PAK. J. SOIL SCI., VOL. 12 (3-4), 1996

RELATIVE SIGNIFICANCE OF NH_4^+ AND NO_3^- FOR WHEAT (*TRITICUM AESTIVUM L.*) GROWING IN FIELD FERTILIZED WITH AMMONIUM NITRATE SELECTIVELY LABELLED WITH ^{15}N

A. Hamid and M. Ahmad[1]

ABSTRACT

Rates of N uptake by wheat (Triticum aestivum L., cv. Mexi-Pak-65) from NH_4^+ and NO_3^- forms applied as ammonium nitrate selectively labelled with ^{15}N were measured in a field experiment. The dry matter and N yields were significantly increased with fertilizer N application compared to those from unfertilized soil. Both NH_4^+ and NO_3^- forms of inorganic N were absorbed by wheat, but NO_3^- uptake was dominant. The wheat crop used 37.7% and 54.0% of $^{15}NH_4^+$, 46.0% and 62.7% of $^{15}NO_3^-$, applied as ammonium nitrate at seeding time and tillering stage, respectively. Thus the uptake of labelled N showed that NO_3^--N was more available form of N for wheat than NO_4-N. However, the effective use of fertilizer N (ratio of labelled N in grain to labelled N in whole plant) was statistically similar for the two forms of N. The application of fertilizer N increased the uptake of unlabelled soil N by wheat crop, a result attributed to a positive added N interaction, which varied with the time of applying fertilizer N; the dose applied at seeding caused greater added N interaction than that applied at tillering stage. Both NH_4^+ and NO_3^- caused statistically similar added N interaction at the respective time of fertilizer N application. The A values varied with the form of N and the time of applying the fertilizer N. As the root biomass increased substantially in response to fertilizer N application and there was a significant positive correlation between added N interaction and A values ($r=0.960^*$), the observed added N interaction in the present study was considered to be real.

INTRODUCTION

It has been observed in a number of studies that the application of NH_4^+-N to soil - plant system increases the mineralization (Jenkinson *et al.*, 1985: Wickramasinghe *et al.*, 1985) and the plant availability (Hart *et al.*, 1986; Recous *et al.*, 1988) of the native soil N. The increased mineralization and availability of soil N is attributed to the so-called priming effect (Hauck and Bremner, 1976). Recently (Jenkinson *et al.*, regarding the added N interaction of applied NO_3^--N. In incubation studies NO_3^--N caused much lower interaction with native soil N as compared with NH_4^+-N in an acid soil and a neutral soil (Wickramasinghe *et al.*, 1985). Whereas no added N interaction was observed during assimilation of NO_3^--N by wheat (Hart *et al.*, 1986). However, Sorenson (1982) observed a significant added N interaction during assimilation of NO_3^--N by barley in the field soil amended with ^{15}N labelled organic matter. All these studies used separate sources of NO_3^--N. The relative added N interaction from NH_4^+-N and NO_3^--N simeltaneously applied in one souce (as NH_4NO_3) has rarely been assessed under field conditions.

The objectives of our work were: (1) to study the uptake of N from NH_4^+ and NO_3^- forms from NH_4NO_3 by wheat under field conditons, and (2) to assess the added N interaction caused by NH_4^+-N and NO_3^--N simultaneously applied to wheat in a single carrier as NH_4NO_3.

MATERIALS AND METHODS

Location and Climate

The experiment was conducted on the farm of the Nuclear Institute for Agriculture and Biology, Faisalabad, Pakistan, which is located on a plain 184.5 m above sea level, 70°0, - 73°45, SE and 30°32· - 30°0·N. The area has a semi-arid and subtropical continental climate. Wheat is grown in the cold season extending from November to April. At sowing, the average maximum temperature is 25.7°C and the average minimum temperature is 9.6°C. At harvest, the average maximum temperature rises to 30.4°C and the average minimum temperature to 15.6°C. January is the coldest month, with an average maximum temperature of 17.1°C, and a short spell of frost for 10-12 days. On average 102 mm rainfall falls during the wheat growin period.