Int.J.Curr.Microbiol.App.Sci (2020) *9*(10): 2971-2976

International Journal of Current Microbiology and Applied Sciences
ISSN: 2319-7706 **Volume 9 Number 10 (2020)**
Journal homepage: http://www.ijcmas.com

Original Research Article https://doi.org/10.20546/ijcmas.2020.910.358

Productivity and Economics of Irrigated Wheat as Influenced by Nitrogen and Sulphur Levels

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Keywords

Wheat, Grain yield, Economics, sedimentation, Nitrogen, Sulphur

Article Info

Accepted:
24 September 2020
Available Online:
10 October 2020

A B S T R A C T

A field experiment was conducted at All India Co-ordinated Wheat and Barley Improvement Project (AICW & BIP), Main Agricultural Research Station, UAS, Dharwad, to study the productivity and economics of irrigated wheat as influenced by nitrogen and sulphur levels. The field experiment was laid out in split-plot design with three replications and twelve treatment combinations involving three main and four subplots. The results indicated that, application of 125 kg N ha^{-1} along with sulphur 30 kg ha^{-1} has recorded significantly higher grain yield (42.47q ha^{-1}), gross return (Rs. 92.756 ha^{-1}), net return (Rs. 54064 ha^{-1}) and sedimentation value (47.23 ml) and was on par with application of 100 kg N ha^{-1} along with sulphur level @ 20 kg ha^{-1}. However, significantly lower grain yield (23.02 q ha^{-1}), gross return (Rs. 51039 ha^{-1}), net return (Rs. 14228 ha^{-1}) and sedimentation value (45.48 ml) were observed with application of nitrogen at 75 kg ha^{-1} along with 0 kg S ha^{-1}.

Introduction

Wheat (*Triticum aestivum* L.) is the second most important cereal staple food crop and vital source of energy in human diet next to rice crop and which is contributing nearly 35 per cent to the national food basket. In India, wheat plays a significant role in food and nutritional security as it is an excellent health building staple food consumed by around 65 per cent of the population in various forms. In India, wheat is grown in an area of 30.59 million hectares (m ha), with an annual production of about 98.51 million tonnes (m ton) and average productivity of about 3216 kg ha^{-1} (Anon., 2019). The productivity of wheat in Karnataka state is around 1075 kg ha^{-1} with an area of 1.68 lakh hectare with an annual production of 1.71 lakh tonnes (Anon., 2019).

The quantity of fertilizers 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. Nitrogen is considered as one of the major nutrient for crop growth and development. The main function of nitrogen is part of proteins, phytohormones, coenzymes and chlorophyll formation and nucleic acid synthesis. All these biochemical activity involved in crop plants, are mainly responsible for nitrogen and other compounds which make it essential for crop growth and development of wheat (Kutman *et al.,* 2011). Therefore, application of nitrogenous fertilizer at optimum dose is essential to soil to get higher productivity of wheat (Ali *et al.,* 2000). The main significant role of sulphur in agriculture is gaining importance because of the recognition of its role in increasing crop production, not only in oilseeds, pulses and forages but also helpful for many cereal crops (Singh *et al.,* 2000). Nowadays, sulphur deficiency occurring gradually due to continuous use of sulphur free fertilizers, high yielding varieties and intensive cropping system for higher productivity. It is noticed that optimum application of sulphur resulted in higher grain and straw yield of wheat (Yadav *et al.,* 2017). The productivity of wheat is largely depends on its nutrient requirement and management particularly that of nitrogen, phosphorus, potassium and sulphur. Information on fertilizer requirement particularly nitrogen and sulphur levels on irrigated wheat is scanty. Hence, there is need to determine optimum levels of nitrogen and sulphur for growth, yield and economics of irrigated wheat in Northern Transition Zone of Karnataka.

