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INTERCROPPING MEDICINAL PLANTS UNDER RUBBER (*HEVEA*)

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INTRODUCTION

Inter planting of crops belonging to different plant species under rubber, either during the immature phase or during the mature phase is a common practice. Growing of medicinal plants as intercrops however, has not been tried under rubber until recently. With the increased interest shown by communities in traditional medicine, the demand for medicinal plants has increased and the extraction of large quantities of them from natural habitats have resulted in the decrease of their populations and some have reached extinction levels. It has now become necessary to grow them commercially and one possibility is the growing of them as intercrops under rubber.

A program supported by the 'Sri Lanka Conservation and Sustainable Use of Medicinal Plants Project' that investigated the possibility of intercropping five selected species of medicinal plants viz. Aerva lanata (Polpala), Solanum virginianum (Syn. Solanum xanthocarpum) (Katuwelbatu), three 'selections' of Piper longum (Thippili), Indigofera tinctoria (Nilavariya) and Plumbago indica (Ratnitul) under rubber was concluded recently.

The total national requirement of the above five species is 47281, 135094, 58606, 56374 and 16722 kg/year respectively (Abyawardana and Hettiarachchi, 2001) and S. virginianum and P. longum are mostly imported. Other three species are collected locally.

A. lanata is a herb found in home gardens, cleared forest areas and fallow farmlands. It is used as a herbal drink and as a remedy for indigestion and coughs. S. virginianum is also a plant found growing in farm lands in the dry zone. The whole plant is included in many decoctions for its effect as an expectorant and in treatment for coughs, asthma, colic fever, loss of appetite and pains in the chest. P. longum is a species native to India and Sri Lanka and grows as an under shrub in forests. Almost all parts of this plant have medicinal uses and the female inflorescence (spike) and the roots are the important parts used in medicine. The spikes containing the alkaloid Piperine are used in treatment of diseases of the respiratory tract, and also for coughs, bronchitis, asthma and many other conditions and it is among the 20 most widely used medicinal plants. I. tinctoria is leguminous shrub common in most parts of the country. Both the plant and the dye obtained from the leaves are used medicinally. The plant is administered in the form of a decoction or a powder. Among other uses, the juice of leaves is given for whooping cough, asthma, some diseases of lungs and kidney, palpitation of the heart, enlargement of the spleen and liver; juice

of fresh leaves is used in the preparation of hair oils. P. indica is a perennial herb native to India and produces long succulent roots. The roots and the root bark containing the yellow pigment Plumbagin are important indigenous drugs and the roots are used in dyspepsia, colic inflammations, cough, bronchitis, helminthiasis and is also an abortifacient (Dastur, 1952).

Experimental sites

These experiments were conducted in three districts, namely Kalutara, Ratnapura and Moneragala and were mainly in small holdings. One main experiment was established in the RRISL sub station at Kuruwita.

Propagation methods

A. lanata was propagated by seeds and soaking of seeds overnight in water improved germination. Seeds were either sown directly as unpurified seeds containing flower debris or as 'Compact nursery' plants (Pathiratna & Seneviratne, 2001). *I. tinctoria* and *S. virginianum* were also propagated by seeds and the same seed treatment method was used. *P. longum* (Pathiratna *et al.*, 2005) and *P. indica* were propagated vegetative from stem cuttings. Plants of all species except *A. lanata* were raised in polythene bags.

Cultivation practices

These five species were planted in the 8.1m inter row space of new rubber clearings and both rubber and medicinal plants were established in the same year. Another experiment was conducted under four years old rubber where canopies have partly closed and there was sufficient sun light only in the middle of the inter row. Organic fertilizer as cow dung in the planting hole and inorganic fertilizer after establishment were used. Regular weeding of intercrop plots was necessary but was costly. Plant pruning and training methods to curtail vegetative growth were compulsory to induce the formation of main stems, reproductive branches and spikes in all three 'selections' of *P. longum* (Pathiratna *et al.*, 2005). *A. lanata* was planted thrice, while *S. virginianum* was planted only twice during the year and further details of these experiments are given elsewhere (Pathiratna, 2002).

