Original Research Article

Effect of Nitrogen and Sulphur on growth and yield of Wheat (*Triticum aestivum*.L)

Abstract

A field experiment was conducted during *Rabi* 2022 at Crop Research Farm, Department of Agronomy, SHUATS, Prayagraj (U.P). The soil ofthe experimental plot was sandy loam in texture, nearly neutral in soil reaction (pH 7.1), low in organic carbon (0.36 %), available N (171.48 kg/ha), available P (15.2 kg/ha) and available K (232.5 kg/ha). The experiment was laid out on Randomized Block Design with nine treatments; each replicated thrice based onone year experimentation. The treatments which are T_1: Nitrogen 80 kg/ha + Sulphur 15 kg/ha, T_2: Nitrogen 80 kg/ha + Sulphur 30 kg/ha, T_3: Nitrogen 80 kg/ha + Sulphur 45 kg/ha, T4: Nitrogen 100 kg/ha + Sulphur 15 kg/ha, T_5: Nitrogen 100 kg/ha + Sulphur 30 kg/ha, T_6: Nitrogen 100 kg/ha + Sulphur 45 kg/ha, T_7: Nitrogen 120 kg/ha + Sulphur 15 kg/ha, T_8: Nitrogen 120 kg/ha + Sulphur 30 kg/ha,T_9: Nitrogen 120 kg/ha + Sulphur 45 kg/ha are used. The results showed that application of Nitrogen 120 kg/ha + Sulphur 45 kg/ha was recordedto significantly higher Plant height (98.13 cm), No. of Tillers/hill (10.71), Plant dry weight (17.83 g/plant), whereas significantly highest Crop growth rate (7.47 g/m^2/day) was recorded with the treatment Nitrogen 80 kg/ha + Sulphur 15 kg/ha. However, significantly maximum No. of Grains/spike (47.34), Test weight (38.30 g), Grain yield (6.14 t/ha),and Straw yield (9.52 t/ha)was obtained in the treatment of Nitrogen 120 kg/ha + Sulphur 45 kg/ha as compared to other treatments.

Key words: Nitrogen,Sulphur, Wheat, Growth and yield.

Introduction

Wheat (Triticum aestivum L.), which triggeredthegreen revolution in the Indian subcontinent, is an important food grain providing nourishmentto nearly 35 per centof people worldwide. Ona global scale, the crop is grown over an area of 211.06 million ha with a production of 566.8million tonnes. India is the second largest wheat producer in the world, nextonly to China and the crop has provided the fastest growth to Indian agriculture. Among cereals, wheat is next to rice inthe area (24.23 million ha) and production (75.6 million

tonnes) **(Jagshoran et al., 2004).** Wheat contributes about 60 per cent of daily protein requirement and more calories tothe world diet than any other food crop**.** Asthe main staple food, wheat continues to assume greater significance in the years to come both from grain productivity andquality points of view. Wheat is one ofIndia's most important cereal cropswith diverse uses. Intensive cultivation has resulted inthe depletion of soil nutrients to a great extent;thus,thenutrient requirement of crops has increased considerably during the last few years.

The most crucial role of N in the plant is its presence in the structure ofthe protein, the mostimportant building substance from which the living material or protoplasm of every cell ismade. In addition, nitrogen is also found in chlorophyll, the green colouring matter of leaves.Nitrogen occupies a conspicuous place in plant metabolism. All vital processes in theplant areassociated with protein, of which nitrogen is an essential constituent. Although greater N application has produced higher yields, this is not a linear relationship(seebelow),andthereisanoptimum economicapplicationoffsettingincrementalyieldincrease against the cost of additional N inputs, which needs to be determined for individualcultivars **(King et al., 2003).** Availability Of N impacts crop development, affecting seedling establishment, tillering, canopy development as well as grain filling, all of which have the potential to affect final yield and determine the crop requirements.

Sulphur is anotheressential nutrient in all plant nutrients anda component of amino acids,which are the building block of protein. In cereal crops, sulphur ranges from 0.16-0.20%.Sulphur performs many physiological functions like synthesizing sulphur - containing aminoacids, which positively improve grain quality**(Chaudhary et al., 2003).**Sulphur is a structural constituent of organic compounds, someuniquely synthesized by plants, providing humans and animals with essential aminoacids(methionine cystine and cysteine). It is involved in chlorophyll formation andactivating enzymes and is a part of vitamins biotin and thiamine (B1) **(Hegde and SudhakaraBabu, 2007).** Sulphur deficiency in crops is gradually becoming widespread due tothe continuous use of sulphur-free fertilizers, high-yielding crop varieties, intensive multiple cropping systems, andhigher productivity.

Objectives:

To evaluateon effect of nitrogen and sulphur on growth and yield of wheat and study the economics of different treatment combinations.