Materials and Methods

The field experiment was conducted at University of Agricultural Sciences, Dharwad of Northern Transition Zone of Karnataka, during *Rabi* 2019. The field experiment was laid out in Split-plot design with three replications. There were 12 treatment combinations involving three main plots and four sub plots. Soil of the experimental site was neutral in reaction and soil differed in fertility status. The experimental site soil pH (7.52), electrical conductivity (0.25 dS m^{-1}), organic carbon (0.67 %), available N (220 kg ha^{-1}), P_2O_5 (23.1 kg ha^{-1}), K_2O (395.4kg ha^{-1}) and S (10.5 ppm). The treatments comprised of main plots: Nitrogen levels (kg ha^{-1}) N_1: 75 kg ha^{-1}, N_2: 100 kg ha^{-1} and N_3: 125 kg ha^{-1}, Sub plots: Sulphur levels (kg ha^{-1}) S_1: 0 S_2: 10 kg ha^{-1} S_3: 20 kg ha^{-1} and S_4: 30 kg ha^{-1}. The application of recommended dose of fertilizers 75 kg P_2O_5: 50kgK_2O ha^{-1} and FYM @ 7.5 tonnes ha^{-1} was common to all the treatments and sulphur was applied through gypsum. The test crop was irrigated wheat (UAS 304). The observation on grain and economics were recorded as per treatments accordingly.

Results and Discussion

Among the nitrogen levels, significantly higher plant height (82.76 cm), dry matter production (309.99 g), leaf area index (3.29) and effective tillers (273.83) were recorded with nitrogen level of 125 kg ha^{-1}, however, it was on par with 100 kg N ha^{-1}. Whereas, significantly lower growth parameters *viz*., plant height (75.63 cm), dry matter production (288.03 g), leaf area index (3.02) and effective tillers (254.25)) were observed with nitrogen level of 75 kg ha^{-1} The application of nitrogen at optimum level which might have helped in irrigated wheat plant to enhance the more number of leaves per plant and higher leaf area which helped in more photosynthetic activity, and thus contributed for higher dry matter accumulation at different parts of the irrigated wheat. The similar results are noticed by Ali *et al.,* (2011), Ullah *et al.,* (2018) and Yousaf *et al.,* (2019).

The investigation on sulphur levels revealed that significantly higher plant height (83.60 cm), dry matter production (303.99 g), leaf area index (3.33) and effective tillers (278.33) were recorded (Table 1) with sulphur level of 30 kg ha^{-1}, however, it was on par with 20 kg S ha^{-1}. Whereas, significantly lower growth parameters such as, plant height (74.61 cm), dry matter production (284.70 g), leaf area index (2.94) and effective tillers (247.77) were observed with sulphur level of 75 kg ha^{-1}.

Table.1 Growth parameters at harvest of irrigated wheat as influenced by nitrogen and sulphur levels

Treatments	Growth parameters of irrigated wheat			
	Plant height (cm)	Dry matter production (g)	Leaf area index	Effective tillers
Main plots: Nitrogen levels (kg ha^{-1})				
N_1: 75 kg ha^{-1}	75.63	288.03	3.02	254.25
N_2: 100 kg ha^{-1}	80.58	297.04	3.22	265.92
N_3: 125 kg ha^{-1}	82.76	309.99	3.29	273.83
SE.m ±	**0.99**	**3.92**	**0.05**	**4.01**
C.D @ 5 %	**3.90**	**15.39**	**0.18**	**15.74**
Sub plots: Sulphur levels (kg ha^{-1})				
S_1: 0	74.61	284.70	2.94	247.77
S_2: 10 kg ha^{-1}	78.50	293.58	3.20	262.78
S_3:20 kg ha^{-1}	81.91	303.99	3.24	269.78
S_4:30 kg ha^{-1}	83.60	311.14	3.33	278.33
SE.m ±	**2.08**	**5.65**	**0.05**	**4.95**
C.D @ 5 %	**6.18**	**16.79**	**0.16**	**14.70**
Interaction				
N_1S_1	67.73	273.96	2.70	233.65
N_1S_2	72.63	281.10	3.01	249.67
N_1S_3	80.73	293.69	3.10	260.67
N_1S_4	81.43	303.36	3.29	273.00
N_2S_1	76.37	288.83	3.05	253.33
N_2S_2	80.93	294.65	3.25	261.67
N_2S_3	81.70	298.93	3.26	270.00
N_2S_4	83.30	305.74	3.33	278.67
N_3S_1	79.73	291.29	3.08	256.33
N_3S_2	81.93	305.00	3.33	277.00
N_3S_3	83.30	319.36	3.36	278.67
N_3S_4	86.07	324.33	3.36	283.33
SE.m ±	**3.60**	**9.79**	**0.09**	**8.57**
C.D @ 5 %	**NS**	**NS**	**NS**	**NS**

