LEGUMINOUS COVER PLANT - *MUCUNA BRACTEATA*

By : CHERIACHANGEL MATHEWS[1]
Golden Hope Plantations Berhad, Tangkak Estate, P.O. Box 503, 84900 Tangkak, Johor Darul Takzim, Malaysia

From the trials Mucuna bracteata merits more extensive cultivation. Its desirable characters are that the seed rate is very much lower than conventional cover plants and less labour intensive for planting. The initial three months requires purification of leguminous cover plant. Its vigorous growth coupled with its probable allelopathic property, noxious weeds and grasses are well smothered; thus requiring less maintenance other than monthly circle spraying. M. bracteata's drought and shade tolerance are far superior than conventional covers that poses less of a hazard in the dry weather. It has a high level of phenolic compounds which deters insects and cattle. This perennial leguminous creepers have deep roots and produce significant quantities of litter which decomposes slowly, and increases the fertility of surface soil. At the onset of second year of planting M. bracteata dominated the other two covers in growth and coverage.

Keywords: Leguminous cover plant, *Mucuna bracteata*

The establishment of a legume cover in young rubber and oil palm plantings is a common practice in Malaysia. The main functions of such ground cover are to protect the soil from erosion and enrich the organic matter; the latter improves the soil structure leading to better aeration, infiltration and retention of moisture.

The cover plants also minimise leaching losses of nutrients and reduce competition from noxious weeds. When selecting ground cover plants, preference is always given to legumes because they fix nitrogen and make it available to the main crop (Hartley, 1977).

However, management of ground covers is an important aspect of rubber and oil palm cultivation. In Malaysia, *Pueraria phaseoloides, Calopogonium caeruleum* and *Centrosema pubescens* are widely cultivated as cover for rubber and oil palm (Pushparajah, 1973; Wahab, 1977). These traditional leguminous covers do not normally compete successfully against volunteer weed growths, particularly *Mikania, Asystasia* and grasses without the laborious hand weeding and weeding with herbicides during the first year of establishment. Subsequent years with increasing shade from oil palms and rubber trees, the leguminous cover plant growth is hampered (except *Calopogonium caeruleum*) and provides little soil coverage and shade tolerant weeds take dominance.

The social problem of cattle grazing on the leguminous covers and drought season, further exasperates planter in the establishment of legumes. In the past planters were often judged by the ability to establish pure leguminous covers; however this is a fallacy now, due to shortage of labour and virulent weeds. The merits for introducing a new leguminous cover plant would be very timely.

The desirable characteristics are:

- Very vigorous growth
- Easy establishment and low seed rate
- Non-palatability to cattle
- High-drought tolerance
- Shade tolerance
- Presence of alleolo chemical to enhance competitive ability against weed growth
- High biomass production
- Tolerance to pest and diseases
- Low labour and chemical requirements for its establishment
- Good control against soil erosion

MATERIALS AND METHODS

M. Bracteata seeds were imported from Kerala, South India on obtaining the Import Permit from Crop Protection Branch at Kuala Lumpur and Phytosanitary Certificate from Government of India in 1991.
The seed treatment, germination, method of planting, seeding rates, manuring and maintenance of cover and growth characters were studied under field conditions.

This material was evaluated as follows: -
a. *M.bracteata* x 4 replicates - Fld 90 - Flat area
b. 2 types* of LCP x 4 replicates - Fld. 90 - Flat area
c. *M.bracteata* x 4 replicates - Fld. 91 - Terraced

* Pueraria phaeseoloides and *Calopogonium caeruleum*

Plot size was 10 m x 30 m

Details on the establishment of *M. bracteata*

Seeds

The seeds are large, weighing 99 to 190 mg each and are black in colour with a hard seed coat (see Appendix A).

In view of hard seed coat, the seeds did not germinate under ambient conditions. Thus after treatment with concentrated sulphuric acid for 30 minutes a germination rate of 70 percent was obtained in three days. Scarification of seeds mechanically on a rough surface or sand paper recorded 95 percent germination success in three days. Mechanically scarified seeds were raised in mini polythene bags (12.7cm x 17.7cm), which were filled with topsoil. Six weeks after sowing, the seedlings were transplanted to the palm rows, which were free from other vegetative growth.

