Biological Ways to Improve the Production of Forage Pea for Use in the Animal Feed Industry

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Key words : forage , pea , bacterial fertilizers , nutrient uptake

Introduction In grassland farming relatively large amounts of chemical fertilizers are applied . It is clear that the situation could be largely improved if the use of chemicals would be replaced by environmentally friendly biologicals together with leguminous plants (Lugtenberg et al . , 2004) . Legumes such as pea can supply not only a good source of protein for livestock , but can also provide a cheap source of nitrogen to support grass production , and improve soil organic matter through decaying nodules (Lascano , 2001) . The objectives of this work was to monitor the effect of inoculation of soybean and peas with *Rhizobium* and nitrogen fixing bacterial strains , so as to find and develop the most effective bacterial fertilizers for growing peas under nutrient deficient salinated soil of Uzbekistan .

Material and methods Experiments were carried out in arable fields of Tashkent province , north-eastern part of Uzbekistan , characterised by a calcareous serozem soil (1 % organic matter ; 0 .6 mg N 100 g^{-1} soil ; 3 .0 mg P 100 g^{-1} ; 12 mg K 100 g^{-1} ; 6 mg Mg 100 g^{-1} soil ; pH 7 .4) . Pea (*Pisum sativium*) seeds and bacterial strains *Pseudomonas alcaligenes* 15 , and *Rhizobium meliloti* 39 were used for this study . The bacteria were formulated with peat and seeds were inoculated with bacterial inoculants . Plants were grown in open field conditions with a temperature of 36℃ to 38℃ during the day and 20℃ to 24℃ at night . Five weeks after germination , shoots and roots were separated and dried at 105℃ before determining the root and shoot dry weight and N , P , K content of plant . The data were analysed with an ANOVA and Student-Newman-Keuls test for testing the significant differences ($p<0.05$) of main effects .

Results The results showed that bacterial inoculants *Pseudomonas alcaligenes* 15 , and *Rhizobium meliloti* 39 increased shoot and root dry matter of pea significantly from 28% to 38% as compared to the control . Shoot growth increased more than root growth . This increase in biomass translated into significantly higher N , P , and K contents (Table 1) . They increased N up to K and P uptake significantly . The bacterial strains were capable of fixing atmospheric N , and were able produce auxin .

Table 1 *The influence of effective bacteria strains on root and shoot nutrient uptake of pea on a calcisol (pot experiment , mean and standard deviation of 6 replicas per treatment , control= 0 .0268 N mg/shoot , 0 .0076 N mg/root ; 0 .0021 P mg/shoot , 0 .0007P mg/root ; 0 .0194 K mg/shoot , 0 .0046 K mg/root (100%)) .*

Bacterial Strains	N		P		K	
	Shoot	Root	Shoot	Root	Shoot	Root
Control	100 (0 ,0082)[1]	100 (0 ,0067)[1]	100 (0 ,0019)[1]	100 (0 ,0283)[1]	100 (0 ,0225)[1]	100 (0 ,0311)[1]
P . alcaligenes 5	112	132*	129*	126*	111	118*
Rhizobium meliloti 39	114*	115*	129*	109*	110	110
LSD< 0 .05	12	15	14	14	12	14

[1] g/pot
Significantly different from the control for P<0 .05 .

Conclusion The results obtained in our work can have potential applications of bacterial inoculants as bio fertiliser for increasing the productivity of peas as forage crops under N poor soil conditions of Uzbekistan .

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