Response to rhizobial inoculation in *Leucaena leucocephala* (Lam) de wit

In coconut plantations there is vast potential for cultivating the fast growing leguminous tree crop, *Leucaena leucocephala* which is a rich source for nutritious forage, organic manure, fire wood and timber. Optimisation of nitrogen fixation by identifying *Rhizobium* and determining the need for inoculation in different soil types was well recognised as a future research thrust on *Leucaena* (Anonymous, 1977). When *Leucaena* was introduced as a green manure and forage crop in coconut plantations, it was observed that the nodulation of the plant was poor in a few locations in the coastal sandy soils of Kerala. Studies were conducted to recognize a suitable *Rhizobium* culture as inoculant for optimising green matter and nitrogen yields by *L. leucocephala*.

Bacteria were isolated from the pink multilobed nodules occasionally seen on roots of *Leucaena* grown in local soil. These were identified as *Rhizobium* based on their growth characteristics on Hofer's alkaline broth (Hofer, 1935) and Ketolactose test (Bernaertz and Deley, 1963) as also their morphological and physiological characteristics. The isolated bacteria effectively nodulated *Leucaena* seedlings grown on sterilized sand and nitrogen-free nutrient media in Leonard jar assemblies.

A pot culture study was conducted with two *L. leucocephala* cultivars K-67 and K-4 and two rhizobial cultures. One of the rhizobial isolates was obtained from the nodules of *Leucaena* grown in local sandy soil and the other (UAS culture) was procured from the culture collection of the Department of Agricultural Microbiology, University of Agricultural Sciences, Bangalore. This also was originally isolated from nodules of naturally nodulated *Leucaena* plants grown in red loamy soils (Rhodustalf). The cultures were used as lignite-based inoculants containing 10^8CFU/g. The *Leucaena* seeds were treated with hot water, inoculated with *Rhizobium* using 10 g of inoculant per 100 g of seeds, air dried and sown in 30 cm diameter pots holding 10 Kg sandy soil collected from coconut plantations. The important characteristics of the soil are as follows:—organic carbon 0.18%, total N 0.02%, available P 20 ppm, CEC 2.91 meq/100 g, pH 5.6. Superphosphate and muriate of potash to supply 12.5 g P_2O_5 and 1.8 g K_2O were added to each pot. Six seeds were sown in each pot and after10days, the germinated seedlings were thinned out to retain three seedlings per pot. The plants were uprooted carefully after 90 days and the number of nodules, nodule and plant dry weights were recorded. Nitrogen in the plant tissue was analysed by microkjeldahl method. The data are given in Table 1.

The two *Leucaena* cultivars responded differently to rhizobial inoculation. With K-67 cultivar of *L. leucocephala*, inoculation with local isolate of *Rhizobium* resulted in increased number of nodules, but not the nodule dry weight, whereas with the UAS-Bangalore inoculant both the number and weight of nodules increased considerably, eventhough the number of nodules increased to a lesser degree than that obtained with the local isolate. A significant increase in dry weight and nitrogen yield to the extent of 50 per cent over control was recorded in K-67 cultivar when inoculated with the UAS culture. The increases in dry matter yield and nitrogen content of the plant due to inoculation with the local isolate was non-significant.

With the K-4 cultivar of *Leucaena*, the

Table 1. Response to rhizobial inoculation in *L. leucocephala*

Leucaena cultivar	*Rhizobium* treatment	Nodule Number/plant	Nodule weight mg/plant	Plant dry weight g/plant	Nitrogen yield mg/plant
L. leucocephala K-67	Control	7	53.88	3.08	91.72
	Local isolate	40**	60.53	4.01	119.37
	UAS Bangalore isolate	18**	151.83**	4.50*	134.10*
L. leucocephala K-4	Control	9	87.00	2.72	80.96
	Local isolate	18*	158.98*	2.86	85.24
	UAS Bangalore isolate	10	62.67	2.71	80.79

*and **refer to statistically significant difference from control at P=0.05 and 0.01 respectively. Data represent average of six replications.

local isolate nodulated better than the UAS isolate by increasing both the number and weight of nodules. The dry matter yield of plants and the total nitrogen yield of plant biomass did not vary from the control.

The response of the two *Leucaena* cultivars to *Rhizobium* inoculation, therefore, varied and K-67 cultivar responded better. Of the two Rhizobium cultures tested, UAS Bangalore culture obtained from *Leucaena* grown in red loamy soil was better than the local solate in nodulating the host in the sandy soil of Kerala.

The results reveal that there is a potential to increase the dry matter and nitrogen yields of *Leucaena* through rhizobial inoculation. Trinick (1968) reported that the rhizobial requirement for *L. leucocephala* was fairly specific and Mc Leod (1962) found that the plant failed to nodulate with indigenous rhizobia in New South Wales (Australia) soils. Studies conducted at the University of Pretoria (Anonymous, 1954) also indicated that *L. leucocephala* was not nodulated by rhizobia belonging to the cowpea miscellany isolated from 17 different legume species. In our observations also it was found that the legume nodulated only sparsely in the local acidic sandy soil. In view of this, recognition of an efficient inoculant strain of *Rhizobium* is quite relevant. The *Rhizobium* cultures tested were, however, not as effective on K-4 cultivar of *Leucaena* indicating thereby variation in response among the *Leucaena* cultivars to *Rhizobium* inoculation. The response to rhizobial inoculation in K-67 cultivar of Leucaena indicates the suitability of this cultivar for cultivation in coconut plantations.

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