INTERACTIVE EFFECT OF NITROGEN AND POTASSIUM ON NITROGEN USE EFFICIENCY IN WHEAT UNDER SALINE CONDITIONS

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Abstract

Wheat is moderately classified as a moderately salt tolerant crop. Appropriate use of nitrogen (N) and potassium (K^+) under salt stress condition considered as an effective approach to avoid N losses as ammonia (NH_3) and to obtain improved nitrogen use efficiency (NUE). In this study N and K application under normal and saline soil conditions were compared in a pot study under semi-controlled conditions. The results indicated that maximum NH_3 losses (16%) were in saline soil on 2nd day of urea and calcium nitrate application. However, when K as potassium sulphate (SOP) or potassium chloride (MOP) was applied along with N sources apparent decline in NH_3 losses (7%) was observed. Maximum increase in grain N content (3.61%) was observed under application of calcium nitrate with MOP in saline soil. The maximum increase in grain K^+ content (3.05%) was observed under application of urea with SOP in normal soil. While, maximum NUE (30.89%) was observed under application of calcium nitrate with SOP in saline soil. It was concluded that application of N from any source of the two sources shoed better NUE with SOP or MOP application rather using alone in saline soil reducing ammonia losses.

Keywords: nitrogen, potassium, saline soil, ammonia losses, wheat

1. Introduction

Pakistan is ranked in top ten wheat cultivating countries with production of 24 million tons on more than 9 million hectares. However, the average grain yield in Pakistan is very low and imbalance fertilizer is among many reasons for low yield. Most of the farmers are dependent only on N fertilizers and excessive N fertilization is not only reducing the profit margins but also causing N pollution due to low nitrogen use efficiency (NUE) and atmospheric emissions of N gases. In similar climatic conditions neighbouring countries are getting much better yield with little improved management practices including nutrient management (Ashraf *et al*., 2013).

Nitrogen is considered as the most efficient factor resulting in higher biomass and increased grain protein content and crucial part of living tissue synthesis, proteins, phytochromes, coenzymes, chlorophyll contents and nucleic acids. Most of the cereal producing soils of Pakistan lacks in soil K content that causes low soil fertility and yield loss. Increase in nitrogen use efficiency could be possibly obtained through optimum K and N fertilization. Interaction exists between N and K for better N usage by plants for

protein and amino acids makeup. Adequate use of N and K fertilizers in crops proved more profitable for farmers and helpful reduce environmental hazards. Potassium have most important role in transferring of NO_3^- to ariel parts of plants that enhances nitrate assimilating enzymes. These enzymes acted in ways to improve N. Nitrogen assimilation in plants and thus it enhances NUE. Potassium is important for its function in osmoregulation and stress alleviation especially in salt affected soil. The NUE is very low worldwide and recorded 30% in cereal crops. While NUE in wheat is estimated very low about 20 to 50%. Volatilization of ammonia is the main loss of N from soil fertilization. Ammonia loss occur from the conversion of ammonium to ammonia. In Pakistan it is one of the major threats for agriculture sustainability.

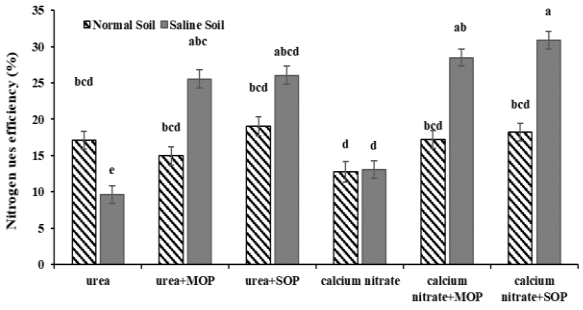
Almost 40% of land in Pakistan affected by salinity causes 25 % reduction in crop production causing a loss of 2.5 billion with each passing year. Based on literature it is possible to enhance NUE efficiency, especially under saline-sodic conditions reducing detrimental effect of Na. Present study was conducted to investigate the interactive effect of N and K on NUE and ammonia gas losses.

2. Material and Methods

A pot experiment was conducted with six treatments including recommended urea, calcium nitrate, urea with MOP, urea along with SOP, calcium nitrate with MOP, calcium nitrate with SOP. Treatments were replicated four times in completely randomize design with factorial arrangement. Different morphological and physiological parameters including plant height, spike length, tiller per pot, flag leaf fresh weight, evapotranspiration rate, 1000 grain weight, shoot fresh weight, chlorophyll contents were measured. Shoot, flag leaf, grain N, K^+, Na^+ content, and NH_3 losses were determined by using static chambers after 2nd and 3rd N split application (Bremner and Douglas, 1971). NUE was also calculated.

3. Results and Discussion

Maximum grain N content was recorded under calcium nitrate with SOP treatment while maximum K^+ content was recorded under calcium nitrate application along with MOP. Maximum ammonia emissions recorded on 2nd and 3rd day soon after N application. However, application of both MOP and SOP resulted in reduced ammonia emissions along with calcium nitrate application, but not in case of urea application. MOP and SOP both can be considered beneficial as it resulted in increased NUE along with reduced ammonia emissions in saline soils, especially.



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