

Effects of different nitrogen levels on growth, yield and nutrient uptake of wheat (*Triticum aestivum* L.)

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ABSTRACT

The effect of different levels of nitrogen on growth, yield, and nutrient uptake of wheat (*Triticum aestivum* L.) was evaluated in a field experiment, conducted at Agricultural Farm Mungeli- Bilaspur, Chhattisgarh, India during 2003 and 2004. The experiment was laid out in randomized complete block design (RCBD). Nitrogen @ 0, 25, 50, 75, 100 and 125 kg/ha was applied in respective plots in the form of urea. Various growth and yield parameters of the crop were influenced differently by various nitrogen levels. The studies concluded that 125 kg N/ha is optimum nitrogen requirement of wheat variety "Raj 3077". The analysis for respective years of experimentation revealed that an application of 125 kg N/ha significantly increased the plant height (95.2 & 96.7 cm), total number of tillers (1402 & 1389/m²), the number of green leaves (1067 and 1087/m²), dry-matter accumulation (14.65 and 14.45 tonnes/ha), number of grains per spike (40.5 & 42.8), 1000 grain-weight (48.1 & 49.8 g), grain and straw yields (4667 and 5884 k/ha based on pooled data), and uptakes of N and P (102.3 and 27.01 kg/ha respectively based on pooled data) of wheat.

Key words: Fertilizer, Nutrient uptake, Nitrogen, Tiller, Wheat.

INTRODUCTION

Among cereals, wheat (*Triticum aestivum* L.) is major component of the cropping systems adopted across the country (except southern states) hence there is need to further improve productivity of wheat and wheat-based cropping systems. Wheat like other commonly grown field crops requires 16 essential elements to complete the metabolic processes necessary for growth and reproduction (Andrew et al., 1968; Graham et al., 1977). Role of nitrogen in increasing growth (Mandal et al., 1992) and yield parameters (Kirrilov and Pavlov, 1989) is well recognized. Crops express maximum genetic yield potential when grown in good environments and under good management practices. Some factors, like increased rates of fertilizer nitrogen, may increase the yield but reduce the quality of the grain (Conry, 1995). Given the importance of nitrogen fertilization, it is necessary to know what the best dose is for each variety as well as its influence on components of yield and other agronomic parameters such as the cycle, plant height, lodging and moisture content of the grain, in order to obtain better knowledge of said productive response. In normal conditions, the quantity of fertilizers to be applied depends on crop, inherent soil fertility status, yield goal and other considerations like irrigated or rainfed conditions. Optimal production requires suitable cultural practices including proper fertility management. Keeping these points in view, the present investigation was undertaken to determine the optimum nitrogen requirement and productivity of wheat variety "Raj 3077" in Chhattisgarh, India at the Agricultural Farm Mungeli- Bilaspur.

MATERIALS AND METHODS

A field experiment on wheat variety "Raj 3077" was conducted at Agricultural Farm Mungeli- Bilaspur, Chhattisgarh, India during the rabi seasons of 2003 and 2004. The analysis for respective years of experimentation revealed that the soil had 0.52, 0.58% organic carbon, 200.5, 214.4 kg/ ha available nitrogen, 19.4, 20.9 kg/ ha available phosphorus, 203.4, 207.2 kg/ha available potassium, 9.1 and 9.3 mg/ kg available sulphate-sulphur, and Cd 0.20, 0.22 mg/ kg soil with pH 6.97 and 7.19. The experiment was laid out in randomized complete block design with three applications of urea as nitrogen source. Nitrogen @ 0, 25, 50, 75, 100 and 125 kg/ha was applied in respective plots at the time of sowing.

A uniform application of 26 kg/ha P as single super phosphate (SSP) and 100 kg/ha K as K₂O were given to all the plots. Wheat variety "Raj 3077" was sown at a row spacing of 25 cm x 10 cm in the first week of November. Plots received identical cultural treatments in terms of ploughing, cultivation, seed rate, sowing method, P and K

fertilizers, and disease control. Chemical herbicides were employed against different weeds during the course of study.

The plant height, tillers/m² and green leaves/ m² were measured 100 days after transplanting. The observations on dry-matter accumulation were recorded up to 120 days after transplanting (at 30-days interval). The plots were harvested and the total grain and straw yields were recorded and yield-attributes viz grains/spike and 1000-grain weight were recorded from plant samples. The nitrogen and phosphorus in plants were analysed as per standard methods, viz Nessler's reagent colorimetric method (Linder, 1944) and Vanadomolybdo phosphoric yellow colour method (Richards 1968), respectively. The data were analysed statistically on pooled basis for both the years, as per procedure suggested by Gomez and Gomez (1984).

RESULTS AND DISCUSSION

All the growth attributes, i.e. plant height, tillers number, the number of green leaves and dry-matter accumulation were significantly affected by applied nitrogen at all the growth stages of the crop.

The data presented in Table 1 revealed a statistically significant increase in plant height due to increasing levels of nitrogen fertilizer throughout the measurement period. Maximum plant height (95.2 & 96.7 cm) was recorded where N was applied 125 kg /ha during 2003 and 2004 respectively. The increase in plant height in response to application of N fertilizers is probably due to enhanced availability of nitrogen which enhanced more leaf area resulting in higher photo assimilates and thereby resulted in more dry matter accumulation. These results are supported by the findings of Mandal et al. (1992).

The number of tillers/m² significantly affected by different doses of N (0 to 125 kg/ha) fertilizer (Table 1). Application of N @ 125 kg/ ha resulted in highest (1402 and 1389) number of tillers/m² during 2003 and 2004, respectively. These results were statistically at par with that of treatment T5. The enhancement in tiller number with increase in fertilizer dose is attributed to the rapid conversion of synthesized carbohydrates into protein and consequent to increase in the number and size of growing cells, resulting ultimately in increased number of tillers (Singh and Agarwal, 2001).

The number of green leaves increased significantly with an increase in N level at all the growth stages of the crop (Table 1). Application of N @ 125 kg/ ha resulted in highest (1067 and 1087/m²) number of green leaves/m² during 2003 and 2004, respectively. Under the treatments, the control plots produced lowest number of green leaves (607 & 601/m²) during 2003 and 2004 respectively. It might be