

## Influence of Arecanut on Economic Yield and Quality Parameters of Medicinal Plants

A large number of plants have been used in traditional medicinal practices such as Chinese, Ayurvedic medicines etc. India has a long history in the use of a large number of medicinal and aromatic plants for various purposes. These plants play an important role in the healthcare of people around the world, especially in the developing countries. Until the advent of modern medicines, man depended on plants for treating human and livestock diseases.

Though, about 95 per cent of the requirement of medicinal plants in herbal drug industry is met from natural sources, due to the dwindling resources and the need for continuous supply in bulk quantities of medicinal plants of uniform quality, the cultivation of medicinal plants in our country has become a necessity. Further, intercropping medicinal plants with other medicinal plants or with tree components or horticulture crops is an attractive option as that would increase land use efficiency and simultaneously improve the economic status of the farmers (Kurian *et al.*, 2003).

The present study was aimed to find out information on intercropping of medicinal plants in an arecanut based farming system with the following objectives; to study the effect of arecanut on growth and yield of selected medicinal plants and to study the effect of arecanut shade on quality parameters of the selected medicinal plants.

The present investigation was carried out during 2004 - 05 in a five year old arecanut garden at Agricultural Research Station (Paddy), Sirsi which is situated in hilly zone (Zone IX - Malnad region) of Uttara Kannada district of Karnataka.

A split plot design was employed having two main plots viz., open conditions and under arecanut shade and seven sub-plots corresponding to the seven different medicinal plant species were evaluated. Experimental plots of dimensions 1.5 X 4.0 m were established in arecanut garden and in open condition. Seven different medicinal plant species viz., Aloe vera, *Alpinia galanga*, *Coleus forskholii*, *Stewia rebaudiana*, *Andrographis paniculata*, *Catharanthus roseus* and *Ocimum sanctum* were planted in the experimental plots and recommended management practices for each medicinal crop including proper land preparation, fertilizer application, weeding, application of fungicides and pesticides etc. were undertaken.

The growth and yield parameters, alkaloid content of various medicinal plants under both open and arecanut shaded conditions were recorded, computed and statistically analyzed.

Differences in the plant height were observed in all the medicinal crops for open and arecanut shaded conditions. The final plant height of Aloe vera at 8 MAP was 53.33cm under open field condition and 29.75cm under arecanut shaded condition. Similarly, for *Coleus forskholii* the observations were 55.62cm for open conditions and 50.55cm under shaded conditions at 6 MAP. In case of *Stewia rebaudiana*, the readings

at 4 MAP were 52.1cm under open condition and 50.3cm under the shade of arecanut. *Andrographis paniculata* recorded a plant height of 37.2cm in the open field and 32.15cm under arecanut shade at 4 MAP. Similarly, in *Catharanthus roseus* and *Ocimum sanctum* the readings were 112.77cm and 152cm for open conditions and 94.63cm and 130.77cm for arecanut shaded condition, respectively (Table 2).

There was a decrease in height of all the medicinal plants under arecanut shade compared to open field at all stages of growth. The decreased plant height may be due to increased competition for sunlight, water and nutrients. As water and plant nutrients were provided to the main crops as well as the intercrops according to the standard recommendations, they were not a limiting factor. Thus, the decreased light intensity under the arecanut plantation (77.95 per cent under open conditions) may be the reason for lower plant height. Similar findings were reported earlier by Singh *et al.*, (2000) in *Valeria wallichii* grown under artificial shade and by Karikalan *et al.*, (2002) for medicinal plants grown under kapok (*Ceiba pentandra*).

There was a significant difference in the case of number of leaves between open and shaded conditions. In Aloe vera, there were 12.17 leaves in open field and 8.5 leaves in the shade of arecanut at harvest. Similarly in *Catharanthus roseus* and *Ocimum sanctum*, the number of leaves in open was 341.5 and 392.7 while under shade it was 148.5 and 258.63, respectively. The plants grown in open field have better opportunities to reap the solar energy required for its photosynthetic activity for the production of photosynthates. Chundawat *et al.*, (1983) reported that in densely planted crops, the poor penetration of light and air to the lower canopies resulted in lesser photosynthetic efficiency, which also resulted in late harvesting as well as physiological maturity. In conditions of higher light penetration, more leaf area is exposed to light, which augments the photosynthesis for normal growth.

The above ground and below ground biomass observations were significant between open and arecanut shaded conditions. The mean economic yield under open conditions was 8804 kg/ha which was significantly higher when compared to 2586 kg/ha obtained from the crops grown under the shade of arecanut (Table 1). These results hold good for roots, tubers as well as foliage. Similar findings have been reported elsewhere by Gangadharan and Menon (2003). The reduction in light intensity as a result of shading reduces the photosynthetic ability of the secondary canopy, thereby reducing the total photosynthate output from the shaded plants. This has been supported by Trang and Giddens (1980) who also reached the same conclusion that dry matter production in open field is higher than in intercropped situation due to greater availability of solar energy for photosynthesis. In a similar vein, Balasimha (1989) had observed that leaves of shade grown crops were thinner but had higher chlorophyll content on fresh weight

basis. He opined that shade leaves need to invest more energy in the production of more and better light harvesting systems than do plants grown under open conditions. This translates to lowered production of photosynthates per leaf area and leads to reduced yields.

