

Influence Of Nitrogen Sources On Nodulation And Nitrogenase Activity In Common Bean.

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ABSTRACT

Effects of combined nitrogen from various nitrogen sources such as KNO_3 (2.3, 7.0 mM), urea (7.0mM), NH_4Cl (7.0mM) and NH_4NO_3 (7.0mM) on nodulation, plant dry weight, nodule fresh weight, nitrogenase activity and specific nodule activity were studied in French bean cultivar HUR-9 and its two nitrate tolerant host mutants *nts-1* and *nts-2* induced through ethyl methane sulphonate, in interaction with standard culture (RMG-1) of *Rhizobium leguminosarum* bivar phaseoli. All the characters related with nitrogen fixation were retarded by addition of nitrogen from different nitrogen sources in the plant growth medium, which were very severe by NH_4Cl and NH_4NO_3 followed by urea and KNO_3 . Earlier two nitrogen sources completely retarded nodulation in the host HUR-9. Under the entire test conditions host mutants' *nts-1* and *nts-2* had higher values for all the characters studied as compared to their parent HUR-9. Host mutant *nts-2* was found to be most tolerant to the deleterious effect of added nitrogen on characters related with nitrogen fixation than *nts-1* and parental cultivar HUR-9.

Key words: Nitrogen fixation, nodulation, nitrogenase activity, common bean.

INTRODUCTION

Common bean, also commonly known as Rajmash is one of the most important source of protein for the hill people. It is widely cultivated as a commercial crop in Zone-III and Zone-IV of Himachal Pradesh. Commercial cultivars of common bean are known to be poor nitrogen fixers, however, in certain cases 40-60 kg nitrogen fixation per hectare has been reported (Bliss, 1993). It is the main reason behind application of about 80 kg nitrogen per hectare for commercial cultivation of common bean in India. Various nitrogenous fertilizers contain nitrogen in the form of nitrate which is known to stimulate nodulation at lower concentrations, however, at higher concentrations nitrate retards the development of nodules in legumes inoculated with *Rhizobium* through the inhibition of root hair infection (Munns, 1968 a) and through catabolic destruction of IAA (Libbengon and Torrey, 1973). Nitrate also decrease the level of nitrogen fixation by diminishing the supply of photosynthate to the nodules following its utilization in the assimilation of nitrate in the shoots and roots (Oghoghorie and Pate, 1971). It also inhibits the activity of nitrogenase in the bacteroids (Manna and Singh, 1988). Some other sources of nitrogen such as urea and ammonium salts cause acidification of the growth medium (Israel and Jackson, 1982) and the inhibitory effect of these nitrogen sources on nitrogen fixation and nodulation is

mediated indirectly through a reduction in pH rather than through the nitrogen status of the plant (Vigue *et al*, 1977).

In the present investigation effect of combined nitrogen from different nitrogen sources on nitrogen fixation in a French bean cultivar HUR-9 and its two nitrate tolerant host mutants *nts-1* and *nts-2* has been studied, with an aim to know the extent of reduction in nodulation and nitrogen fixation, and to ascertain the role of genetic alteration of host in overcoming the deleterious effect of added nitrogen on symbiotic nitrogen fixation.

MATERIALS AND METHODS

The experiments were conducted by taking common bean cultivar HUR-9 as host and a standard culture of *Rhizobium leguminosarum* bivar phaseoli RMG-1 as symbiont. Nitrate tolerant host mutants *nts-1* and *nts-2* were induced by using 0.3% EMS as described by Carroll *et al*. 1985. To study the effects of combined nitrogen from different nitrogen sources, seeds of cultivar HUR-9 and its mutants *nts-1* and *nts-2* were sown in pots containing pure sand. For each treatment 15 pots were used and five seeds were sown in each pot after inoculating with *Rhizobium* culture RMG-1 using gum-arabica as a carrier. The pots were arranged in CRBD having three replications. Nutrient solution as described by Pacobsky *et al*. (1984) was prepared and added with the desired concentrations of different nitrogen sources separately. The pots were fed

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