

Yield response of groundnut (*Arachis hypogaea*) to dual inoculation and liming of an acid hill Ultisol of Manipur

MAUSUMI RAYCHAUDHURI¹, S V NGACHAN², S RAYCHAUDHURI³ and A L SINGH⁴

Manipur Centre, ICAR Research Complex for North-Eastern Hills Region, Lamphelpat, Imphal, Manipur 795 004

Received: 19 July 2002

ABSTRACT

A field experiment was conducted during the rainy seasons of 2000 and 2001 in an acid hill Ultisol of Manipur with groundnut (*Arachis hypogaea* L.) to study the efficiency of single as well as dual inoculation with *Rhizobium* (TAL 1000) and phosphate-solubilizing micro-organism (*Bacillus polymyxa* Prazmowski) in increasing the yield under limed and controlled conditions. *Rhizobium* alone did not increase the pod and haulm yields significantly, but when inoculated in combination with *B. polymyxa* increased the nodule weight/plant (0.23 g), pod (1 520 kg/ha) and haulm yields (2 250 kg/ha) and their respective N (65.1 and 61.5 kg/ha respectively) and P uptake (4.98 and 4.63 kg/ha respectively) significantly. *B. polymyxa* was effective in solubilizing the insoluble phosphorus of the soil and increased the available P content in the soil by 13.5%. Further, liming increased the efficiency of phosphate-solubilizing microorganism and increased the available P content in the soil by 26.9%. Liming alone increased the nodule weight/plant (71%), pod (36%) and haulm yields (37%) and their respective N (51 and 91% respectively) and P uptake (49 and 50% respectively) significantly. Maximum pod yield of 1 740 kg/ha was obtained with dual inoculation of *Rhizobium* (TAL 1000) and *B. polymyxa* coupled with 2.5 tonnes/ha lime compared with the control (992 kg/ha).

Keywords: Crop production, Oilseed, Groundnut, *Rhizobium*, Phosphate-solubilizing micro-organism, Yields, Nutrient uptake, Phosphorus, Lime, Acid hill soil, Ultisol

Groundnut (*Arachis hypogaea* L.) is one of the promising rainy-season oilseed crops of Manipur, covering 1 000 to 1 500 ha area with a total production of 1 000 to 1 150 tonnes. The yield is less than 1 tonne/ha because of the acidic nature of the soil. Deficiency of phosphorus and calcium are some of the factors in acid soil that limit the growth and production of legumes like groundnut. Legumes are sensitive to hydrogen ion, toxic amounts of aluminium and manganese and thus to soil acidity. The acid subsoil restricts the root growth and its lateral distributions. This affects the nodulation and nitrogen fixation in many legume-*Rhizobium* symbiosis of agronomic interest (Glenn *et al.* 1999).

Nodulation is also affected by the native rhizobial population in the soil. Lack of effective rhizobial strains in the soil restricts nodulation and proper growth of groundnut. Although biological nitrogen fixation (BNF) is a natural process, many soils do not have sufficient numbers of specific rhizobia for effective symbiosis. Inoculating legume crops with compatible rhizobia ensures higher BNF. Singleton *et al.* (1992) reported increase in yield of legumes with rhizobial inoculation. Inoculation of plants with phosphate-solubilizing bacteria was

reported by several researchers to increase yields. Hence an attempt was made to study the effect of lime as an amendment and seed inoculation with effective strains of N fixing and P-solubilizing bacteria (PSM) on soil characteristics and also on nodulation, yield and nutrient uptake by groundnut grown in an acid hill soil of Manipur.

MATERIALS AND METHODS

The experiment was carried out at Krishnagiri Farm, Langol Hill, ICAR, Manipur, on terraces during the rainy seasons of 2000 and 2001 in collaboration with National Research Centre for Groundnut, Junagadh, Gujarat. The soil was Kanhaplo humult having clay loam texture, pH 4.9, organic carbon 2.1%, exchangeable Al 1.24 cmol (p⁺)/kg and available P as 7.94 mg/kg. The experiment was carried out in split-plot design with the following treatments. Two lime levels were arranged in the main plot, viz 0 and 2.5 tonnes/ha lime as L₀ and L₂ respectively. Four combinations of seed inoculation with biofertilizers viz control, *Rhizobium* (TAL 1000), phosphate-solubilizing micro-organism (PSM) (*Bacillus polymyxa*) and *Rhizobium* + PSM were arranged in subplots. Nitrogen and K₂O were applied (20 and 40 kg/ha respectively) in all plots. Groundnut 'JL 20' was used as the test crop. Nodule number and nodule weight were recorded 60 days after sowing. The pod and haulm yields

¹Senior Scientist, ²Joint Director, ³Senior Scientist, ⁴Senior Scientist (Plant Physiology), National Research Centre for Groundnut, Junagadh, Gujarat 362 001