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Effect of Foliar Nutrient Sprays on Yield Attributes and Grain Quality in Wheat Varieties

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Abstract

An investigation was conducted on the response of four wheat varieties *viz*., V1- HD 3226, V2- HI 1544, V3- DBW 187 and V4- PBW 1 Zn towards different foliar nutrient application. For foliar nutrition six treatments including control were applied. The treatments were T1 - No foliar fertilization (control), T2 - S (2% elemental sulphur), T3 - N (2% urea), T4 - Zn (0.5% Zn EDTA), T5 - K (1% KCl) and T6 - S (2% elemental sulphur) + N (2% urea) +Zn (0.5% Zn EDTA) + KCl (1%). The study revealed that the yield attributes of these wheat varieties were significantly influenced with foliar nutrition. Foliar application of nutrients was found a beneficial tool to enhance the yield of all these four prevailing wheat varieties. However, elemental S could not prove its impact on yield attributes, all other nutrients may be recommended for yield enhancement of wheat.

Keywords: Wheat varieties, Foliar nutrition, Yield attributes, Statistical design and analysis

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Introduction

Wheat is one of the world's most extensively cultivated and India's second most important staple food crop. It is grown on 17% of the world's cropland and accounts 35% of all food grain production, therefore it is critical to global food security now and in the future too [1]. It is one of the most important cereal crops, with a total production of 765.7 million tonnes [2]. India has a land area of 31.61 million hectares under wheat with production of 109.52 million tonnes and productivity of 34.64 q/ha [3]. For achieving food security, development of high yielding wheat varieties always remains in progress. However, adequate yield can only be attained by proper nutrition. In addition to soil application of recommended doses of manure and fertilizers, foliar nutrition of suitable nutrients is inevitable. The supply of these necessary nutrients to plants through foliar spray has proven to be a successful strategy for raising crop output and enhancing the quality of its seeds [4]. Researchers found significant differences among wheat genotypes for number of productive tillers, biological yield and grain yield [5]. Therefore, this is required to identify suitable varieties for a particular set of management of foliar nutrition. Considering these factors, this study was conducted to evaluate the varietal differences of wheat for different set of foliar nutrition and to find out the most appropriate foliar nutrition plan for important wheat varieties.

Materials and Methods

The field experiment was laid in *rabi* season 2021-22 at D-3 block of Norman E. Borlaug Crop Research Centre, Govind Ballabh Pant University of Agriculture and Technology, Pantnagar (Uttarakhand). Geographically, the location is marked at an altitude of 243.48 m above the mean sea level situated at 29˚ N latitude and 79.5˚ E longitude. This region is known as "Tarai" and is geographically considered the foothills of the Shivalik Range of the Himalayas. Four important wheat varieties *viz*., V1- HD 3226, V2- HI 1544, V3- DBW 187 and V4- PBW 1 Zn were selected for the study and six different foliar nutrition including control having following details were applied on all these four varieties of wheat;

- T1 - No foliar fertilization (control)
- T2 - S (2% elemental sulphur)
- T3 - N (2% urea)
- T4 - Zn (0.5% Zn EDTA)

- T5 - K (1% KCl)
- T6 - S (2% elemental sulphur) + N (2% urea) +Zn (0.5% Zn EDTA) + KCl (1%)

Experiment field view

Treatment application

Figure 1. Representative experimental photos.

The experiment was conducted in strip plot design with three replications. Equal doses of fertilizers (150 kg N:60 kg P_2O_5:40 kg K_2O/ ha) and same cultural operations were performed. The tiller which bore ear was treated as effective tiller. The effective **t**illers in 1m x1m row lengths were counted and expressed as number/ sq m. After leaving 1 row from both the ends of the plots the remaining area was considered as net plot for harvesting and was harvested for yield. Grains were separated from straw manually and yield of each plot was noted separately. By averaging the values, the mean yield of the plot was calculated. From the sampled spikelets, a total of 1000 grains were taken and weighed separately and grain weight was computed and expressed in grams. The yield was taken at 14% moisture of grains. It was recorded in kg/plot and expressed in q/ha.