Growth requirements and yield

A. lanata and *S. virginianum* require full sunlight. They are determinate plants that are very sensitive to stress and shade reduced plant dry matter yields. Shade also affected the composition of plant parts in *A. lanata.* Plants of the same age grown under full sunlight had more flowers and stems compared to those grown under 50% light (Pathiratna *et al.*, 2004 a & b). *I. tinctoria* grew successfully in all experimental sites and tolerated shade and the yields were not greatly reduced even under a light level of about 40% (Pathiratna & Perera, 2004). *P. indica* also grew successfully in all sites and also tolerated some shade. All three 'selections' of *P.*

longum are inherently shade loving and were best suited to grow under about 50% shade (Pathiratna *et al.*, 2005).

Application of fertilizer either as cow dung or as inorganic mixtures improved the yield of all five species (Pathiratna, 2002). But, the type of fertilizer changed the composition of plant parts in *S. virginianum* (Pathiratna *et al.*, 2004 a & b). Application of inorganic fertilizer increased the yield of berries in 120 day old plants while organic fertilizer added plants had more leaves and stems. This aspect was studied because the whole plants were used in medicine in these species and the composition of plant parts seems to be important. There were indications that larger planting holes are more suitable for obtaining higher root yields from *P. indica* (Pathiratna, 2002).

Rainy weather and wet conditions were not suitable for both *A. lanata* and *S. virginianum* and are more suited to drier conditions. They performed well only during the drier months in the Kalutara and Ratnapura areas. Rain did not hamper the growth or yield of other three species.

The dry matter yield of the whole plants of *A. lanata*, *S. virginianum*, dried roots of *P. indica*, dried spikes of *P. longum* and fresh leaves of *I. tinctoria* obtained under the conditions of our experiments are given in Table 1.

Table 1. *Yield /ha/year of the medicinally important parts obtained in the first year*

Plant spp.	Medicinally important part	Yield kg/ha/year	Number of crops/ harvests
I. tinctoria	Fresh leaves	17920	4
A. lanata	Whole plant	9270	3
S. virginianum	Whole plant	2060	2
P. indica	Dried roots	709	1
P. longum	Dried spikes	433	12

Harvesting and processing

A. lanata and *S. virginianum* were harvested 3-4 months after establishment by uprooting the plants. Harvesting of *P. indica* 12 months after establishment gave the highest root yield. Leaves of *I. tinctoria* were harvested bi-monthly commencing after the 4th month and a shorter harvesting cycle progressively reduced the leaf yields (Pathiratna, 2002). *P. longum* cultivated with appropriate management practices started to produce spikes after about 4 months (Pathiratna *et al*, 2005). It takes about 50 days for the spikes to mature and harvesting every two weeks was possible and only 12 harvests were taken in this experiment commencing in the 6th month after establishment. In both *S. virginianum* and *A. lanata*, though the older plants gave higher total plant dry matter yields, harvesting times (age of plants) affected the percentage of plant parts. In *S. virginianum* under the conditions of these experiments, harvesting 70 days after establishment in the field (4 week old seedlings

planted in the field) the percentage yield of leaves was reduced while that of berries was increased. In *A. lanata* too delayed harvesting (100 days after establishment) gave higher percentage of stems and flowers and a lower percentage of leaves (Pathiratna *et al.*, 2004 a,b).

Processing of all these species except in *I. tinctoria* involved the drying of the plant material and dry weather was an important requirement. Harvesting of *S. virginianum* and *A. lanata* had to be done before the rains to avoid drying problems. Drying of the roots of *P. indica* and spikes of *P. longum* was also difficult under wet conditions. Delay in drying yielded poor quality material. This problem did not arise in *I. tinctoria* as fresh leaves were used.

