

## Effect of Different Foliar Application of Nutrients on Yield, Quality and Economics of Wheat

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### Abstract

A field investigation entitled "Effect of different foliar application of nutrients on growth, yield and quality of wheat (*Triticum aestivum* L.)" was conducted in rabi season of 2022- 2023 at the Instructional Farm, Post -Graduate Institute, Mahatma Phule Krishi Vidyapeeth, Rahuri. The experiment was laid out in RBD with nine treatments replicated 3 times. Yield parameter of wheat viz., the highest grain yield( 48.98 q ha<sup>-1</sup>), straw yield (59.51 q ha<sup>-1</sup>), biological yield( 108.49 q ha<sup>-1</sup>), harvest index( 45.14% ) and yield increase over control (73.16%) is obtained significantly maximum due to foliar application of nutrients. The quality parameters like the protein yield (582.37 kg ha<sup>-1</sup>) and protein content (11.89) quality contributing characters. The gross monetary return (Rs. ha<sup>-1</sup> 119658), cost of cultivation (Rs. ha<sup>-1</sup> 51627), Net monetary return (Rs. ha<sup>-1</sup> 69182) and B:C ratio (2.37) is obtained significantly higher due to foliar application of nutrients.

### Key words :

Wheat (*Triticum aestivum* L.) is the second most important cereal crop in India and plays a key role in the country's food security. Wheat is the largest cereal crop in the world. The genus *Triticum* includes the wild and domesticated species usually thought of as wheat. Wheat accounts for 20 per cent of the total calorie intake of human.

Wheat has a relatively high content of 'niacin' and 'thiamine'. It contains the characteristic substance 'gluten', which gives the spongy cell structure of bread, chapatti and other baked goods a structural framework. Contains 13 per cent protein, primarily gluten (75-80 per cent wheat protein) Contains more protein than other grains.

Foliar fertilization is widely used to better manage nutritional status and growth, quickly correct deficiencies, and improve disease resistance for better crop quality. Foliar

application can be considered one of the most common methods. This provided the plants with the necessary nutrients in sufficient concentrations, improved the nutritional status of the plants and at the same time increased the yield and quality. Micronutrients have a significant impact on dry matter, grain yield and straw yield of wheat (Asad and Rafique, 2000). Copper plays an important role in the metabolism of N-compounds. Manganese, together with zinc, influences protein biosynthesis by regulating the activity of peptidases and controlling protein metabolism (Hansch and Mendel, 2009).

Phule Liquid Micro Grade II is a liquid micronutrient solution developed by Micronutrient Research Scheme, Department of Soil Science and Agricultural Chemistry, MPKV, Rahuri. Contains Fe (2.5%), Zn (2.0%), Mn (1%), Cu (1%), Mo (0.1%) and B (0.5%)., 2013). Foliar spraying with NPK (19:19:19) at a concentration of 0.5 per cent to improve wheat grain yield. A favorable balance between macro

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and micro nutrients is also required for optimal agricultural production (Surve and Bhosale, 2015). Improving water-soluble fertilizers Nutrient use efficiency (NUE) is an extremely important concept in evaluating agricultural production systems. Fertilizer management as well as top soil and water management can have a significant impact in this regard.

### Material and methods

A field investigation entitled "Effect of foliar application of nutrients on growth, yield and quality of wheat (*Triticum aestivum* L.)" was conducted in rabi season of 2022- 2023 at the Instructional Farm, Post Graduate Institute, Mahatma Phule Krishi Vidyapeeth, Rahuri. The experiment consists of nine treatments *viz.*, T<sub>1</sub> : Absolute control; T<sub>2</sub> : Only water spray; T<sub>3</sub> : GRDF only (120:60:40 kg N:P<sub>2</sub>O<sub>5</sub>:K<sub>2</sub>O ha<sup>-1</sup> + FYM 10 ton ha<sup>-1</sup>); T<sub>4</sub> : 75% GRDF + 2 sprays of Phule Liquid Micronutrient Grade II @ 1% at 45 DAS and 65 DAS; T<sub>5</sub> : 75% GRDF + 2 Foliar spray of 19:19:19 @ 1% 45 DAS and 65

; T<sub>6</sub> : 75% GRDF + 1 foliar spray of Phule Liquid Micronutrient Grade II @ 1% and 1 Foliar spray of 19:19:19@ 1% 45 DAS and 65; T<sub>7</sub> : 50% GRDF + 2 Foliar spray of 19:19:19 @ 1% 45 DAS and 65; T<sub>8</sub> : 50% GRDF + 2 sprays of Phule Liquid Micronutrient Grade II @ 1% 45 DAS and 65; and T<sub>9</sub> : 50% GRDF + 1 Foliar spray of 19:19:19 @ 1% 45 DAS. Line sowing of wheat seeds was done on flat beds at spacing of 20 cm × 5 cm. The mean available nitrogen, phosphorus and potassium content in soil after harvest of wheat crop were 178.36, 16.49 and 413.99 kg ha<sup>-1</sup> respectively. The recommended dose of fertilizer (120:60:40 kg N:P<sub>2</sub>O<sub>5</sub>:K<sub>2</sub>O ha<sup>-1</sup>) was applied 60:60:40 kg N:P<sub>2</sub>O<sub>5</sub>:K<sub>2</sub>O ha<sup>-1</sup> as a basal and 60 kg N as top dressing through urea, SSP and MOP in treatment T<sub>3</sub> to T<sub>9</sub>. Thereafter, different foliar application of fertilizers was done at 25 and 40 days after sowing, respectively. Periodical observations on the growth characters, yield contributing characters, grain yield and straw yield were recorded during investigation.

