B-31:Influence of phosphorous and growth rate on biological nitrogen fixation of *Centrosema macrocarpum*

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Availability of phosphorous is frequently a problem in tropical soils and had been identified as one of the most limiting elements for pastrue establishment. Experiments carried out using *Centrosema* spp. in tropical soils showed that added phosphorous enhanced the symbiotic nitrogen fixation as well as dry matter accumulation. The objectives of this study were to test the following

hypothesis: a.Higher growth rate induces the increasing demand for nitrogen thereby promoting biological nitrogen fixation. b.Phosphorus is the limiting element for the development of root nodules and their efficiency. c.Under low mineral nitrogen supply the plants fix higher percentage nitrogen through symbiosis.

The experiment was conducted in controlled environmental chambers. *Centrosema macrocarpum* acc. 5452 (Schultze-Kraft, 1986) was used for the experiment. The experimental design was a complete randomized design with 6 replicates including 4 nutrient levels. The cabin temperatures were 28/23°C day/night and 23/18°C day/night. The relative humidity was 70-80% and light intensity was 500-600 mol quanta. Light intensity was measured at plant height with a Licer apparatus. *C.macrocarpum* seedlings were established in square plastic pots filled with quartz sand.

The relative humidity was 70(-8-)% and light intensity was 500-600μ mol quanta. Light intensity was measured at plant height with a Licer apparatus. *C.macrocrpum* seedlings were established in square plastic pots filled with quartz sand. A nutrient solution including the following levels of phosphorous and nitrogen were given to the plants from 2 weeks onwards:

Level 1. N_1P_1 - 0.5 mM N 0.02 mM P;
Level 2. N_1P_2 - 0.5 mM N 0.2 mM P;
Level 1. N_2P_1 - 2.5 mM N 0.02 mM P:
Level 1. N_2P_2 - 2.5 mM N 0.2 mM P;

1.7 g/l and 4.26 g/l ^{15}N labelled $NaNO_3$ was incorporated with 0.5 mM and 2.5 mM nitrogen levels respectively.

The leaf areas, dry matter,yields and nodule parameters were determined at 37 and 44 days for high temperature and 44 and 54 days for low temperature respectively. Plant nitrogen concentrations were determined by using the Kjeldahl method. Nitrogen fixation was determined by using the ^{15}N isotope dilution technique. Growth analysis was done according to the computer program derived by Hunt and Parsons (1974); statistical analysis of the experimental data using the package SAS.

The plants grown at 28/23° had higher relative growth rates (RGR) than plants grown at 23/18°C. Irrespective of temperature, high N and P supply also positively affected the relative growth rates of plants. The changes in net assimilation rates (NAR) showed a similar pattern.

The plants grown at 28/23°C showed significantly higher dry matter accumulation than plants grown at 23/18°C. The plants receiving high N and P levels (N_2P_2) had highest dry matter yields at both air temperatures as compared with N_1P_2, N_2P_1 and N_1P_1 plants. Irrespective of nitrogen level and temperature, plants grown with high P levels had the highest nodule dry matter at all harvests, but when compared with each other the values were not significant.

The N concentrations in plant tissues were higher for all the treatments at 23/18°C as compared with 28/23°C. Irrespective of temp, plant tissue nitrogen concentration was lowest in plants receiving low N and P levels and highest in plants receiving high N and low P levels. The highest percentage N derived from atmosphere (%NDFA) was observed in plants receiving low N and high P levels (N_1P_2) at both temperature regimes. When considering the amount of N fixed (mg/plant) the N_1P_2 plants were superior than that of N_2P_2, N_2P_1 and N_1P_1 plants.

The highest RGR of plants receiving high N and P were due to increase in NAR. High air temperature also favourably affected the above parameters. Dry matter accumulation of *C.macrocarpum* was significantly increased under high temperature conditions and also by high N and P supply.

Phosphorus showed a specific effect on modulation of *C.macrocarpum*. Under low mineral nitrogen supply, the percentage of N derived from the atmosphere was more. This was also favoured through the specific effect of phosphorous on stimulating growth and nodule development. Therefore, it is concluded that inspite of higher growth rate the symbiotic nitrogen fixation of *C.macrocarpum* did not increase.