Improvement of Production and Nutrient Uptake of *Pueraria phaseoloides* by Rock Phosphate Fertilization in Kombucha Suspension and *Glomus manihotis* Fungi Inoculation

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Key words : *Glomus manihotis* , Kombucha , *Pueraria phaseoloides* , rock phosphate

Introduction Rock phosphate (RP) is often considered as an alternative to the use of more expensive soluble P fertilizers (SP) . Symbiotic association between AM fungi and legume plants has been reported to be more responsive and efficient with RP than the other type of P fertilizers . Kombucha is a sweetened tea beverage that contains various organic acids such as citric and malic acid (Bartholomew and Bartholomew , 2001) . Ishikawa *et al* . (2002) reported that citric and malic acid were capable of mobilizing P from the soil . The objective of the research is to investigate the influence of RP fertilization in Kombucha suspension and *Glomus manihotis* fungi inoculation on the dry matter (DM) production , and nutrient uptake of puero (*Pueraria phaseoloides*) .

Materials and methods The experiment was conducted in a greenhouse on the acid latosolic soil . A completely randomized design with 5 treatments , and 5 replicates was used . The treatments were control (T0) , RP (T1) , RP + *G . manihotis* (T2) , RP + Kombucha (T3) , and RP + Kombucha + *G . manihotis* (T4) . Standard fertilization as urea (46% N) and KCl (60% K_2O) at 50 kg N ha^{-1} and 83 kg K ha^{-1} , respectively , were added to each pot . RP (27% P_2O_5) fertilization as the treatment was used at 87 kg P ha^{-1} (2.22 g RP pot^{-1}) . We prepared 10 glasses and poured 100 ml of Kombucha suspension , added 2 .22 g of RP into each glass and stirred the suspension for T3 and T4 . Each pot received 6 kg of dry soil and contained two seedlings of puero , inoculated with 50 g crude inoculum of *G . manihotis* , according to the assigned treatment at the time of planting . After 8 weeks of growth , plants were cut and oven-dried at 70^0C for 48 hours . These samples were analyzed for measurement of DM production , nitrogen (N) and phosphorus (P) uptake . Data were analysed using GLM procedure of SAS . Significant differences among the treatments were tested using Duncan's Multiple Range Test (Steel and Torrie , 1980) .

Results and discussion There were no significant differences in DM production , N and P uptake between T0 , T1 , T2 , and T3 . However , T4 increased DM production , and N and P uptake compared to T0 , T1 , T2 and T3 (Table 1) . Kombucha produced citric and malic acid (Bartholomew and Bartholomew , 2001) , and was capable of solubilizing RP (Ishikawa *et al* ., 2002) . Puero has magnolioid roots , which are highly responsive to AM fungi inoculation . Therefore , their association with AM fungi combined with RP fertilization in Kombucha suspension will improved the growth and development of puero .

Table 1 *Dry matter production , nitrogen and phosphorus uptake of* Pueraria phaseoloides *by rock phosphate fertilization in Kombucha suspension and* Glomus manihotis *fungi inculation .*

Treatment	DM Production (g $plant^{-1}$)	N Uptake (mg $plant^{-1}$)	P Uptake (mg $plant^{-1}$)
T0 (control)	0 .71 b	21 .73 b	1 .91 b*
T1 (rock phosphate)	0 .98 b	28 .08 b	2 .72 b
T2 (RP+G . manihotis)	1 .35 b	34 .50 b	3 .43 b
T3 (RP+Kombucha)	0 .48 b	15 .31 b	1 .20 b
T4 (RP+Kombucha+G . manihotis)	3 .06 a	81 .25 a	7 .20 a

* Significantly different at DMRT 5%

Conclusion Rock phosphate fertilization in Kombucha suspension combined with *Glomus manihotis* fungi inoculation increased DM production , N and P uptake of *Pueraria phaseoloides* in the acid latosolic soil . No differences in DM production , N and P uptake were found between other treatments .

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