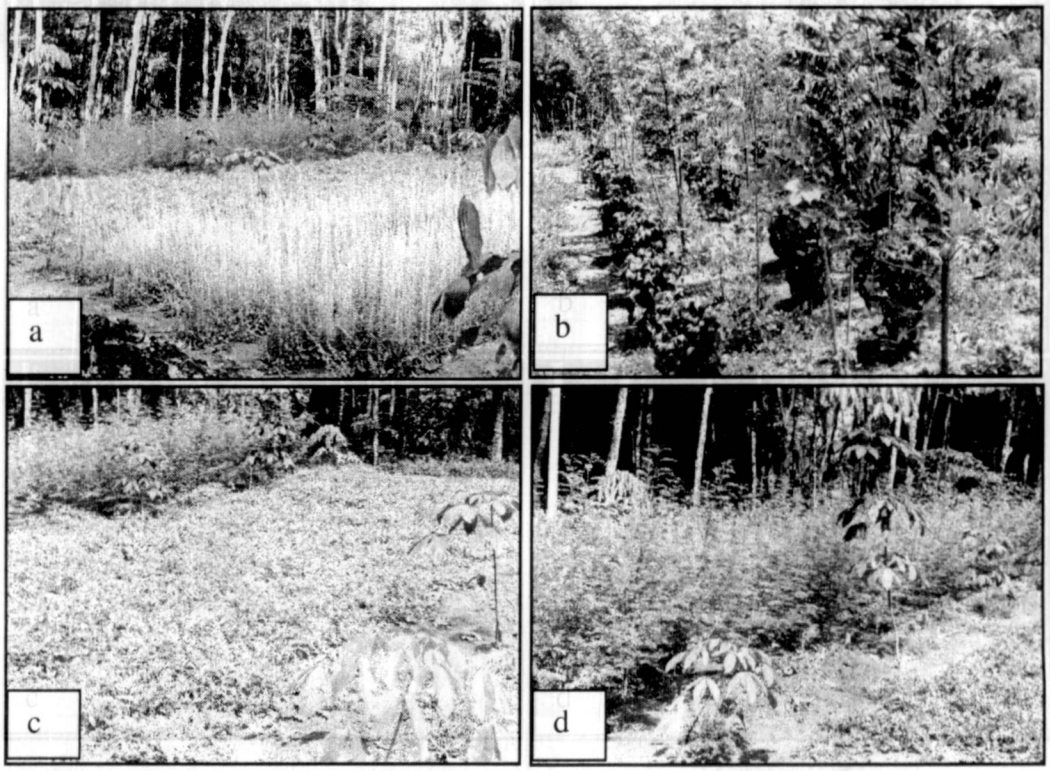

Plate 1. Five species of medicinal plants (a) *A. lanata*, (b) *P. longum*, (c) *S. virginianum* (d) *I. tinctoria* growing in the 8.1m inter row space of rubber four months after establishment. Crops (a), (c), and (d) are ready for harvesting. Live *Gliricidia* provides shade for *P. longum* and have started flowering.

Cost of production

The cost of production was highest for *P. longum* but also gave the highest market value and a higher profit margin. Although the profit margin for *S. virginianum* is low it is a plant in very high demand (Table 2).

Table 2. *The yield, cost of production and the market price of the medicinally important parts the five species*

Plant spp.	Cost of production Rs/ha	Cost of production Rs/kg#	Market price Rs /kg*
I. tinctoria	56750	3.17	11.54
A. lanata	46900	13.71	34.03
S .virginianum	58750	57.04	88.07
P .indica	52350	73.80	98.58
P .longum	82250	190.00	512.03

cost in the year 2002; *year 2000 prices (Abayawardana & Hettiarachchi, 2001)

Diseases

No major diseases were recorded in any of the species tested except *S. virginianum* that was very sensitive to wet conditions and retention of water in soil. Root diseases were common under such conditions particularly in young seedlings. Leaf diseases were also common in the rainy season. However, these disease problems were not encountered in Moneragala. *I. tinctoria* was subjected to leaf curling caused by a mite that affected leaf yields. No important diseases were seen in the other three species except for some fungal spots in *P. longum* under heavy rains. Addition of fresh or partly decomposed cow dung also caused root rot problems in *P. longum.*

CONCLUSION

All five species of these medicinal plants can easily be grown in rubber growing areas. Full sunlight requiring determinate species, *S. virginianum* and *A. lanata* can only be grown in drier months and dry weather is also required for drying the plants, while *P. indica* and *I. tinctoria* can be grown for a longer period under immature rubber but not under the intense shade of mature rubber. *I. tinctoria* also can be used as a green manure. *P. indica* is not suitable for lands prone to erosion as their harvesting involves digging and collection of roots. *P. longum* is a species that needs shade and highest yields are obtained under about 50% shade and if grown under immature rubber sufficient shade will have to be provided. This species can be grown even under mature rubber with appropriate plant training methods since they seem to give moderate yields under shade levels even above 50%.

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