Planting density

Three seedlings of *M. bracteata* of six weeks old were planted in between two palms (in conjunction with palm planting). Lower seed rate of two seedlings took 30 percent longer time for longer coverage. In a stand of 136 palms per hectare, only 408 *M. bracteata* seedlings or 75g of seeds were required per hectare. Care was taken to plant the seedlings during wet weather. *M. bracteata*'s growth at the initial period of 12 months was slow; subsequently it took over and exhibited it's vigorous growth. (To provide faster soil coverage *Mucuna conchinchinensis* is recommended to be sown along with *M. bracteata* for the initial temporary ground cover or along with conventional covers e.g. *Pueraria phaseoloides*).

Manuring

M. bracteata is very sensitive to inorganic fertiliser. It is recommended to apply Bayfolan (trace elements- foliar fertiliser) after two months of planting in the field. At the eighth month 50 kg per hectare rock phosphate followed by 100 kg per hectare rock phosphate at the 14th month was used. No further application was required after the 14th month.

Maintenance

In the initial three months, a zone free of vegetation of 1 m around each seedlings of *M. bracteata* was maintained. In view of the low seedling rate per hectare, care was taken not to spray herbicide directly in order to prevent its drift on the *M. bracteata* seedlings. Thereafter, only eradication of 'woody' plants was carried out. *M. bracteata* gave full coverage of the field from second year onwards. Monthly circle sprayings of palms were very pertinent as the vigorous growth of *M. bracteata* would otherwise engulf the palms.

RESULTS

Growth characters

The vines grew very fast by branching from each node. Dark green trifoliate leaves grew to a size of about 14 cm to 10 cm. The leaves are thermonastic - when temperature rises or falls the leaves close up. The three seedlings of *M. bracteata* planted between two palms grew and covered about 20m2 in 10 months and suppressed the noxious weeds. The dead older leaves shed and formed thick mulch over the ground.

A sampling after three years of establishment showed that the dry matter productions from *M. bracteata* was 8 to 10 tonnes compared with 4.4 tonnes with conventional covers (Table 1). Leaf litter was 3.4 to 7.3 tonnes under *M. bracteata* and only 1.5 tonnes under conventional covers (Table 2).

The thickness of the green vegetation of *M. bracteata* on the ground ranged from 39 cm to 90 cm. Such a luxuriant growth of cover plants will be much value in smothering weeds and reducing soil temperature. The probable presence of alleolo-chemicals in the tips of young vein inhibits the growth of engulfed weeds. The mulch of dried leaves would increase the microbial activity and enrich the nutrient status of the soil. Roots developed from the nodes of vines touching the ground are fibrous. Nodules formed on such roots are small and round. The nodules that developed on the roots of established plants were irregular in shape measuring 0.2cm to 2 cm. The nodules on aging turn black indicating presence of oxyhaemoglobin (Cloonan, 1963), which can serve the function of leghaemoglobin.

TABLE 1
DRY MATTER PRODUCTION BY DIFFERENT COVERS IN THE TRIALS

Trial P90 (*M. bracteata*)

Green vegetative matter				
	Fresh wt (g)	Dry wt (g)	Moisture (%)	Dry wt (t/ha)
Rep 1	728.70	130.87	82.0	5.23
Rep 2	1 905.97	320.64	83.2	12.83
Rep 3	1 507.70	232.14	84.6	9.29
Rep 4	1 380.40	301.41	78.2	12.06
Mean	1 380.69	246.27	82.0	9.85

Trial P91(*M. bracteata*)

Green vegetative matter				
	Fresh wt (g)	Dry wt (g)	Moisture (%)	Dry wt (t/ha)
Rep 1	1 747.03	298.47	82.9	11.94
Rep 2	767.30	139.00	81.9	5.56
Rep 3	651.18	133.25	79.5	5.53
Rep 4	1 529.12	300.51	80.3	12.02
Mean	1 173.66	217.81	81.2	8.71

Trial P90 (LCP Conventional)

Green vegetative matter				
	Fresh wt (g)	Dry wt (g)	Moisture (%)	Dry wt (t/ha)
Rep 1	797.74	103.50	87.0	4.14
Rep 2	705.08	117.39	83.4	4.70
Rep 3	768.84	116.35	84.9	4.65
Rep 4	682.56	103.79	84.8	4.15
Mean	738.56	110.26	85.0	4.41

The very presence of nodules indicates the penetration of *Rhizobium* (Dutta, 1970); however, over a period the leghaemoglobin will indicate its presence on build up of right type of *Rhizobium*. The main roots grew to depth of 2 to 3 m. As found by Wycherley (1963) deep rooted plants may increase the fertility of surface soil by extracting nutrients from deeper layer of soil and depositing them on the surface in the form of organic matter. Total biomass at the end of forth year after establishment 15.63 in the case of *M.bracteata* as against 4.16 tonnes per hectare in *Pueraria phaseoloides* (Kothandram et al., 1989).

