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FEASIBILITY OF GROWING MEDICINAL PLANTS IN COCONUT LANDS OF THE WET ZONE OF SRI LANKA

H A J Gunathilake, L Arambewewela*, H Ratnayake and S Rajapakse

Coconut Research Institute, Lunuwila, Sri Lanka

ABSTRACT

There is a growing demand for plant materials for use in perfumery and ayurvedic preparations. Although much research has been carried out on intercropping coconut lands, little attention has been given for medicinal plants.

Ten selected medicinal plants were tested at Walpita Estate in the Low Country Wet Zone of Sri Lanka. Yield and chemical quality of the species grown under coconut and in the open field were assessed.

Piper longum under coconut showed higher plant yield and piperine content than when grown in the open field. *Kaempheria galanga* and *Plumbago indica* also showed the same trend. Yield difference of *Adhathoda vasica* and *Aloe vera* under coconut and in open field was not significant. The other species, *Plectranthus spp*, *Solanum xanthocarpum*, *Hibiscus abelmoschus*, *Withania somnifera* and *Cassia angustifolia* did not perform well in AER WL3 and require further evaluation in other agro-climatic regions.

INTRODUCTION

The Coconut Research Institute has been engaged in research on intercropping in coconut lands, with both annual and perennial crops such as coffee, pepper, pineapple, ginger, etc., and has a considerable database and experience in this field (Gunathilake and Liyanage, 1996). However, lack of experience and knowledge on intercropping of medicinal plants in coconut lands is a serious drawback in popularising such crops.

Sri Lanka imports approximately Rs. 80-100 million worth of medicinal plant materials for use in perfumery and ayurvedic preparations. A major component of annual plant species such as *Solanum xanthocarpum* (S: Katuwelbatu), *Cassia angustifolia* (S: Senehekola), *Withania somnifera* (S: Ashawagandha), *Piper longum* (S: Tippili), *Kaempferia galanga* (S: Ingurupiyali), *Hibiscus abelmoschus* (S: Kapukinissa) etc. The chemical

* Natural Product Division, ITI, Bauddhaloka Mawatha, Colombo 7

activity of some of the imported dried plant material is less than the desired level due to long periods of storage and transportation before they are used.

The objectives of this work were to study the feasibility of growing several, hither to imported medicinal plants species under coconut and to assess the chemical quality of the produce cultivated under these conditions.

MATERIALS AND METHODS

This study was carried out at Walpita Estate, Kotadeniyawa in the Agro Ecological Reagion WL_3 where annual rainfall is approximately 2000 - 2200 mm. The age of the Coconut plantation was 46 years and available sunlight was approximately 60% under coconut, which was planted at 8.5 m x 8.5 m spacing (150 palms/ha). The soil was well drained and moderately deep Boralu series. (Somasiri *et al.,* 1994).

Selected medicinal plants listed in Table 1, were established in 4.0 m x 6.0 m plots prepared in the center of the coconut square. The plots were arranged in a Complete Randomized Block Design with three replicates per species. At planting, 500 g of concentrated Super Phosphate was applied to each plot followed by the application of 10 kg of dried cattle manure every three months during the experimental period.

A similar experiment was conducted in an open area (without coconut) for comparision.

Growth and reproductive parameters were recorded monthly and samples were taken for assessment of yield and chemical quality at the end of the first and second years, after planting. Agrochemicals were not used for pest and disease control.

RESULTS

Yield

The yields obtained over the first year, both in the open and under coconut are presented in Table 2. *Plectranthus spp* (Iriweriya) failed to produce any yield due to high mortality. Iriweriya plants under both conditions (open and under coconut) were susceptible to collar rot disease caused by *Pythium spp* and succumbed after two months. Under coconut *Piper longum* (Tippili) produced two and half times the yield obtained in the open field. *Kaempheria galanga* (Ingurupiyali) also yielded more under coconut than in the open. The yield of the other species tested was less under coconut than in the open field.

Extrapolated yields for one ha of land in the open (10,000 m^2) and under coconut (excluding 2m radius for coconut manure circle - 6,600 m^2) are given in Table 3. It showed that *Piper longum* has yielded more under coconut although the effective area is 2/3 under coconut. *Kaempheria galanga, Aloe vera, Plumbago indica, Adhathoda vasica* and *Withania somnifera* continued to produce a yield in the second year also (Table 4). Except for *Withania* and *Plumbago*, the yields under coconut of the other three species during the second year were higher than during the first year (Table 4). Extrapolated fresh leaf yield of *Aloe vera* in the second year was 12.6m.t./coconut ha (Table 5).

