

**RESEARCH ARTICLE :**

Coconut based cropping system with medicinal plants for sustainable production

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SUMMARY : Coconut based cropping system ensures maximum resource utilization, improvement in the soil properties and biological activities leading to better growth and higher additional return from per unit area of land. Coconut plant is eulogized as karpavriksha or tree of garden. In the recent past economy of coconut farmer's had weakened due to the fluctuation in the price of coconut. So, adoption of coconut based multiple cropping system can improve the economic status of the farmers. The experiment was carried out in a 25 year old coconut plantation at farmer's field Coimbatore, Tamil Nadu, to identify suitable medicinal plants for intercropping in coconut gardens of maidan tract of Tamil Nadu. The medicinal plants selected for intercropping were Aloe, Arrow root, Ashwagandha, glorylily, kalmegh, periwinkle, *Tulsi*. Intercropping dynamics of the coconut based farming of these medicinal plants were worked out by using the parameter *viz.*, plant height (cm) / Vine length / Plant spread, number of branches / Sucker/no. of primary vines, no. of leaves, Individual plant yield, Tuber/Rhizome/ Sucker yield. The BCR worked for the crops revealed that the intercropping system of growing Periwinkle under coconut was recorded the highest net income (Rs. 81,865/ha) and BC ratio (2.79) followed by tulsi (Rs. 77,472/ha and 2.71), kalmegh (Rs. 75,163/ha and 2.56), arrow root (Rs. 72,211/ha and 2.28), Aloe (Rs. 71,865/ha and 2.39), Ashwagandha, (Rs. 67,058/ha and 2.68). Beneficial effect of intercropping on main crop *i.e.* coconut was observed which was reflected in the yield. Hence, intercropping of periwinkle, *Tulsi*, kalmegh, aloe, arrow root, with coconut can be recommended for maidan tract of Tamil Nadu.

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BACKGROUND AND OBJECTIVES

In a coconut based cropping system, coconut trees are planted as a base crop and all other crops are intercropped using the vertical and horizontal spaces between coconut trees. Coconut is a tree which as no branches and grows straight vertically

upwards providing more and more space under its canopy. Its leaves are such that it allows sun light to the crops grown under it. Because of these peculiar characteristics of this tree the coconut based cropping system is quite different from other cropping system based on other crops. Coconut based cropping system is a combination of multiple cropping

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systems in vertical and horizontal dimensions. Medicinal plants are a new group of plant species that demands domestication owing to the dwindling natural availability from forests coupled with the increased demand for quality crude drugs. More than 90% of medicinal plants used by the ayurvedic industry today are collected from the wild and that too mostly from forests. The medicinal plants are the gifts of nature for well being of mankind and now days, the use of world is shifting from the use of synthetic drugs to use of natural drugs. World Health Organization (WHO) has estimated that at least 90 per cent of the world population only on traditional system of medicinal plants their primary health needs. Some of the species having high demand is to be put to large scale cultivation for meeting their increasing requirement. However, their profitability can be ensured only on development of systematized marketing channels. Many of the medicinal plants which are found as undergrowths in the thick forest in their natural habitat come up well in stimulated shaded conditions esp. of coconut gardens (Sivakumar *et al.*, 2006). Hence a number of plants can be grown as intercrops in coconut gardens of various ages.

Growing coconut as monocrop is the most inefficient way of using natural resources. A high spacing of 7.5 m x 7.5 m in the square system is recommended mainly to accommodate the large grown of the palms. However, several studies have revealed that natural sources *i.e.*, soil, water, air space and solar radiation are not fully utilized under this spacing schedule and much land space is generally left unproductive throughout the long life span of palms. Adoption of coconut based cropping system emerges as the viable way for improving the economic status of coconut farmers. Many workers have stressed the importance of incorporating medicinal plants into intercropping system (Sreekala and Jayachandran, 2006).

The present investigation was undertaken to evaluate the performance of different medicinal plants grown as intercrop in coconut garden and study the effect of coconut based cropping with medicinal plants for sustainable production.

RESOURCES AND METHODS

The experiment was carried out in a 25 year old coconut plantation of farmer's field at Coimbatore in Tamil Nadu. The site was sandy loam texture having medium NPK and soil ph 7.0. The coconut palms spaced

at 7.5 m x 7.5 m. The medicinal plants selected for intercropping were Aloe, Arrow root, Ashwagandha, Kalmegh, Periwinkle, *Tulsi*. The experiment plots were prepared thoroughly by repeated ploughing to get a fine tilth. Well rotten FYM was applied and mixed thoroughly during land preparation. After leveling, raised beds were prepared in the inter space of coconut (between the row of palms) leaving 2.0 m radius from the base of each palm. The medicinal plants were planted in the middle of May-June. All the cultural measures were done as per need of crop. Need based irrigation was given for intercrops and main crop. Plant protection measures were taken as and when necessary for intercrop as well as main crop. The observation on different growth parameters were recorded from five randomly selected plant per replication. Yield for coconut was taken per plant basis at harvest. For intercrop yield was calculated considering their actual area coverage.

OBSERVATIONS AND ANALYSIS

Coconut based cropping system is a very intensive type of cultivation and hence special attention should be paid to soil fertility maintenance. This is achieved by establishing a systematic water and organic matter cycle. The farm land should be so structured that all the rain water should be absorbed in the farm itself or stored in appropriate storage tanks. Where water scarcity is experienced, store water in non-permeable tanks for use during scarcity period. Along with appropriate soil and water conservation extensive mulching should be practiced. Eventually these mulches become organic matter to the soil. Special effort should be made to generate and incorporate as much organic material as possible into the soil. Priority should be given to nitrogen fixing plants and biofertilizers.

