RESEARCH ARTICLE

Effect of Phosphorus, Zinc and Sulphur on Growth and Yield Attributes of Wheat (*Triticum aestivum*)

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ABSTRACT

A field experiment was conducted during the Rabi season 2019-2020 and 2020-2021 at Farmers field in Sant Kabeer Nagar District of Uttar Pradesh, to study the effect of phosphorus, sulphur and zinc on wheat (Triticum aestivum L) Pooled data revealed that the growth parameters, yield attributes and yield increased significantly with application of 50 kg P2O5, 20 kg S and 10 kg Zn ha-1.

Keywords: *Parameters, Zinc, Growth and Attributes.*

INTRODUCTION

Wheat is one of the most important cereal crops of India with diverse uses. Intensive cultivation has resulted in depletion of soil nutrients to a great extent thus nutrients requirement of crops has increased considerably during the last few years [1]. Phosphorus is the backbone of any fertilizer management programme and plays key role in energy related activities and development of root system. Sulphur performs many physiological functions like synthesis of sulphur containing amino acids which have positive role in improving quality of grain [2]. The soil of U.P. is deficient in micronutrient such as zinc, sulphur and boron. The application of N, P, K, S, and Zn containing fertilizer in proper proportion is necessary to augment the productivity of wheat. Hence, the effect of various nutrients in balancedproportion on yield of wheat will be of immense significance to understand the nutrients requirement because crops reach their full yield potential with adequate supply of various nutrients. Zinc is also an important micronutrient reported deficient in Indian soils and plays a significant role in various enzymatic and physiological activities of plant body. It helps in formation of chlorophyll and auxins [3]. The present investigation was therefore conducted to find out efficient and balanced use of fertilizers for sustainable crop production in wheat.

MATERIALS AND METHODS

The investigation was carried out during the winter (rabi) season of 2019-20 and 2020-21 at Farmers field in Sant Kabeer Nagar District of Uttar Pradesh. The soil was siltloam with 8.15 pH 0.43 organic carbon, 0.32 EC, available N (137.0 and 196.0 kg/ha), P (19.0 and 21.0 kg/ha), S (6.50 and 6.52 kg/ha), Zn (0.54 and 0.57 ppm) and medium in K (251.0 and 241.0 kg/ha). The experiment was laid out in split-plot design with 3 replications. Main plots were fertilized with 3 levels of phosphorus (25, 50 and 75 kg P2O5 ha-1) and Subplots were fertilized with 3 levels of sulphur (0, 20 and 40 kg S/ ha) and 2 levels of zinc (0, and 10 kg Zn/ha). Wheat variety 'HUW-234' was sown on 20 December 2019 during the first year and 23 December 2020 during the second year using a seed rate of 125 kg/ha at a row spacing of 20.0 cm. A common dose of 120 kg N/ha was applied in 3 splits (half basal, one-fourth first and

Table 1. Effect of phosphorus, sulphur and zinc on growth parameter, yield attributes and yield of wheat (pooled over two year)

