Thesis Title Effectiveness of Rhizobium Strains on Nitrogen Fixation and Yield Improvement of Red Kidney Bean and Navy Bean in the Northern Highlands

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## Abstract

Field experiment were conducted for evaluation of effectiveness of rhizobial strains in $N_2$ fixation and yield improvement of three cultivars of *Phaseolus vugaris* L. at two locations , Kae Noi and Pang Da in the highland areas with different environment. The randomized block design with 4 replications and 5 treatments was used to each cultivar at each location. The treatments consisted of (1) unionculation and no N fertilizer application ( control ), (2) N fertilizer application at the rate of 8 kgN/rai and three rhizobial inoculated treatments. The following strains / isolates of *Rhizobium leguminosarum* biovar *phaseoli* were used : CIAT 899 , UMR 1899 and native isolate KN 6 for Mokcham cultivar , CIAT 899 , TAL 182 and native isolate 6/1 for MKS 8 cultivar , CIAT 899 , TAL 182 and native isolate KN 6 for Navy bean.

It was found that in the control treatment, the indigenous rhizobia contributed about 15 kgN/rai of fixed N for both red kidney bean cultivars at Pang Da while those in Kae Noi soil contributed about 11 kgN/rai of fixed N. The amounts of fixed N of Navy bean at both sites were about 12 kgN/rai. The percentage of fixed N for Navy bean,MKS 8 and Mokcham cutivars were 70, 62 and 59 % of the total N accumulated in the whole

plants through out the growing season respectively. At Kae Noi, there were similar percentage of fixed N ( 43 - 44 % ) among these three cultivars of bean.

The significant difference between the control and N-applied treatments was not found for dry matter and N uptake of shoot and seed yield of Navy beans at both sites. Furthermore , at Pang Da , the application of N-fertilizer resulted in significant reduction of relative ureide index of root bleeding sap of Navy bean at $R_4$. The percentage of fixed N of Navy bean at this site was also significantly reduced to 34 %. There were no significant responses of Mokcham cultivar to N-fertilizer application on dry matter of shoot, seed yield and the amount and percentage of fixed N at both sites. Nevertheless , significant improvement of N uptake of shoot of this bean at $R_1$ by N-fertilizer application was found at Kae Noi. At Pang Da significant reduction of relative ureide index of root bleeding sap at $R_6$ was observed in the N-applied treatment of Mokcham cultivar. There were significant effects of N-fertilizer application on reduction of nodule dry weight at $R_1$ and relative ureide indices at $R_4$ and $R_6$ of MKS 8 bean at Pang Da. However , increment of seed yield of 31% above the control ( $P > 0.01$ ) by N-applied treatment was found. No significant responses of MKS 8 bean to N-fertilizer application on all collected parameters were observed at Kae Noi.

All rhizobial inoculated treatments had no significant effects on dry matter and N uptake of shoot seed yield and the amount and percentage of fixed N of Mokcham bean cultivar at both sites. However , rhizobial inoculated treatments had beneficial effect on nodule dry weight particularly at Kae Noi which significant improvement of nodule dry weight by KN 6 inoculated treatment was found. At this site , inoculation of CIAT 899 resulted in significant increment of relative ureide index of Mokcham bean. At Pang Da, MKS 8 bean did not show significant responses to all rhizobial inoculated treatments on all parameters except relative ureide index at $V_4$ which increased significantly by TAL 182 inoculation. At Kae Noi , significant improvement of nodule dry weight at $V_4$ by CIAT 899 and TAL 182 inoculated treatments were observed. Furthermore CIAT 899 inoculated treatment improved the percentage of fixed N 28 % above the control ( $P > 0.01$ ).

However , significant difference between each inoculated treatment and the control treatment on seed yield and amount of fixed N of MKS 8 were not found. There were no significant responses of Navy bean to all rhizobial treatments at both sites on all aspects except nodule dry weight. At Pang Da, all rhizobial inoculated treatments produced significantly more nodule dry weight of Navy bean than the control. At Kae Noi , though there were no significant differences among rhizobial inoculated treatments but only TAL 182 and KN 6 produced significant nodule dry weight than the control.