Materials and Methods

The present examination was conducted during Rabi 2021 at Crop Research Farm, Department of Agronomy, SHUATS, Prayagraj, UP, located at 25.28^{o}N latitude, 81.54^{o}E longitude and 98 m altitude above the mean sea level. The experiment laid out in Randomized Block Design which consisting of nine treatments with T_1: Nitrogen 80 kg/ha + Sulphur 15 kg/ha, T_2: Nitrogen 80 kg/ha + Sulphur 30 kg/ha, T_3: Nitrogen 80 kg/ha + Sulphur 45 kg/ha, T4: Nitrogen 100 kg/ha + Sulphur 15 kg/ha, T_5: Nitrogen 100 kg/ha + Sulphur 30 kg/ha, T_6: Nitrogen 100 kg/ha + Sulphur 45 kg/ha, T_7: Nitrogen 120 kg/ha + Sulphur 15 kg/ha, T_8: Nitrogen 120 kg/ha + Sulphur 30 kg/ha,T_9: Nitrogen 120 kg/ha + Sulphur 45 kg/ha are used. The experimental site was uniform in topography and sandy loam in texture, nearly neutral in soil reaction (P^H 7.1), low in Organic carbon (0.38%), medium available N (225 kg ha^{-1}), higher available P (19.50 kg ha^{-1}) and medium available K (213.7 kg ha^{-1}). In the period from germination to harvest, several plant growth parameters were recorded at frequent intervals;several yield parameters were recorded after harvest. Growth parameters, plant height,and plant dry weight are recorded. The yield parameters likeSeeds/spikes, Test weight, Grain yield and stover yield were recorded and statistically analyzed using analysis of variance (ANOVA) as applicable to Randomized Block Design (Gomez K.A. and Gomez A.A. 1984).

Results and Discussion

Growth attributes

As can be seen in Table 1 growth parameters are summarized statistically. At 100 DAS, significantly highest plant height (98.13 cm) was recorded in the treatment with Nitrogen 120 kg/ha + Sulphur 45 kg/ha over all the other treatments. However, the treatments with application of Nitrogen 100 kg/ha + Sulphur 45 kg/ha (97.27 cm) and Nitrogen 120 kg/ha + Sulphur 30 kg/ha (97.72 cm) was statistically at par with treatment Nitrogen 120 kg/ha + Sulphur 45 kg/ha. The minimum plant height was recorded in the treatment combination of Nitrogen 80 kg/ha + Sulphur 15 kg/ha which is (94.33 cm). Significantly maximum number of tillers/hill (10.71) was recorded withNitrogen 120 kg/ha + Sulphur 45 kg/ha. However, the treatments with Nitrogen 100 kg/ha + Sulphur 45 kg/ha (10.47) and Nitrogen 120 kg/ha + Sulphur 30 kg/ha (10.56) was statistically at par with Nitrogen 120 kg/ha + Sulphur 45 kg/ha. The minimum number of tillers/hills was recorded in the treatment combination of Nitrogen 80 kg/ha + Sulphur 15 kg/ha which is (9.55). Significantly maximum plant dry weight (17.83 g/plant) was recorded with Nitrogen 120 kg/ha + Sulphur 45 kg/ha. However, the treatments Nitrogen 100 kg/ha + Sulphur 45 kg/ha (17.22 g/plant)

andNitrogen 120 kg/ha + Sulphur 30 kg/ha (17.64 g/plant) was statistically at par with Nitrogen 120 kg/ha + Sulphur 45 kg/ha. The minimum plant dry weight was recorded in the treatment combination of Nitrogen 80 kg/ha + Sulphur 15 kg/ha (15.74). Indira Chaturvedi has applied different nitrogen levels on growth, yield and nutrient uptake of wheat (*Triticum aestivum L.*)Sharma, H. R. and Gupta, A. K. Effect of sulphur on growth parameters and yield ofsome selectedcrops.