Treatment	Plantheight	Dry matteraccumulation (g)perrunning meter	Numberofeffectivesh-oots(m^{-1} rowlength)	Spikelength(cm)	Number of spikelets $spike^{-1}$	Number of grainsspike^{-1}	1000-grain-weight(g)	Grain-yield(q/ha)	Straw-yield(q/ha)	Biological-yield(q/ha)
Phosphoruslevels(P_2O_5kgha^{-1})										
P25	77.22	152.83	57.04	7.73	19.85	36.43	31.78	30.56	42.05	72.60
P50	83.76	165.73	71.48	8.93	23.05	42.16	33.30	35.71	47.73	83.43
P75	87.15	172.47	74.56	9.17	23.74	43.53	33.93	36.73	49.48	86.21
SEm±	1.42	3.83	1.38	0.17	0.48	0.82	0.63	0.65	1.01	1.67
CDat5%	5.59	14.35	5.42	0.68	1.87	3.22	NS	1.90	3.97	6.56
Sulphurlevel(kgha^{-1})										
S_0	78.37	152.92	59.67	7.89	20.43	37.48	32.24	31.59	42.95	74.54
S20	83.95	166.89	70.97	8.79	22.68	41.95	33.10	35.08	47.52	82.59
S40	85.8	171.22	72.43	9.08	23.52	42.83	33.66	36.33	48.80	85.12
SEm±	1.28	2.32	1.00	0.16	0.31	0.78	0.60	0.65	0.67	1.57
CDat5%	3.7	6.71	2.89	0.46	0.90	2.24	NS	31.59	1.94	4.53
Zinclevels (kg ha^{-1})										
Zn_0	80.28	160.86	65.83	8.36	21.81	39.67	32.56	33.41	45.55	78.96
Zn_{10}	85.14	166.49	69.56	8.82	22.62	41.84	33.45	35.25	47.28	82.53
SEm±	1.04	1.89	0.82	0.13	0.25	0.63	0.49	0.53	0.54	1.28
CDat5%	3.02	3.47	2.36	0.38	0.73	1.83	NS	1.56	1.58	3.71

one- fourth at second irrigation). Sulphur was applied through elemental sulphur, phosphorus as diammonium phosphate and zinc applied through zinc oxide basal placed as per treatments.

RESULTS AND DISCUSSION

Growth characters Pooled data (Table 1) revealed that application of 50 kg P2O5/ha significantly increased the plant height, dry matter accumulation and total shoots which was significantly superior over 25kg P2O5/ ha application but remained at par with 75 kg P2O5/ha. This may be attributed to better proliferation of roots and increased uptake of nutrients. The finding confirms the results of [4]. Application of 20 kg S/ha significantly increased the plant height, dry matter accumulation and total shoots over no application. Further increase in level of S at 40 kg/ha could not bring significant improvementinthese parameters.Thegreater photosynthetic activity and chlorophyll synthesis due to sulphur fertilization seemed to have promoted vegetative growth. Similarresult was reported by [5-6]. Zinc fertilization at 10 kg/ha significantly enhanced all these growth parameters over the control. Zinc plays a pivotal role in regulating the auxin concentration in plant and nitrogen metabolism and might have improved these growth attributes. [7-8] also recorded significantly higher shoots/m row length and dry matter production of wheat over control.

Yield attributes and yield

Phosphorus fertilization at 50 kg P_2O_5/ha significantly increased effective shoots/m row length, grains/spike, spike length, test weight and grain, straw and biological yields of wheat over 25 kg. This could be attributed to the fact that phosphorus plays a key role in root development, energy transformation and metabolic processes in plant Brady (1986) also observed beneficial effect of phosphorus on the fruiting of plants and ascribed the beneficial effect to better translocation of desired metabolites to the yield contributing parts of the plant. These results' are in conformity with those of [9-10].

Successive increase in sulphur levels up to 20 kg/ha significantly improved effective shoots, grains/spike, spike length and seed,

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straw and biological yields. The increase beyond 20 kg S/ha was non-significant. Since available sulphur status of the experimental fields was medium (6.50 and 6.52 kg/ha S). S application improved nutritional environment of rhizosphere as well as plant system as evident from greater uptake of nutrients (Table 2) and ultimately metabolic and photosynthetic activity, resulting in better development of yield attributes and yield. Similar result were reported by [11] .Zinc fertilization @ 10 kg/ha significantly enhanced all the yield attributes and grain, straw and biological yields over the control. The increase in yield and yield attributes due to Zn fertilization might be the fact that Zn plays an important role in bio-synthesis of IAA and initiation of primordia for reproductive parts were reported by [12]. On the basis of the results it could be concluded that a combination of 50 kg P2O5 20 kg S and 10 kg Zn ha-1 proved to be most effective for improving the growth, yield attributes and yield of wheat.

Conflict of Interest: Authors declared conflict of Interest.

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