There were mixed results for the quality parameters of the medicinal plants grown under open and arecanut shaded conditions (Table 1). Aloe vera had 0.44 per cent aloine content when grown in open fields while under the shade of arecanut the aloine content was below detectable range. Similarly, *Alpinia galanga* and *Coleus forskohlii* had higher values for their respective alkaloids in the open fields when compared to arecanut plantations. However, in case of *Stewia rebaudiana*, the value obtained for stevoiside content was similar in both the conditions. Further, in case of the remaining crops, the

alkaloid content in the shaded plants was significantly higher than that in the plants grown in the open conditions.

Higher light intensity promotes better and more efficient photosynthesis, leading to production of larger quantities of photosynthates. These photosynthates are the natural building blocks of the chemical alkaloids and therefore, higher dry matter production leads to higher alkaloid content. Similar results have been reported by Shanmughavel and Francis (2001) in turmeric wherein higher oleoresin content as well as essential oil yield was reported when grown as a sole crop as compared to their growth as understory intercrops. However, Gangadharan and Menon (2003) have stated that in case of understory species, the effect of shade was significant, with lesser amount of shade promoting higher yield, thus following an inverse relationship. This argument is supported by Ram *et al.* (1999) who reported that in patchouli (*Pogostemon patchouli*), its major constituent patchouli alcohol was considerably increased by shade in the intercropped situation of patchouli with papaya than in sole patchouli crop. The bio synthesis of secondary metabolites in these plants is therefore an adaptive mechanism to shaded conditions, and is controlled by environment. These secondary products and alkaloids result from the breakdown and resynthesis from the primary products and this process is favoured by shaded conditions.

The importance and suitability of cultivation of medicinal plants under the shade of arecanut lie in the early years of the arecanut crop. Medicinal plants would have the advantage of providing short term returns without competing with the main arecanut crop for water, light or nutrients. Additionally, medicinal plants have the advantage over other traditional intercrops in arecanut gardens such as banana or cardamom, in that they are more resistant to pests and diseases, thus reducing the dependence on chemical pesticides and fungicides.

Based on the performance of the various medicinal crops in terms of growth, yield, quality parameters and their economics of cultivation, *Catharanthus roseus*, *Andrographis paniculata* and *Stewia rebaudiana* can be recommended for

Table 1. Alkaloid content & economic yield of different medicinal crops under shade of arecanut and under open conditions

Treatment	Alkaloid content (%)	Economic yield (kg/ha)
<b>Main Plot</b>		
M <sub>1</sub> – Open field	1.27	8804
M <sub>2</sub> – arecanut plantation	1.44	2586
SEm±	0.0006	31.98
CD	0.0052	77.39
<b>Sub plots</b>		
S <sub>1</sub> – <i>Aloe vera</i>	0.22	9,637
S <sub>2</sub> – <i>Alpinia galanga</i>	0.15	9,994
S <sub>3</sub> – <i>Coleus forskohlii</i>	0.37	1,681
S <sub>4</sub> – <i>Stewia rebaudiana</i>	6.18	1,711
S <sub>5</sub> – <i>Andrographis paniculata</i>	1.54	3,040
S <sub>6</sub> – <i>Catharanthus roseus</i>	0.75	7,835
S <sub>7</sub> – <i>Ocimum sanctum</i>	0.30	4,469
SEm±	0.0042	98.90
CD	0.0102	239.32
<b>Interaction</b>		
M <sub>1</sub> x S <sub>1</sub>	0.44	13,390
M <sub>1</sub> x S <sub>2</sub>	0.17	14,923
M <sub>1</sub> x S <sub>3</sub>	0.47	2,492
M <sub>1</sub> x S <sub>4</sub>	6.18	2,123
M <sub>1</sub> x S <sub>5</sub>	1.24	5,229
M <sub>1</sub> x S <sub>6</sub>	0.15	12,157
M <sub>1</sub> x S <sub>7</sub>	0.29	7,979
M <sub>2</sub> x S <sub>1</sub>	0.00	5,883
M <sub>2</sub> x S <sub>2</sub>	0.12	5,064
M <sub>2</sub> x S <sub>3</sub>	0.27	869
M <sub>2</sub> x S <sub>4</sub>	6.18	961
M <sub>2</sub> x S <sub>5</sub>	1.84	852
M <sub>2</sub> x S <sub>6</sub>	1.34	4,513
M <sub>2</sub> x S <sub>7</sub>	0.32	958
SEm±	0.006	139.9
CD	0.018	366.2

Table 2. Growth parameters of different medicinal crops at harvest under shade of arecanut and under open conditions.

Medicinal crops	Plant height (cm)		Number of leaves	
	Open	Shade	Open	Shade
<i>Aloe vera</i>	53.33	29.75	12.17	8.50
<i>Alpinia galanga</i>	15.13	7.93	166.27	72.53
<i>Coleus forskohlii</i>	55.62	50.55	493.30	213.40
<i>Stewia rebaudiana</i>	52.10	50.30	433.67	181.33
<i>Andrographis paniculata</i>	37.20	32.15	124.17	68.30
<i>Catharanthus roseus</i>	112.77	94.63	341.50	148.50
<i>Ocimum sanctum</i>	152.00	130.77	392.70	258.63
CD (P <sub>c</sub> 0.05)	2.52	2.38	5.02	4.72

cultivation in the arecanut gardens of the Malnad tract of Karnataka as suitable and financially viable intercrops. During the early phase of the growth of arecanut (during the non bearing

period), cultivation of medicinal plants in the arecanut plantations could act as a supplementary source of income to the farmer.

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