse or shade crop in arecanut plantations. Suitable banana cultivars for intercropping are Robusta, Mysore Poovan, Red Banana and Karpuravally. The variety Red Banana gives maximum net returns without any adverse effect on yield of arecanut. Banana fetches interim revenue in the initial years, which helps the farmers in cash flows.

Arecanut + Pepper Intercropping System

Pepper is raised exclusively as mixed crop in homestead gardens in Kerala and Karnataka and over 90 % pepper is trained on coconut and arecanut trunks. Pepper is most compatible perennial spice crop with arecanut and can be profitably grown. There is no detrimental effect on yield of arecanut palms due to training black pepper on them. Further, it helps to augment the income of farmers by mixed cropping of black pepper. The performance of pepper cultivars, Panniyur 1 and Karimunda are better. Karimunda gives maximum yield

followed by Panniyur 1. The cultivars, Uddakare and Malligesara, are poor-yielding ones in arecanut. On an average one kg of dry berries can be obtained from one vine which is around 1300 kg/ha. Thus, pepper is highly profitable crop when grown as mixed crop with arecanut.

High-Density Multispecies Cropping System

It is a system where more than two crops are grown simultaneously with main crop. Arecanut-based high-density cropping systems having component crops like cocoa, pepper and banana is self-sustainable and application of N and P through inorganic fertilizers could be reduced or skipped when the recyclable wastes from the system are recycled as vermicompost. The system improves the soil physico-chemical and biological properties of the soil which enhances the productivity from unit area of land. But the system is exhaustive with respect to K availability. The exhaustion of K indicates the necessity of including K in the fertilizer schedule of the system. The increase in productivity from growing of pepper+cocoa+banana with arecanut is about 2250 kg/ha. The net returns per rupee invested in this system is 4.5 which indicates the economic advantage of cropping system in arecanut.

Intercropping Medicinal and Aromatic Plants

Medicinal and aromatic plants can be grown successfully in arecanut with higher net return per rupee investment. Shatavari (*Asparagus racemosus*), vetiver (*Vetiver zizanoides*), long pepper (*Piper longum*), brahmi (*Bacopa monnieri*), Nilagirianthus (*Nilagirianthus ciliatus*), periwinkle (*Catharanthus roseus*), Aloe (*Aloe vera* or *barbadensis*), lemon grass (*Cymbopogon flexuosus*), palmarosa (*Cymbopogon martinii*), basil (*Ocimum basilicum*), davana (*Artemisia pallens*) and patchouli (*Pogostemon cablin*) perform better as intercrops in arecanut. Senna (*Cassia angustifolia*), safed musli

(*Chlorophytum borivillianum*), aswagandha (*Withania somnifera*) and geranium (*Pelargonium sp*) do not come up well as intercrops in arecanut. These crops contribute to productivity increase of 11-53% in arecanut. In terms of net profit per rupee investment, all medicinal and aromatic plants are superior (1.95-4.25) and system productivity can be considerably enhanced with intercropping. It is advisable to grow variety of medicinal plants in small areas based on local demand and advice of State Medicinal Plants Board. As the market demand for aromatic plants is huge, it is advisable to grow them in large areas.

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