COMPARATIVE EFFICIENCY OF *MUCUNA BRACTEATA* D. C. AND *PUERARIA PHASEOLOIDES* BENTH. ON SOIL NUTRIENT ENRICHMENT, MICROBIAL POPULATION AND GROWTH OF *HEVEA*

Establishment and maintenance of a ground cover in rubber plantations is an accepted agromanagement practice for rubber. Cover crops help in the improvement of soil structure and other physical properties (Soong & Yap, 1976). Studies conducted elsewhere have shown that leguminous ground cover helps in better growth of *Hevea* during immature phase and in attaining higher yield (Watson, 1961; Watson *et al.*, 1964; Pushparajah & Chellappah, 1969; Wycherley & Chandapillai, 1969). Leguminous cover also helps in the formation of large size aggregates and causes higher rate of infiltration (Krishnakumar, 1989).

The most widely used leguminous cover crop in India is *Pueraria phaseoloides,* though others like *Calopogonium mucunoides, Centrosema pubescens* and *Mimosa invisa* var. *inermis* are also grown on a limited scale (Potty *et al.*, 1980). An ideal cover crop should have such characters as fast growth, non-competition with rubber in any respect, shade tolerance, non-palatability to cattle, high nitrogen fixing capacity, drought tolerance and freedom from pests and diseases. One of the major constraints is the highly palatable nature of these cover crops, except *M. invisa* var. *inermis,* to cattle resulting in indiscriminate removal from the field. Hence efforts were made to identify a suitable ground cover and *Mucuna bracteata* a wild, fast growing legume introduced from the North Eastern States of India, was found to possess most of the desirable characters. The growth characters, nodulation and nitrogen fixation of *M. bracteata* have been reported by Kothandaraman *et al.*, (1987). *Mucuna* sp. has been reported to reduce parasitic nematodes in soil (Anon, 1983). Thankamony *et al.*, (1989) found high resistance for *M. bracteata* against nematode infection.

This creeper has deep roots and shows luxuriant growth even during peak summer which has led to the apprehension that it would compete with rubber for moisture during summer months. The comparative efficiency of this cover crop over the most popularly grown *P. phaseoloides* in nutrient enrichment and other desirable characters were not established. Hence, a study has been taken up for comparing the efficiency of *M. bracteata* and *P. phaseoloides* in soil nutrient enrichment, building up of microbial population, improving soil moisture status, suppression of weeds and influence on growth of *Hevea* during immature phase.

A field experiment was conducted at Chithalvetty near Punalur in an area planted with polybag plants of clone RRII 105 at a spacing of 5 x 5 m. There were 14 plots, seven each under *M. bracteata* and *P. phaseoloides.* Each plot consisted of 49 rubber plants. Soil samples were collected at 0-15 and 15-30 cm depths before starting the experiment and analysed for various nutrients following Jackson (1973) and the values were compared with those after three years. Shoot, root and litter were also analysed for plant nutrients. To study the nodulation characters, the percentage of plants nodulated and the number and weight of nodules per plant were recorded. Soil moisture content at three different depths was assessed gravimetrically during the summer months and compared with that of soil under grass cover. The general microbial population was studied following the method of Timonin (1940) and phosphate solubilisers by that of Sperber (1958).

The build up of total biomass by the two cover crops and the estimate of nutrient enrichment to the soil by each and their root-shoot ratio are given in Table 1. The data indicate that *M. bracteata* develops a higher biomass which supplies relatively larger quantities of nitrogen to the soil.

The variation in soil nutrient status in the beginning of the fourth year as compared to that prior to the starting of the experiment is presented in Table 2. An increase in the organic carbon was observed at both the depths, but was more pronounced at 15–30 cm. The increase in total nitrogen was observed to be more under *P. phaseoloides* which may be due to its better decomposition as evidenced by the narrow C : N ratio. A depletion in available phosphorus was observed at both the depths under *P. phaseoloides* but such depletion under *M. bracteata* was observed at the depth of 15–30 cm only. Available potassium in soil also showed an increase in both the layers, the higher being at the bottom layer.