Chemical Quality

A chemical analysis of the medicinal plants/parts are presented in Table 6. *Piper longum, Kaempheria galanga* and *Phumbago indica* had higher concentrations of the active chemical ingradient in plants grown under coconut compared to those grown in the open. In contrast, *Solanum xanthocarpum, Withania somnifera* and *Cassia angustifolia* produced a lower concentration of the active chemicals under coconut than in open sunlight.

Comparing yield and volatile oil content of *Kaempheria* in the first and second years, those two characters behaved inversely i.e. in the second year, yield was higher but volatile oil was lower (Table 6). While *Aloe vera* and *Plumbago* produced higher contents of chemicals in the second year than in the first year.

DISCUSSION

Piper longum and *Kaempheria galanga* performed well under coconut showing their shade loving nature. These two species probably originated under shade in their natural habitats. The other species produced low yields under coconut possibly due to competition above or below the ground level. As the supply of nutrients and water was abundant, it can be assumed that the yields were reduced due to insufficient sunlight. This was clearly evident with *Solanum xanthocarpum, Hibiscus abelmoschus, Withania somnifera* and *Cassia angustifolia*. Although the yield per plant of *Aloe vera, Plumbago indica* and *Adhathoda vasica* under coconut was slightly reduced, their performance under coconut could be considered satisfactory. *Aloe vera, Plumbago, Adhathoda, Kaempheria* and *Withania* survived and carried over in to the second year after planting, as they are perennials. *Aloe vera, Adhathoda* and *Kaempheria* yielded fairly well in the second year. *Plimbago* could be maintained up to the end of the second year its yield was reduced considerably.

In regard to both chemical quality and yield, *Piper longum* and *Kaempheria* performed well under coconut.

Yield and chemical content of *Plumbago indica* grown under coconut behaved inversely, with the yield reduction being compensated by the better quality of extracts showing that this plant is also adaptable to the coconut situation.

Assessed in terms of yield and quality *Solanum xanthocarpum*, *Hibiscus abelmoschus, Withania somnfera* and *Cassia angaustifolia* failed to tolerate conditions under coconut in WL3. *Plectranthus spp* needs further investigation on its susceptibility to soil-borne diseases.

CONCLUSION

Piper longum, *Kaempheria galanga* and *Plumbago indica* are clearly medicinal plants with a good potential to be developed as intercrops under coconut in the wet zone due to their shade loving nature. *Adhathoda vasica* and *Aloe vera* also show promise. The other species tested should be experimented under different agro-climatic conditions for their adaptability.

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Table 1: The spacing and density of which the medicinal plants were tested

Scientific Name	Common Name	Spacing (cm)	Density	
			Plants/ha	Plants/coconut ha*
Piper longum	Tippili	75x75	17,500	11,700
Kaempheria galanga	Ingurupiyali	60x45	36,000	24,000
Aloe vera	Komarica	50x30	66,000	44,000
Plumbago indica	Rathnitol	60x60	27,000	18,000
Plectranthus spp	Iriweriya	30x30	111,000	72,000
Solanum xanthocapum	Katuwelbatu	45x15	142,500	95,000
Hibiscus abelmoschum	Kapukinissa	60x60	27,000	18,000
Withania somnifera	Amukkara	60x30	54,000	36,000
Cassia angustifolia	Senehekola	60x30	54,000	36,000
Adhathoda vasica	Adhathoda	60x90	18,000	12,000

- Area excluding 2.0 m radius for coconut manure circle (effective land area for intercropping in one hectare of coconut is 6,600 m^2)

Table 2: Yield in gram per plant over the first year in the open and under coconut