Yield attributes

As can be seen in Table 2 Yield parameters are summarised statistically. At the time of harvest significantly maximum Number of Grains/spike (47.34) was recorded with Nitrogen 120 kg/ha + Sulphur 45 kg/ha over all the treatments. However, the treatments Nitrogen 100 kg/ha + Sulphur 45 kg/ha (46.61) and Nitrogen 120 kg/ha + Sulphur 30 kg/ha (47.03) was statistically at par with Nitrogen 120 kg/ha + Sulphur 45 kg/ha. The minimum number of grains/spike was recorded in the treatment combination of Nitrogen 80 kg/ha + Sulphur 15 kg/ ha which is (44.56). Significantly highest Test weight (38.30 g) was recorded with nitrogen 120 kg/ha + Sulphur 45 kg/ha over all the treatments. However, the treatments Nitrogen 100 kg/ha + Sulphur 45 kg/ha (37.67 g) and Nitrogen 120 kg/ha + Sulphur 30 kg/ha (38.00 g) which were found to be statistically at par with Nitrogen 120 kg/ha + Sulphur 45 kg/ha. The minimum test weight was recorded in the treatment combination of Nitrogen 80 kg/ha + Sulphur 15 kg/ ha (35.75). Significantly highest Grain yield (6.14 t/ha) was recorded with the treatment application of Nitrogen 120 kg/ha + Sulphur 45 kg/ha over all the treatments. However, the treatments with (5.96 t/ha) in Nitrogen 100 kg/ha + Sulphur 45 kg/ha and with (6.05 t/ha) in Nitrogen 120 kg/ha + Sulphur 30 kg/ha which were found to be statistically at par with Nitrogen 120 kg/ha + Sulphur 45 kg/ha. The minimum Grain yield was recorded in the treatment combination of Nitrogen 80 kg/ha + Sulphur 15 kg/ ha (5.04). Significantly highest Straw yield (9.52 t/ha) was recorded with the treatment application of Nitrogen 120 kg/ha + Sulphur 45 kg/ha over all the treatments. However, the treatments with (9.23 t/ha) in Nitrogen 100 kg/ha + Sulphur 45 kg/ha and with (9.34 t/ha) in Nitrogen 120 kg/ha + Sulphur 30 kg/ha which were found to be statistically at par with Nitrogen 120 kg/ha + Sulphur 45 kg/ha. The minimum straw yield was recorded in the treatment combination of Nitrogen 80 kg/ha + Sulphur 15 kg/ ha (8.16). There was no significant difference between the treatments. However, the highest harvest index (39.30 %) was recorded with the treatment application of Nitrogen 120 kg/ha + Sulphur 45 kg/ha. In contrast, the lowest harvest index (38.19%) was recorded with nitrogen 80 kg/ha +Sulphur15 kg/ha**.** Test weight, a significant

yield determining component, is a genetic character and is least influenced by the environment. This might be due to the higher conservation of light energy into chemical energy and its subsequent translocation from source to sink. Similar findings were observed **by Saha*et al*., (2017).**

CONCLUSION

It is concluded thatthe application of Nitrogen 120 kg/ha + Sulphur 45 kg/harecorded asignificantly higher Grain yield (6.14 t/ha)compared to other treatments sincethe findings arebased on the research done in one season.

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Table 1: Effect ofnitrogen andsulphuron growth attributes of wheat

Treatments	Plant height (cm)	Tillers/hill	Dry weight (g/plant)
1. Nitrogen 80 kg/ha + Sulphur 15 kg/ha	94.33	9.55	15.74
2. Nitrogen 80 kg/ha + Sulphur 30 kg/ha	94.62	9.76	15.89
3. Nitrogen 80 kg/ha + Sulphur 45 kg/ha	95.85	9.97	16.64
4. Nitrogen 100 kg/ha + Sulphur 15 kg/ha	95.17	9.83	16.12
5. Nitrogen 100 kg/ha + Sulphur 30 kg/ha	96.77	10.24	16.88
6. Nitrogen 100 kg/ha + Sulphur 45 kg/ha	97.27	10.47	17.22
7. Nitrogen 120 kg/ha + Sulphur 15 kg/ha	96.29	10.10	16.37
8. Nitrogen 120 kg/ha + Sulphur 30 kg/ha	97.72	10.56	17.64
9. Nitrogen 120 kg/ha + Sulphur 45 kg/ha	98.13	10.71	17.83
F- test	S	S	S
S. Em (±)	0.31	0.11	0.20
C. D. (P = 0.05)	0.94	0.33	0.61

Table 2. Effect of nitrogen and sulphur on yield attributes and yield of wheat

Treatments	Grains/spike	Test Weight (g)	Grain yield (t/ha)	Straw yield (t/ha)	Harvest Index (%)
1. Nitrogen 80 kg/ha + Sulphur 15 kg/ha	44.56	35.75	5.04	8.16	38.19
2. Nitrogen 80 kg/ha + Sulphur 30 kg/ha	44.87	36.05	5.17	8.33	38.30
3. Nitrogen 80 kg/ha + Sulphur 45 kg/ha	45.73	36.63	5.52	8.78	38.62
4. Nitrogen 100 kg/ha + Sulphur 15 kg/ha	45.16	36.26	5.35	8.54	38.49
5. Nitrogen 100 kg/ha + Sulphur 30 kg/ha	46.37	37.32	5.82	9.17	38.84
6. Nitrogen 100 kg/ha + Sulphur 45 kg/ha	46.61	37.67	5.96	9.23	39.24
7. Nitrogen 120 kg/ha + Sulphur 15 kg/ha	45.96	37.05	5.66	8.89	38.87
8. Nitrogen 120 kg/ha + Sulphur 30 kg/ha	47.03	38.00	6.05	9.34	39.30
9. Nitrogen 120 kg/ha + Sulphur 45 kg/ha	47.34	38.30	6.14	9.52	39.21
F test	**S**	**S**	**S**	**S**	**NS**
S. Em (±)	0.25	0.26	0.07	0.10	0.29
CD (P = 0.05)	0.75	0.76	0.21	0.31	-