

Effects of Inoculum Densities of *Rhizobium Meliloti* and Different Rates of Nitrogen Fertilizers on Alfalfa Plants Grown in Calcareous Soil

A.M. Heggo and F.N. Barakah

Soil Science Department, College of Agriculture,
King Saud University, P.O. Box 2460, Riyadh 11451 Saudi Arabia

(Received 25/10/1422H; accepted for publication 16/1/1424H)

Abstract. The influence of *Rhizobium meliloti* inoculum density and application of different rate of nitrogen fertilizers, on nodulation, N_2 -fixation, dry matter and N or P nutrients uptake by alfalfa plants (*Medicago sativa* L.) grown in calcareous soil of Saudi Arabia was studied in pot experiment. Application of rhizobial inoculum densities up to (9×10^9) cell pot^{-1} and N-fertilizers (urea or diammonium phosphate denoted as DAP) up to 90 mg N pot^{-1} significantly enhanced nodulation, nitrogenase activity, dry matter, nitrogen and phosphorus contents in alfalfa plants grown on calcareous sandy soil. Increasing in dry matter due to application of different inoculum densities (9×10^7 , 9×10^8 and 9×10^9 cell pot^{-1}) in soil received N-fertilizer in rate of 90 mg N pot^{-1} , ranged from (60 to 110%) over noninoculated treatment that fertilized with the same rate of N-fertilizer. Highest nitrogen contents were found in plants inoculated with 9×10^9 rhizobial cell pot^{-1} and fertilized with DAP in rate of 120 or 150 mg N pot^{-1} . The peak of phosphorus concentration and contents in alfalfa plants was found when soil treated with (DAP) in the rate of 150 mg N pot^{-1} and inoculated with *Rhizobium* with density of (9×10^9) rhizobial cell pot^{-1} . Residual nitrogen and phosphorus concentrations in soil after harvesting of alfalfa crop, tend to increase significantly by increasing both rhizobial inoculum density and N-fertilizer rate. From the economic point of view, this work recommends the usage of (DAP) as a nitrogen fertilizer at the rate of 90 Kg N h^{-1} along with the rhizobial inoculant at the density level of (5×10^7) cell seed $^{-1}$ which equal (72×10^{12}) cell Kg^{-1} seeds.

Keywords: Alfalfa, *R. meliloti*, inoculum density, nitrogen fertilizer, calcareous soil.

Introduction

Nitrogen is one of the most limiting factors affecting crops production in arid and semi arid zones. In north Africa and west Asia, there are 30 millions hectares of fallow land suitable for pasture and forage legumes, which could add about 1.4 millions tones of nitrogen to the soil per year [1]. There are many problems in rhizobia/legume association including adapted cultivars and inability of plants to nodulate with wild rhizobia [2,3]. Most of Saudi soils are arid, especially Riyadh region and also known to