The observation on the soil moisture level during summer months, presented in Table 3 shows that there was not much variation between the two ground covers. Both registered higher values compared to grass cover. The thick mulch provided by *M. bracteata* and its deep rooted nature and the differences in evapo-transpiration might have contributed to slightly higher soil moisture at the top layer.

Table 1. **Biomass and nutrient enrichment (kg per effective ha)**

		M. bracteata	*P. phaseoloides*
1.	Total biomass		
	(Shoot + root + litter)	5,620.00	3,783.00
2.	Nutrient addition possible through the biomass		
	(a) Nitrogen	219.74	108.02
	(b) Phosphorus	10.55	7.86
	(c) Potassium	67.71	58.27
	(d) Calcium**	18.23	21.68
	(e) Magnesium**	8.87	8.06
3.	Shoot/root ratio	9.47	8.51

** Shoot and root alone.

Table 2. **Nutrient status of the soil**

Cover crop	Soil depth (cm)	Organic carbon (%)		Total nitrogen (%)		Available phosphorus (mg 100 g^{-1})		Available potassium (mg 100 g^{-1})	
		Initial	After 3 years	Initial	After 3 years	Initial	After 3 years	Initial	After 3 years
M. bracteata	0–15	1.29	2.13 (65)	0.21	0.40 (90)	2.22	2.41 (9)	5.12	10.15 (98)
	15–30	0.86	1.91 (122)	0.17	0.32 (88)	1.88	0.85 (–55)	3.15	8.63 (174)
P. phaseoloides	0–15	1.34	2.27 (69)	0.21	0.51 (143)	2.87	1.32 (–54)	3.89	7.77 (100)
	15–30	0.79	1.96 (148)	0.17	0.38 (124)	1.26	0.54 (–57)	2.88	6.09 (111)

Figures in parentheses are percentage increase/decrease over initial value.

Table 3. **Soil moisture content (%) during dry months**

Months	Soil depth (cm)	Ground cover		
		M. bracteata	*P. phaseoloides*	*Grass*
January	0–15	18.55	17.00	13.95
	15–30	18.15	18.30	15.40
	30–60	18.45	18.35	16.25
February	0–15	14.90	14.45	10.50
	15–30	14.80	15.00	11.55
	30–60	15.45	15.70	11.95
March	0–15	13.90	13.50	9.80
	15–30	14.90	14.20	10.80
	30–60	15.60	14.90	11.80

The observation on nodulation showed that *P. phaseoloides* had higher percentage of nodulated plants and number of nodules per plant (98 and 6.9, respectively) compared to *M. bracteata* (88.0 and 3.7, respectively). The weight of nodules per square metre was also higher in the former (1.55 g) than the latter (1.47 g).

The counts of total bacteria, fungi and actinomycetes were higher in soils under *M. bracteata* (Table 4). The population of

Table 4. **Microbial population in soil x 10^4/g of dry soil**

Microbes	*M. bracteata*	*P. phaseoloides*
Bacteria	55.00	32.14
Fungi	13.14	11.00
Actinomycetes	14.14	11.14
Beijerinckia sp.	5.43	2.71
Phosphate solubilisers	9.00	5.29

Beijerinckia sp., the non-symbiotic nitrogen fixing bacteria, and phosphate solubilising micro-organisms were also found to be higher. The latter might have caused the higher value of available phosphorus.

Total biomass at the end of the fourth year was 15.63 tonnes in the case of *M. bracteata* as against 4.61 tonnes per ha in *P. phaseoloides*. The enhanced growth rate even after the fourth year suggests that *M. bracteata* is relatively shade tolerant. *M. bracteata* has not caused any retarding effect on the growth of *Hevea* as evidenced by the mean girth which was 42.13 cm for trees in plots with *M. bracteata* as cover and 42.22 cm for those with *P. phaseoloides*. From the trend in growth of *M. bracteata* it could be presumed that due to a higher build up of biomass during the later years the influence of this ground cover would prolong during the mature phase also. Such influence of cover crops on mature trees was reported by Pushparajah (1977).

The present study clearly indicates that *M. bracteata* is an ideal ground cover for rubber plantations.

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