



## EFFECT OF FOLIAR APPLICATION OF NITROGEN, POTASSIUM AND ZINC ON WHEAT GROWTH

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### ABSTRACT

A research trial was planned to find out the effect of foliar application of Nitrogen (N), Potassium (K) and Zinc (Zn) solutions on the growth of wheat cultivar (variety) Ghazanive-98. The experiment was conducted at Agriculture Research Institute Tarnab- Peshawar Pakistan during 2002-2003 and data was recorded on emergence of plants  $m^{-2}$ , number of tillers  $m^{-2}$ , plant height (cm), number of days to anthesis and number of number of spikes  $m^{-2}$ . The statistical analysis showed that number of plants emerged  $m^{-2}$ , number of tillers  $m^{-2}$ , plant height (cm) and number of spikes  $m^{-2}$  were significantly affected while number of days to anthesis was not affected significantly by foliar treatments. Maximum emergence  $m^{-2}$  (309), number of tillers (527)  $m^{-2}$ , plant height (100.50cm) and number of spikes (238)  $m^{-2}$  were recorded in those plots which were sprayed with 0.5% N, 0.5% K and 0.5% Zn solutions two times while minimum emergence  $m^{-2}$  (130), number of tillers (263)  $m^{-2}$ , plant height (75.25cm) were recorded in control plots and minimum number of spikes (123)  $m^{-2}$  was recorded in plots sprayed with 0.5% K solution two times. It was concluded that growth performance of wheat was highly influenced by the application of two times spray of 0.5 % N, 0.5% K and 0.5% Zn solutions.

**Keywords:** wheat, growth performance, foliar application, nitrogen, potassium, zinc.

### INTRODUCTION

Wheat (*Triticum aestivum* L.) belongs to family Poaceae (Gramineae) and is an annual self pollinated and photo periodically long day cool season cereal. It ranks first among the cereal crops in Pakistan. The prosperity of Pakistan depends directly and indirectly on the proper wheat husbandry. During 2006-2007 in Pakistan, the total area under wheat cultivation was 8578.2 thousand hectares with a total production of 23294.7 thousand tones while in Khyber Pakhtunkhwa area under wheat cultivation during the same year was 754.3 thousand hectares with 1160.4 thousand tones production (Agriculture Statistics of Pakistan, 2006-2007).

Wheat demand in Pakistan is increasing day by day due to increase in population. To meet the required demand, more area should be brought under cultivation to increase production. Wheat yield can also be increased by the use of recently developed high yielding; lodging and disease resistant varieties, irrigation and use of appropriate amounts of macro and micro-nutrients (Nitrogen, Potassium, Zinc etc) either as a soil or foliar application. The foliar application of nutrients is more effective as compared to soil applied nutrients because of effective utilization by plant and minimum cost per unit area (Narang *et al.*, 1997).

Nitrogen and Potassium are the main macronutrients that are taken by the plants in comparatively large quantities and these are usually deficient in most soil. So foliar spray of these elements is the best method of fertilizer application to control their losses from the soil and make them more and easily available to the plant and in turn increase the yield and quality of wheat grain (Zhiguleve, 1992).

Potassium (K) is involved in growth of meristematic tissue and is indispensable for the maintenance of cell turgor pressure, which is required for cell expansion (Rogalski, 1994). The use of K is especially important where high rate of nitrogen and phosphorus are used and when high yield is expected (Defan *et al.*, 1999 and Narang *et al.*, 1997).

Zinc (Zn) is also involved in key metabolic processes such as respiration, photosynthesis and assimilation of some major nutrients. Zinc plays an important role in enzymes activation as well. The efficiency of such type of elements is improved when it is used in combination with other elements like N and K (Rajput *et al.*, 1995 and Fathi *et al.*, 1990).

The present study was conducted to determine the effect of foliar application of Nitrogen, Potassium and Zinc on the growth performance of wheat under the irrigated areas of Peshawar valley.