TABLE 2
LEAF LITTER PRODUCTION

Trial P90 (*M. bracteata*)

Leaf litter				
	Fresh wt (g)	Dry wt (g)	Moisture (%)	Dry wt (t/ha)
Rep 1	978.15	176.61	81.9	7.06
Rep 2	864.10	169.70	80.4	6.79
Rep 3	1296.10	202.89	84.3	8.12
Rep 4	948.10	181.98	80.8	7.28
Mean	1021.99	182.80	81.9	7.31

Trial P91 (*M. bracteata*)

Leaf litter				
	Fresh wt (g)	Dry wt (g)	Moisture (%)	Dry wt (t/ha)
Rep 1	404.98	75.53	81.3	3.02
Rep 2	423.64	78.53	81.5	3.14
Rep 3	618.84	115.04	81.4	4.60
Rep 4	379.93	66.45	82.5	2.66
Mean	456.62	83.89	81.7	3.36

Trial P90 (LCP Conventional)

Leaf litter				
	Fresh wt (g)	Dry wt (g)	Moisture (%)	Dry wt (t/ha)
Rep 1	310.25	54.21	82.5	2.17
Rep 2	242.28	32.37	86.7	1.29
Rep 3	96.72	18.42	81.0	0.74
Rep 4	229.38	44.83	80.5	1.79
Mean	219.71	37.46	82.7	1.50

From the trend in growth of *M.bracteata* the higher build up of biomass will prolong its growth further into the mature phase of the main crop. Such influence of cover plants on mature trees was reported by Pushparajah (1977).

It was observed that *M. bracteata* litter decomposes slowly. The slower decomposition rate and gradual nutrient mineralisation of cover plants leaf litter are valuable attributes, as the mulch would have a more lasting effect and nutrients would be available over a longer period for uptake (Tan et al., 1976). From trials at North Labis Estate, at the end of third year, the total biomass of *M. bracteata* was 17.16 tonnes (flat area) and 12.07 tonnes (terraced area) against 5.91 tonnes per hectare of conventional covers (*Pueraria phaseoloides* and *Calopogonium caeruleum*) (Tables 1 & 2).

Drought and shade tolerance

This plant did not dry during hot spells (4 months drought). Only older leaves shed during the dry months and new shoots came out about 30 days later. Under shade, this cover plant also grew, but the growth was comparatively less.

Pest and disease

So far no serious pest or disease problems were noticed in this cover plant. In the months of December/January, insect infestation was manifested by tiny holes on the leaves of this cover plant, however the infestations were mild as high level of *phenolic compounds* deter the insects (Kothandram et al., 1989). It is also non-palatable to cattle due to presence of high levels of phenolic compounds and there is no menace from cattle.

Propagation

Propagation of *M.bracteata* is possible through seeds and stem cuttings. As seeds are not easily available, propagation by cuttings or tissue culture could be adopted.

DISCUSSION

Based on the initial establishment of *M.bracteata* since 1 June, 1991 in North Labis Estate, the following points of interest in relation to its cultivation and its reaction to environment is noted.

- In view of the low seed rate, the initial growth is comparatively slow thus sowing together with *Mucuna cochinchinesis* for an initial quick ground cover is advocated.
- The thick biomass is conducive to beneficial microbes *e.g. Actinomycetes, Tricoderma*.
- The alleolopathic property of this cover plant should be further investigated.
- The high level of phenolic compounds deters insects and cattle.
- As it does not flower in the plains, its cultivation for seed purpose should be attempted in the high ranges e.g. Cameron Highlands.
- In view of low success rate of stem cuttings, propagation by tissue culture should be attempted.
- There is a need to determine an indigenous Rhizobium strain which further promotes nitrogen fixation.
- This cover grows well on decayed organic matter, hence it would do well in zero burn areas.
- One year after establishment of *M.bracteata* the only weed maintenance required is regimented monthly circle weeding / spraying.
- Its drought resistance and shade tolerance is far superior to conventional covers thus poses less of a fire hazard in the dry weather.
- Its deep root increase the fertility of surface soil by extracting nutrients from deeper layer of soil and depositing them on the surface in the form of organic matter.
- At the onset of second year of planting, *M. bracteata* dominated the other conventional covers in growth and coverage.
- Total biomass is superior to that of *Pueraria phaseoloides* and *Calopogonium caeruleum*.
- The significant quantities of litter, which decomposes comparatively slowly attributes to longer period of uptake of nutrients.

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