Medicinal Plant	Medicinally useful part	Yield at 1 year after planting (g/plant)		% difference compared to open
		Open	Under coconut	
Thippili	Berries (dried)	13.4 a	32.4 b	+241.8
Ingurupiyali	Rhyzome (dried)	39.2 a	45.2 b	+15.3
Komarica	Leaves (fresh)	1719a	1145.0 b	-33.4
Rathnitol	Roots (dried)	131.9 a	86.9 b	-34.1
Adhatoda	Total plant (dried)	180.0 a	132.5 b	-26.4
Katuwelbatu*	Total plant (dried)	24.8 a	10.1 b	-59.3
Kapukinissa	Seeds (dried)	27.0 a	5.1 b	-81.1
Amukkara	Roots (dried)	48.8 a	15.2 b	-68.9
Senehekola	Leaves (dried)	4.2 a	1.3 b	-69.0
Iriweriya	Shoots (dried)	nil	nil	-

* Harvested at 5 ½ months after planting
(Within columns, values sharing a common letter do not differ significantly at P=0.05)

Table 3: Extrapolated yield of different medicinal plants in the open and under coconut

Medicinal plants	Medicinally useful part	Yield at 1 year after planting		% difference compared to open
		Open kg/ha	Under coconut kg/coconut ha*	
Thippili	Berries (dried)	235 a	379 b	+61.1
Ingurupiyali	Rhyzome (dried)	1,410 a	1,084 b	-22.5
Komarica	Leaves (fresh)	113,454 a	503,800 b	-55.6
Rathnitol	Roots (dried)	3,561 a	1,564 b	-56.1
Adhatoda	Total plant (dried)	3,240 a	1,590 b	-50.9
Katuwelbatu	Total plant (dried)	3,534 a	960 b	-72.8
Kapukinissa	Seeds (dried	729 a	92 b	-87.4
Amukkara	Roots (dried)	2,635 a	547 b	-79.2
Senehekola	Leaves (dried)	227 a	47 b	-79.4

* Area available after excluding 2.0 m radius for coconut manure circle
(Within column, values sharing a common letter do not differ significantly at P=0.05)

Table 4: Yield in gram per plant in the second year in the open and under coconut

Medicinal plants	Medicinally useful part	Yield (g/plant)		% difference compared to open
		Open	Under coconut	
Ingurupiyali	Rhyzome (dried)	62.7 a	76.6 a	+30.8
Komarica	Leaves (fresh)	2,312.8 a	2,876.7 a	+24.4
Rathnitol	Roots (dried)	56.7 a	59.5 a	-4.9
Adhatoda	Total plant (dried)	1,327.0 a	1,072.2 b	-19.2
Amukkara	Roots (dried)	15.8 a	6.5 b	-58.9

(Within column, values sharing a common letter do not differ significantly at P=0.05)

Table 5: Extrapolated yield of several medicinal plants in the year after planting in the open and under coconut

Medicinal plants	Medicinally useful part	Yield	
		Open kg/ha	Under coconut kg/coconut ha*
Ingurupiyali	Rhyzome (dried)	2,254 a	1,839 b
Komarica	Leaves (fresh)	152,644 a	126,573 b
Rathnitol	Roots (dried)	1,531 a	1,071 b
Adhatoda	Total plant (dried)	23,886 a	12,886 b
Amukkara	Roots (dried)	853 a	234 b

* Area available, excluding after 2.0 m radius for coconut manure circle
(Within column, values sharing a common letter do not differ significantly at P=0.05)

Table 6: Chemicals/ingredients analysis of medicinal plants

Medicinal plants	Medicinally important parts	Chemicals/ ingredients associated	Percentage			
			Open		Under Coconut	
			1 YAP	2 YAP	1 YAP	2YAP
Thippili	Berries (dried)	Piperine	0.64	-	0.82	-
Ingurupiyali	Rhyzome (dried)	Votatile oil	7.41	3.25	8.73	3.31
Komarica	Leaves (fresh)	Fresh plant juice	2.35	6.30	2.23	6.40
Rathnitol	Roots (dried)	Total extract	14.7	28.86	22.97	27.60
Katuwelbatu	Whole plant (dried)	Alkaloids in roots	*1.9	-	*0.81	-
Kapukinissa	Seeds (dried)	-	n.a.	n.a.	n.a.	n.a.
Amukkara	Roots (dried)	Alkaloids Steroids	0.91	0.26	0.26	0.27
Senehekola	Leaves	Sennoside	1.50	-	1.20	-
Adhatoda	Whole plant (dried)	Essential oil	n.a.	n.a.	n.a.	n.a.

* Samples collected at 5 ½ and 15 month of age for 1 YAP and 2 YAP respectively
n.a - not analysed
YAP - years after planting