### MATERIALS AND METHODS

An experiment titled "Effect of foliar application of Nitrogen, Potassium and Zinc on wheat growth" was conducted in research farm of Khyber Pakhtunkhwa, Agricultural University, Peshawar, during 2002-03. The soil of experimental site was silty clay-loam with a clay type montmorillonite, low in nitrogen (0.03 - 0.04 %), low in organic matter (0.8-0.9%) and alkaline in nature with pH of 8.0-9.2. The experiment was laid-out in Randomized Complete Block Design (RCBD), having four replications. Various treatments including control, water spray, and one time spray solution of i) 0.5% N ii) 0.5% K iii) 0.5% Zn iv) 0.5 % N+ Zn v) 0.5% K+ Zn vi) 0.5% N+ K+ Zn while two times spray solution of i) 0.5% N ii) 0.5% K iii) 0.5% N+ Zn was applied to wheat crop at



tillering and boot stages. Sources of nitrogen, potassium, zinc used was urea, sulphate of potash and zinc sulphate, respectively. Data regarding number of number of plants emerged  $m^{-2}$ , number of tillers  $m^{-2}$ , number of days to anthesis, plant height (cm), and number of spikes  $m^{-2}$ . Number of plants emerged ( $m^{-2}$ ) was recorded by counting seedlings in three randomly selected sampling units in three central rows plot<sup>-1</sup>, each of which consisting of one meter long row. Data on number of tillers  $m^{-2}$  in randomly selected sampling units was recorded by counting number of tillers plant<sup>-1</sup> and then converted to number of tillers  $m^{-2}$ . Number of days to anthesis calculated from date of sowing to date of anthers coming out from glumes. Plant height was recorded by measuring height from ground level to the tip of the spike of three randomly selected tillers plot<sup>-1</sup> and then converted to average value. Data on number of spikes  $m^{-2}$  was recorded by counting spikes in three randomly selected sampling units and then calculated through the following formula.

$$\text{Spikes } m^{-2} = \frac{\text{Number of spikes in three rows}}{\text{Row length} \times \text{Number of rows} \times \text{R-R distance}}$$

The data were statistically analyzed using analysis of variance for Randomized Complete Block Design (RCBD).

## RESULTS AND DISCUSSIONS

### Emergence of plants $m^{-2}$

None of the treatment had been applied by foliar spray when data was recorded on emergence of plants  $m^{-2}$ , however the data recorded on various treatments were analyzed, and showed significant differences. Maximum emergence of plants  $m^{-2}$  (309) was recorded in plots sprayed with 0.5% N + 0.5% K + 0.5% Zn solution two times, while minimum emergence of plants  $m^{-2}$  (130) was recorded in control (No spray) plots. The possible argument could be the increased seed rate which produced significant effect on the emergence of plants  $m^{-2}$ .

### Number of tillers $m^{-2}$

The foliar application of N, K and Zn solutions had significant effect on the number of tiller  $m^{-2}$  (Table-1). Maximum number of tillers  $m^{-2}$  (527) was recorded in plots sprayed with 0.5%N + 0.5%P + 0.5% Zn solutions two times, while minimum number of tiller  $m^{-2}$  (263) was recorded in control (no spray) plots. This might be due to the fact that crop get more nutrients through foliar application which in return produced more tillers  $m^{-2}$ . Secondly it might be due to that crop response was more to favorable environment in term of increased vegetative growth like tillers production. These results are in the conformity with those of Dafen *et al.*, (1999), who reported that number of tillers  $m^{-2}$  increased with foliar application of Potash, similarly Shah and Saeed (1989) also reported that foliar spray of urea increased the number of productive tillers.