Table.2 Grain yield, economics and quality of irrigated wheat as influenced by nitrogen and sulphur levels

Treatments	Grain yield and Economics of irrigated wheat				
	1000 grain weight (g)	Grain yield (q/ha)	Gross return (Rs.ha^{-1})	Net return (Rs.ha^{-1})	Sedimentation values (ml)
Main plots: Nitrogen levels (kg ha^{-1})					
N_1: 75 kg ha^{-1}	37.29	30.04	66387	29015	45.86
N_2: 100 kg ha^{-1}	38.26	35.11	77351	39601	46.08
N_3: 125 kg ha^{-1}	38.87	39.22	85913	47785	46.69
SE.m ±	**0.25**	**1.15**	**2440**	**2440**	**0.14**
C.D @ 5 %	**1.00**	**4.51**	**9582**	**9582**	**0.64**
Sub plots: Sulphur levels (kg ha^{-1})					
S_1: 0	36.88	28.49	62935	25736	45.16
S_2: 10 kg ha^{-1}	37.93	33.37	73594	36036	46.10
S_3:20 kg ha^{-1}	38.54	37.29	81933	43994	46.29
S_4:30 kg ha^{-1}	39.20	40.01	87748	49434	46.92
SE.m ±	**0.41**	**1.07**	**2172**	**2172**	**0.27**
C.D @ 5 %	**1.22**	**3.17**	**6454**	**6454**	**0.79**
Interaction					
N_1S_1	35.44	23.02	51039	14228	45.48
N_1S_2	37.17	26.90	59534	22354	45.60
N_1S_3	38.10	33.50	73918	36357	45.70
N_1S_4	38.47	36.73	81057	43121	46.68
N_2S_1	37.30	29.10	64435	27246	45.28
N_2S_2	38.20	34.21	75536	37978	45.87
N_2S_3	38.37	36.31	80004	42065	46.06
N_2S_4	39.17	**40.84**	89431	51117	46.86
N_3S_1	37.90	33.35	73302	35735	45.61
N_3S_2	38.43	38.99	85712	47776	46.82
N_3S_3	39.17	**42.07**	91879	53562	47.10
N_3S_4	39.97	**42.47**	92756	54064	47.23
SE.m ±	**0.71**	**1.85**	**3762**	**3762**	**0.48**
C.D @ 5 %	**NS**	**5.49**	**NS**	**NS**	**NS**

The higher growth parameters might be due to higher sulphur application which enhanced physiological activity in the plant, chlorophyll formation and ultimately enhanced the higher dry matter production in different parts of the plant. The similar findings were noticed by Ponkia *et al.,* (2018) in wheat.

Among the sulphur levels, grain yield, economics and quality of irrigated wheat differed significantly. Significantly higher 1000 grain weight (39.20 g), grain yield (40.01 q ha^{-1}), gross return (Rs. 87748 ha^{-1}), net return (Rs. 49434 ha^{-1}) and sedimentation value (46.92 ml) were recorded with sulphur level of 30 kg ha^{-1}. However, it was on par with 20 kg S ha^{-1}. Whereas, significantly lower 1000 grain weight (36.88 g) grain yield (28.49 q ha^{-1}), gross return (Rs. 62935 ha^{-1}), net return (Rs. 25736 ha^{-1}) and sedimentation value (45.16 ml) was observed with 0 kg S ha^{-1} (Table 2). The sulphur helped the plant to perform physiological activity like synthesis of sulphur containing amino acids such as, cysteine, cystine and methionine and involved in various metabolic processes of plant and constituent of glutathione, a compound associated with the plant respiration, synthesis of essential oil and formation of chlorophyll. The application of sulphur resulted in enhanced availability of nitrogen and higher uptake by crop. These similar findings are close confirmed by Metha *et al.,* (2005), Yadav *et al.,* (2017) and Ponkia *et al.,* (2018).