Intercropping refers to growing of two or more generally dissimilar crops simultaneously on the same piece of land. Intercrops like aloe, arrow root, Ashwagandha, kalmegh, periwinkle, glory lily, tulsi etc. can be grown in coconut gardens. Suitable crops are to be selected based on age of palms, spacing provided and market potential. However, both coconut and intercrops are to be manured and managed separately as per the recommendations specific to the area.

The plant height (cm), number of branches and number of leaves per plant were found in arrow root (86.96, 5.51, 45.65), kalmegh (42.85, 16.28, 35.14), aloe

(24.83, 0, 10.06), Ashwagandha (38.15, 11.89, 59.03), periwinkle (80.46, 16.94, 165.82) and *Tulsi* (203.67, 11.75, 176.85). The estimated yield (kg/ha) and Quality (%) of arrow root (1206, 0.88 %), kalmegh (155.63, 1.43%), aloe (1510, 0.028 and 0.069%), Ashwagandha (530.24, 10.29 %) and periwinkle (981.64, 0.197 %) and *Tulsi* (215.82, 0.35). The above medicinal plants were recorded with high yield and more quality as intercrop in coconut gardens in Coimbatore, Tamil Nadu.

Economic assessment considering all the inputs revealed that the variable capital requirement per hectare was Rs. 21750, gross return realized was Rs. 44000 and net return per hectare was Rs. 22250 for coconut as monocrop. The BCR worked for the crops revealed that the intercropping system of growing Periwinkle under coconut was recorded the highest net income (Rs. 81,865/ha) and BC ratio (2.79) followed by *Tulsi* (Rs. 77,472/ha and 2.71), kalmegh (Rs. 75,163/ha and 2.56), arrow root (Rs. 72,211/ha and 2.28), Aloe (Rs. 71,865/ha and 2.39), Ashwagandha (Rs. 67,058/ha and 2.68), respectively. Beneficial effect of intercropping on main crop *i.e.* coconut was observed which was reflected in the yield.

The constraints identified in the previous section call for research on both biological and socio-economic aspects, and the development of an efficient extension service in order to make coconut intercropping system more productive, economical, adoptable and successful.

The agronomic requirements of individual crops when they are grown as intercrops need to be standardized. At the same time, the interaction of crops when they are grown in close proximity need to be studied elaborately so that research results can be obtained on the pattern of sharing of resources and growth factors by all components species of system (Ann Samuel, 1999). In order to arrive at prudent management recommendation, it is necessary to take into account both complementary and competitive interactions affecting production of individual species as well as total production of the whole system not only during short span of time but over a long period on a sustainable basis. A reassessment of the hitherto accepted planting patterns and densities of sole crops coconut is also worth undertaking with the objectives of growing intercrops without adversely affecting the palm's productivity while most other agroforestry systems consist of perennial that often help improve soil fertility though continuous addition of leaf litter and other organic material, coconut do not add much organic materials to soil and therefore, ways of maintaining soil fertility in coconut intercropping systems through external application of nutrients have to be designed appropriately. Use the inter space on the ground between adjacent coconut trees which are planted at 30' -33' apart. This space can be utilized by cultivating seasonal, biennial and perennial crops of any kind. This is the horizontal use of the interspaces. Coconut trees

Table 1: Coconut intercrops for different medicinal plants

Crops	Botanical name	Active ingredient	Required quantity (T)
Aloe	<i>Aloe vera</i>	Aloin, cathartic anthraxglycosides	15
Arrow root	<i>Marantaarundiaceae</i>	Total starch content	12
Ashwagandha	<i>Withaniasomnifera</i>	Withanolide- A and B	19
Kalmegh	<i>Andrographispaniculata</i>	Andrographidin	1.53
Periwinkle	<i>Catharanthusroseus</i>	Wincrestin, winblastine	8
<i>Tulshi</i>	<i>Ocimum sanctum</i>	Eugenol, Carvactrol	6

Table 2: Coconut intercrops for medicinal plants of growth and yield characters

Crops	Plant height	No. of branches	No. of leaves	Fresh yield (g/plt)	Dry yield (g/plt)	Estimated yield (kg/plt)	Quality (%)
Arrow root	86.96	5.51	45.65	663.70	182.16	1206.60	0.88 %
Aloe	14.82	-	11.52	86.78	19.15	1510.90	0.028 and 0.069 %
Ashwagandha	24.83	-	10.06	2197.48	430.49	530.24	10.29 %
Kalmegh	42.85	16.28	35.14	27.61	10.12	155.62	1.432 %
Periwinkle	80.46	16.94	165.82	72.50	27.90	981.64	0.197 %
<i>Tulshi</i>	203.67	11.75	152.38	176.85	138.98	215.82	0.35 %

space use of maximum vertical air space below the canopy. The coconut tree because of its peculiar structure (branchless ness) creates more and more vertical airspace below its umbrella like canopy which allows sun light to penetrate to the ground in sufficient amount for all types of crops to grow. Crops of various canopy heights are planted to utilize maximum the vertical air space below and between the coconut canopy. The number of combinations of crops that can be grown in a coconut based cropping system is greater than in any other cropping system.

Coconut based cropping system ensures maximum resource utilization, improvement in the soil properties and biological activities leading to better growth and higher additional return from per unit area of land. Medicinal plant cultivation is gaining importance and proves to be a viable option for coconut gardens as there is an increase in trust on natural remedies in curing the health problems profit maximization can be achieved in agriculture. Beneficial effect of intercropping on main crop *i.e.* coconut was observed which was reflected in the yield.

Hence, intercropping of periwinkle, *Tulsi*, kalmegh, aloe, arrow root with coconut can be recommended for maidan tract of Tamil Nadu.

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