### Number of days to anthesis

The statistically analysis of variance showed (Table-1) that number of days to anthesis has not significantly affected by foliar spray. Maximum days to anthesis (118) was recorded in plots sprayed with water and 0.5% N solution, while minimum number of days to anthesis (112) were recorded in plots sprayed 0.5% Zn solution and 0.5% N + 0.5% K solution. The possible arguments could be due to that 0.5% N spray increases the vegetative growth of the crop and so it takes maximum number of days to reach up to anthesis stage. The contrasting results were given by Zameer *et al.*, (2006). They reported that wheat varieties give more response towards foliar application of Nitrogen and Potassium. These results are in the conformity of Smith *et al.*, (1991) who reported that days to anthesis increased with foliar spray of urea.

### Plant height (cm)

The analysis of variance (Table-1) revealed that plant height had significantly affected by foliar application of N, K and Zn solutions. Maximum plant height (100 cm) was recorded in those plots which were sprayed with 0.5% N + 0.5% K + 0.5% Zn solution two times, while minimum plant height (75 cm) was recorded in control (no spray) plots. This might be due to foliar application of N, K and Zn solution to increase the stem length at boot stage which in turn resulted in maximum plant height. These results are in close agreement with those of Rogalski (1994).

### Number of spikes $m^{-2}$

The number of spikes  $m^{-2}$  is given in Table-1. The statistical analysis of variance showed that foliar spray of 0.5% N + 0.5% K + 0.5% Zn solutions had significant effect on the number of spikes  $m^{-2}$ . Highest number of spikes  $m^{-2}$  (238) were obtained from those plots which were sprayed with 0.5% N + 0.5% K + 0.5% Zn solution two times, while minimum number of spikes  $m^{-2}$  (123) were recorded in plots sprayed with 0.5% K solution two times. This might be due to more number of tillers each of which bear more number of spikes. Secondly might be due to more suitable temperature. These results are completely supported by the findings of Smith *et al.*, (1991) who reported that foliar spray of urea increase the number of spikes.

## CONCLUSIONS AND RECOMMENDATIONS

The foliar applications of 0.5% N + 0.5% K + 0.5% Zn solutions at tillering and booting stages influenced significantly the growth performance of wheat. Therefore foliar application of 0.5% N + 0.5% K + 0.5% Zn solutions two times i.e., at tillering and boot stages is recommended for best growth of wheat under the agro-climatic zone of Peshawar valley.



**Table-1.** Effect of foliar application of nitrogen, potassium and zinc solutions on plants emergence  $m^{-2}$ , number of tillers  $m^{-2}$ , days to anthesis, plant height (cm) and number of spikes  $m^{-2}$ .

Treatment	Emergence $m^{-2}$	Number of tillers $m^{-2}$	Days to anthesis	Plant height (cm)	Number of spikes $m^{-2}$
Control (No spray)	146 d	263 e	114	75 g	136ef
Water spray	150 cde	303 cde	118	80 f	139 e
0.5% N solution (once)	172 cde	421 abcd	118	85 e	158 d
0.5% K solution (once)	204 bc	430 abc	117	87 de	192 c
0.5% N solution (twice)	178 cde	363 bcde	117	89 cd	162 d
0.5% K solution (twice)	130 e	293 de	116	92 bc	123 f
0.5% Zn solution (once)	174 bcd	345 bcde	112	87 de	186 c
0.5% N + 0.5% K spray (once)	189 bcd	395 bcd	112	94 b	182 c
0.5% N + 0.5% Zn spray (once)	159 cde	370 bcde	115	92 b	149 de
0.5% K + 0.5% Zn spray (once)	164 cde	365 bcde	115	94 b	155 d
0.5% N + 0.5% K + 0.5% Zn spray (once)	231 b	445 ab	115	98 a	216 b
0.5% N + 0.5% K + 0.5% Zn spray (twice)	309 a	527 a	115	100a	238 a
LSD	58.29	129.8	ns	2.856	14.47

Mean followed by one letter (s) are not significant statistically at  $P \leq 0.05$ .

ns = Non significant

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