INTERACTION OF ENDOMYCORRHIZAL FUNGI AND PHOSPHATE ON *NEONOTONIA WIGHTII,* LACKEY[a]

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ABSTRACT

This experiment was carried out in greenhouse condition, to study the effect of four phosphorus levels (20, 80, 140 and 200 kg of P_2O_5/ha) with or without fungi mycorrhizal inoculation (*Acaulospora longula* + *A. morrowae*). Five accessions of *Neonotonia wightii* (Wightii & Arn) Lackey (perennial soyabean) were studied: Malawi, Tinaroo, NO1264, NO409 and NO 250. The growth of Neonotonia was improved by the phosphorus fertilization.The effect of VAM inoculation was greater in the lower levels of P fertilization reducing its effect in the higher levels of P applied. The presence of soluble P induced higher N accumulation and P uptake in all mycorrhizal plants.

KEYWORDS

Tropical forage legume, phophate fertilization, vesicular-arbuscular mycorrhiza.

INTRODUCTION

The use of forage legumes, as companion crop to increase production of tropical grasses, is becoming an established practice in order to reduce the requirement for N fertilization, besides functioning as a feed of better nutritive value for the animal.

Perennial soyabean has showed successful development of productive pastures in tropical areas. This forage legume requires adequate nutrition for plant growth. Phosphorus deficiency is probably the major limitation for growth of legumes in tropical America, particularly those areas with soils of high P fixing capacities (França and Carvalho (1980). The relatively high cost per unit of phosphatic fertilizer demands technologies which improve the utilization of phosphorus. Vesicular-arbuscular mycorrhizal (VAM) fungi can improve plant growth, enhancing P uptake, mainly in infertile soils, commonly found in tropical regions, Siqueira et al. (1984).

The aim of this paper was to test in five accessions of perennial soyabean the effects of four phosphorus levels and VAM inoculation upon growth, nodulation and root colonization.

MATERIAL AND METHODS

The trial was conducted under greenhouse conditions at Instituto de Zootecnia, using a Red-Yellow Latosol (Oxisol) , having the following chemical characteristics: pH ($CaCl_2$)= 4,0; Ca= 0,4; Mg= 0,9; K= 0,7; H+Al= 27,8 (all in $mmol_c/dm^3$) and P= 5,2 mg/dm^3. Soil acidity was corrected using liming to increase cation exchange saturation ratio to 70%. Treatments were arranged in completely randomized blocks with three replications and consisted of presence or absence of VAM inoculation (*Acaulospora longula* and *A. morrowae*) and four levels of phosphorus (20, 80, 140 and 200 kg P_2O_5/ha). Five accessions of *Neonotonia wightii* (perennial soyabean) were tested: Malawi, Tinaroo, NO1264, NO409 and NO250. Each experimental unit was represented by a pot with 5,0 kg dry soil. Seeds were scarified with 65½C water. Pots were sown with twenty seeds and inoculated with specific Rhizobium. Seven days after emergence, seedlings were thinned to three plants per pot. Soil water content was assessed daily by weighing the pots. Soil was maintained at 80 percent field moisture capacity. Plants were cut at the soil surface after 40 days of growth, and the aboveground biomass was dried in an oven at 65½C for 48 hours. The above dry matter was analyzed for N, and P concentrations. The nodules were detached from the roots, cleaned, oven dried, counted and weighed. Root segments were stained with trypan-blue lactophenol for evaluation of VAM colonization, according to the methodology of Phillips and Hayman (1970).

RESULTS AND DISCUSSION

Dry weight of shoots and roots showed increases ($P<0.05$) with phosphorus levels and VAM inoculation. These increases varied according to the accessions used. Plants inoculated with VAM plus phosphorus recorded higher dry yields, while the lowest DM was found in the absence of VAM and without phosphorus application (Figure 1).

The response to VAM inoculation decreased as phosphorus fertilization increased. In the absence of VAM inoculation maximum yields were achieved with the application of 215 kg of P_2O_5/ha, while those with VAM inoculation occurred with 180 kg of P_2O_5, resulting in fertilizer economy. Several reports have demonstrated that benefits of VAM inoculation, is dependent of P levels, in order to increase production in tropical legumes, Huang *et al.,* (1985) and Paulino *et al.,* (1986).

With the lower phosphorus addition (20 kg of P_2O_5/ha) accessions Malawi, Tinaroo and NO 1264 had the best behaviour, but with the addition of 80 kg P_2O_5/ha or more the two first ones plus accession number NO 409 instead of number 1264 were the most productive (Figure 2).