The application of 125 kg N ha^{-1} along with sulphur 30 kg ha^{-1} recorded significantly higher grain yield (42.47q ha^{-1}), gross return (Rs. 92.756 ha^{-1}) and net return (Rs. 54064 ha^{-1}) which was on par with 100 kg N ha^{-1} along with sulphur level @ 20 kg ha^{-1}. However, significantly lower grain yield (23.02 q ha^{-1}), gross return (Rs. 51039 ha^{-1}) and net return (Rs. 14228 ha^{-1}) were observed with nitrogen level 75 kg ha^{-1} along with 0kg S ha^{-1}. The higher grain yield might be due to interaction effect of nitrogen and sulphur levels which ultimately enhanced yield of irrigated wheat (Dostalova *et al.,* 2015). The synergetic effect between potassium and sulphur levels helped in increasing the grain and straw yield to the extent of 38.0 and 36.6 per cent with application of 60 kg K_2O ha^{-1} and along with 40 kg S ha^{-1} over control (Ponkia *et al.,* 2018).

In conclusion, treatment combination of 125 kg N ha^{-1} along with sulphur 30 kg ha^{-1} resulted in significantly higher growth parameters, grain yield and economics of irrigated wheat which was on par with application of 100 kg N ha^{-1} along with sulphur level @ 20 kg ha^{-1}.

Acknowledgement

I would like to thank Indian Council of Agricultural Research (ICAR) Department of Research and Education (DARE), New Delhi under India-Afghanistan Fellowship program and University of Agricultural Science, Dharwad for all their help, efforts and support throughout the completion of my degree programme.

References

Ali, A., Ahmad, A., Syed, W. H., Khaliq, T. and Ali, P., 2011, Effects of nitrogen on growth and yield components of wheat. *Sci. Inter*., 24:331-332.

Anonymous, 2019, Area, production and productivity of wheat in India and Karnataka. *www.Indiastat.com.*

Dostalova, Y., Hrivna, L., B. Kotkova, B. and V. Sottnikova, V., 2015, Effect of nitrogen and sulphur fertilization on the quality of barley protein. *Plant Soil Environ.*, 61(9): 399–404.

Kutman, U. B., Yildiz, B. and Cakmak, I., 2011, Effect of nitrogen on uptake,

remobilization and partitioning of zinc and iron throughout the development of durum wheat. *Plant Soil*., 342: 149-164.

Lakho, A. A., Oad, F. C., Samo, H. A. and Ghaloo, S. H., 2004, Economic analysis of wheat under different nitrogen levels and placements. *Asian J. Plant Sci.*, 3: 69-71.

Metha, 2005, Importance of sulphur nutrition to crops. *Agro bios.*, Pp. 21-25.

Ponkia, H. P., Vekaria, L. C., Ramani, V. B. and Sakrvadia, H. L., 2018, Potassium and sulphur fertilization of wheat (*Triticum aestivum L.)* in medium black calcareous soils of Saurashtra Region of Gujarat. *Int. J. Pure App. Biosci*., 6 (1): 1634-1640.

Ullah, M., Ali, N., Durrani, S., Muhammad A., Abdul, H. and Hafeez A., 2018, Effect of different nitrogen levels on growth, yield and yield contributing attributes of wheat. *International J. Sci. Engineering Res*., 9(9): 201-205.

Yadav, S. K., Singh, G., Kumar, R. and Pradeep Kumar., 2017, Effect of phosphorus, sulphur and zinc on growth, yield and yield attributes of wheat (*Triticum aestivum*) *Int. J. Curr. Microbiol. App. Sci.*, 6(8): 2581-2584.

Yousaf, M., Muhammad S., Suliman, A. and Ali, M., 2019, The effect of nitrogen application rates and timings of first irrigation on wheat growth and yield. *International J. Agric. Inno. Res.*, 2(4): 120-125.

How to cite this article:

Zamir Muradi and Sudha, T. 2020. Productivity and Economics of Irrigated Wheat as Influenced by Nitrogen and Sulphur Levels. *Int.J.Curr.Microbiol.App.Sci.* 9(10): 2971-2976. doi: https://doi.org/10.20546/ijcmas.2020.910.358