Results and Discussion

The yield attributes presented in Table 1 showed that in all the four varieties of wheat the number of effective tillers/ m^2 remained the lowest under control. 2% Urea spray was found to produce maximum number of effective tillers/ m^2 in all the four varieties. However, V1- HD 3226 and V4- PBW 1 Zn were the foremost with 332 effective tillers/ m^2. Other nutrients also increased the effective tillers/ m^2 as compared to control. The significant increase in the number of spikes/m² in nutrient spray treatments may be attributed to better growth and development attained by the crop due to additional application of nutrients known to be involved in photosynthesis, protein metabolism and energy transfer reactions. These results are in agreement with the finding of [6] and [7]. Foliar nutrition, by balancing nutrient delivery, helps the crop in performing its functions to the best of its ability. As a result, tiller production increases, and the spike number increases. Higher spikes are due to increased dry matter build-up, which is a precursor to higher yield qualities. In present study, among foliar spray treatments, foliar application of urea produced higher number of tillers This might be due to adequate availability of N required to accelerate vegetative growth that has resulted with maximum impact for tiller formation and growth. Zn is required for the synthesis of tryptophan which plays an active role in the production of auxin. Auxin is essential for tiller growth. whereas, potassium maintains cell turgor pressure, that required for cell expansion necessary for tissue growth. More number of tillers developed due to its genetic characteristics, which includes open canopy with narrow and straight leaves resulted in significant differences in tiller count among varieties.

1000 grain weight was also found to be lowest under control for all the varieties and application of elemental S also could not increase 1000 grain weight significantly. Urea 2% and KCl 1% increased the 1000 grain weight with maximum difference from control. Varietal differences for individual treatments were also significant and V3- DBW 187 showed minimum value for 1000 grain weight. Foliar application of urea at the later growth stages of the crop might have increased the availability of nitrogen to the crop which favoured enhanced accumulation of photosynthate in the grains. Zinc and K also involve in accumulation of photosynthates in the grain but to smaller extent in comparison to N. The results are in line with [8] and [9]. Except elemental S, foliar nutrition had significant effect on grain yield within a variety. Urea 2% showed its superiority over other treatments, however, mostly it was statistically *at par* to KCl 1%. The varietal differences for grain yield were also significant for given treatments and V2- HI 1544 gave lowest yield under all the treatments as compared to other varieties. Response of different varieties towards various treatments are subject to genetic potential of particular variety. V2- HI 1544 was found to be less responsive as compared to other

varieties for the given treatments in terms of yield attributes. However, careful observation of data revealed that the yield attributes of V2- HI 1544 were positively affected with the treatments over control and elemental sulphur.

Stimulating effect of nutrients on yield could be due to increment in biomass production, more vegetative growth and yield attributes as they play an important role in maintenance of balanced plant physiology. The results are in conformity to [6] and [10].

Table 1 Response of yield attributes of various wheat varieties towards foliar nutrition

Variety	**V1- HD 3226**	**V2- HI 1544**	**V3- DBW 187**	**V4- PBW 1 Zn**	**V1- HD 3226**	**V2- HI 1544**	**V3- DBW 187**	**V4- PBW 1 Zn**	**V1- HD 3226**	**V2- HI 1544**	**V3- DBW 187**	**V4- PBW 1 Zn**
Treatment	**No. of effective tillers/m²**				**1000 grain weight**				**Grain yield q/ha**			
T1- No foliar spray	300	292	302	296	35.0	36.5	32.9	37.6	39.2	31.4	45.2	44.3
T2- S- 2% elemental S	304	296	315	324	36.3	36.5	33.1	35.6	41.5	32.1	48.3	46.5
T3- N- 2% urea	332	320	331	332	37.5	38.7	35.2	38.0	45.9	37.6	54.4	53.0
T4- Zn- 0.5% Zinc EDTA	315		320	300	36.5	38.3	34.6	36.2	45.8	37.5	49.7	51.0
T5- K- 1% KCl	316	324	315	324	38.0	35.8	34.0	36.4	45.2	37.0	51.6	51.0
T6- S + N + Zn + K	320	300	319	308	36.9	37.2	34.0	35.6	45.3	35.0	51.2	49.0
CD @5%	Horizonal values at same level of Vertical factor-12.3 Vertical values at same level of Horizontal factor- 9.4				Horizonal values at same level of Vertical factor - 1.9 Vertical values at same level of Horizontal factor - 2.0				Horizonal values at same level of Vertical factor - 5.4 Vertical values at same level of Horizontal factor - 5.0			

Conclusion

Foliar application of nutrients has been found a beneficial tool to enhance the yield of all these four prevailing wheat varieties. However, elemental S could not prove its impact on yield, all other nutrients may be recommended for yield enhancement of wheat. Sulphur is a building block of protein and a key ingredient in the formation of chlorophyll and sulphur bonds that are vital for sustaining the protein structure in wheat. However, in the present study, additional supplementation of sulphur through foliar sprays, could not resulted in better position than other nutrients. This might be either due to the more pronounced effects of other treatments or the adequate availability of sulphur. Therefore, the role of sulphur as foliar application needs to be investigated in larger perspective including varying soil conditions and protein content of grains.

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