The highest root colonizations were obtained in the presence of the lowest level of P applied. The addition of soluble phosphate reduced the root colonization of three perennial soyabean accessions (Tinaroo, 409 and Malawi) but did not change for 250 and 1264 accessions. These results suggest that there are some specific relations between host and fungi studied. The relatively low phosphatic fertilization, besides being economical, favored mycorrhization. Although for this legume species some works mention that around 80 kg P/ha are necessary to optimize forage yield (França and Carvalho, 1970), soil acidity correction by liming improved phosphorus profit (Table 1).

The results of the present work show that the application of medium rates of phosphorus, together with VAM inoculation are capable of increasing perennial soyabean yields using less fertilizers in acid soils.

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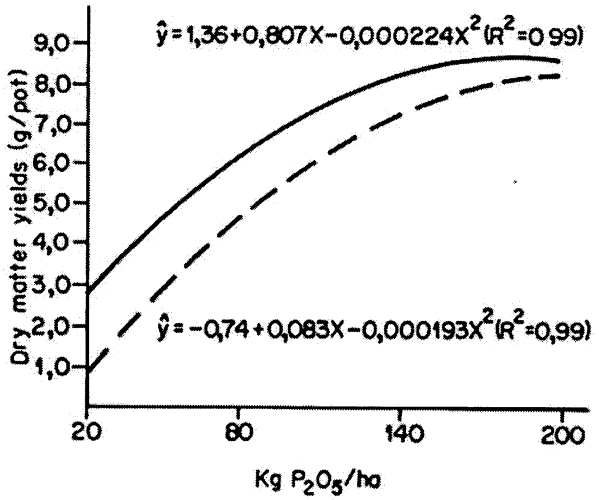
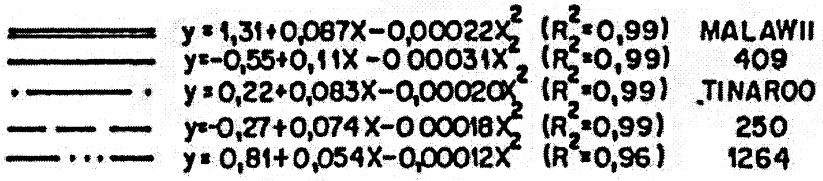
Table 1
Effect of P application on VAM colonization roots in accessions of soyabean.

Accessions	VAM Root Colonization (%) Phosphorus - kg P_2O_5/ha			
	20	80	140	200
Malawi	52	50	44	35
Tinaroo	42	29	27	31
NO1264	18	19	23	17
NO409	40	47	39	29
NO250	46	41	52	40

Figure 1
Effect of P levels in dry matter of perenial soyabean, first cut, without (- - -) and with (—) endomycorrhiza inoculation.





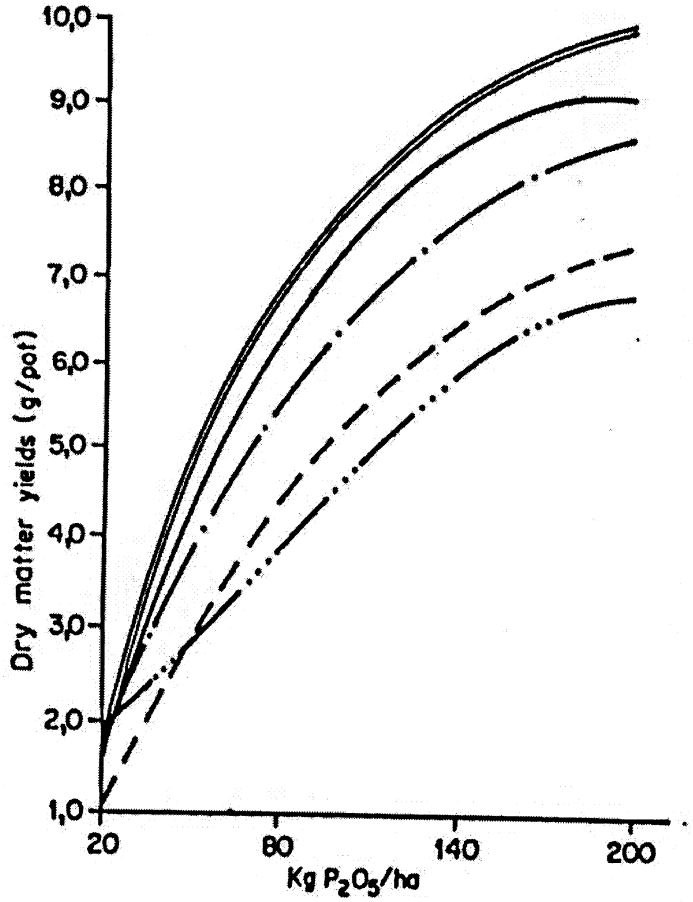


Figure 2
Effect of phosphorus on dry matter yield in some accessions of perenial soyabean.