**Table 1.** Effect of different foliar application on grain yield, straw yield, biological yield, harvest index and yield increase over control of wheat

Treatments	Yield (q ha <sup>-1</sup> )			Harvest index (%)	Yield increase over control
	Grain yield	Straw yield	Biological yield		
T <sub>1</sub> - Absolute control	28.22	42.34	70.56	39.99	-
T <sub>2</sub> - Only water spray	28.74	43.12	71.86	40	-
T <sub>3</sub> - GRDF only (120:60:40 kg N:P <sub>2</sub> O <sub>5</sub> :K <sub>2</sub> O ha <sup>-1</sup> + FYM 10 ton ha <sup>-1</sup> )	41.86	51.17	93.03	44.99	48.33
T <sub>4</sub> - 75% GRDF + 2 sprays of Phule Liquid Micronutrient Grade II @ 1% at 45 DAS and 65 DAS	43.29	52.91	96.2	45	53.40
T <sub>5</sub> - 75% GRDF + 2 Foliar spray of 19:19:19 @ 1% at 45 DAS and 65 DAS	43.93	53.70	97.63	44.99	55.66
T <sub>6</sub> - 75% GRDF + 1 foliar spray of Phule Liquid Micronutrient Grade II @ 1% and 1 Foliar spray of 19:19:19 @ 1% at 45 DAS	48.98	59.51	108.49	45.14	73.63
T <sub>7</sub> - 50% GRDF + 2 Foliar spray of 19:19:19 @ 1% at 45 DAS and 65 DAS	38.69	47.29	85.98	44.97	37.10
T <sub>8</sub> - 50% GRDF + 2 sprays of Phule Liquid Micronutrient Grade II @ 1% at 45 DAS and 65 DAS	37.78	46.19	83.97	45.51	33.87
T <sub>9</sub> - 50% GRDF + 1 Foliar spray of 19:19:19 @ 1% at 45 DAS	35.46	43.35	78.81	81.79	25.65
S.E. ±	2.06	2.58	-	-	-
C.D. at 5%	6.05	7.59	-	-	-
General mean	38.27	48.53	86.80	48.02	-

## Results and Discussion

Among all the treatments given to wheat crop, significantly higher grain yield and straw yield (48.98 and 59.51 q ha<sup>-1</sup>, respectively) were recorded under the treatment T<sub>6</sub> i.e. 75% GRDF + 1 foliar spray of Phule Liquid Micronutrient Grade II @ 1% + 1 Foliar spray of 19:19:19@ 1% at 45 DAS and 65 DAS. The biological yield and harvest index of the treatment T<sub>6</sub> i.e. 75% GRDF + 1 foliar spray of Phule Liquid Micronutrient Grade II @ 1% + 1 Foliar spray of 19:19:19@ 1% at 45 DAS and 65 DAS is 108.49 q ha<sup>-1</sup> and 45.14%. The highest grain yield, Straw yield, biological yield, harvest index and yield increase over control is obtained due to the availability of both macro and micro nutrients is uniform throughout the vegetative growth stage of crop. Due to foliar application of nutrients, there was increase in plant height, total number of tillers, number of leaves leaf area and dry matter accumulation which may results into higher yield parameter of wheat. The results are in comparison with the results found by Rahman *et al.* (2014), Nitharwal *et al.* (2022), Vikas *et al.* (2019), Muhammad *et al.* (2006), Hasina *et al.* (2011), Surve and Bhosale (2015), Wagan *et al.* (2017) and Dhaker *et al.* (2022).

The wheat fertilized with treatment T<sub>6</sub> i.e. 75% GRDF + 1 Foliar spray of 19:19:19 @ 1% + 1 foliar spray of Phule Liquid Micro Grade II @ 1% at 45 DAS and 65 DAS produced significantly maximum protein yield (582.37 kg ha<sup>-1</sup>) as compared to rest of the nutrient management treatments during investigation. The wheat fertilized with Phule Liquid Micro Grade II has been produced higher grain yield and as the protein yield is product of protein content and grain yield the present reflection was noticed. Parallel findings were discovered by Sadaphal and Das (2002) and sabir *et al.* (2015).

The highest gross monetary returns of wheat (Rs. 119658 ha<sup>-1</sup>) obtained in wheat with the application of treatment T<sub>6</sub> i.e. 75% GRDF + 1 Foliar spray of 19:19:19 @ 1% + 1 foliar spray of Phule Liquid Micro Grade II @ 1% at 45 DAS and 65 DAS as compared to other treatments. Then wheat crop applied with treatment T<sub>4</sub> i.e. 75% GRDF+ 2 Foliar spray of Phule Liquid Micro Grade II @ 1% at 45 DAS and 65 DAS, respectively accounted the highest cost of cultivation (Rs. 51627 ha<sup>-1</sup>) among all other treatments. Among all the treatments,

**Table 2.** Effect of different foliar application on protein content and yield of wheat

Treatments	Protein content	Protein yield (kg ha <sup>-1</sup> )
T <sub>1</sub> - Absolute control	10.97	309.57
T <sub>2</sub> - Only water spray	11.01	316.42
T <sub>3</sub> - GRDF only (120:60:40 kg N:P <sub>2</sub> O <sub>5</sub> :K <sub>2</sub> O ha <sup>-1</sup> + FYM 10 ton ha <sup>-1</sup> )	11.60	485.57
T <sub>4</sub> - 75% GRDF + 2 sprays of Phule Liquid Micronutrient Grade II @ 1% at 45 DAS and 65 DAS	11.74	508.22
T <sub>5</sub> - 75% GRDF + 2 Foliar spray of 19:19:19 @ 1% at 45 DAS and 65 DAS	11.76	516.61
T <sub>6</sub> - 75% GRDF + 1 foliar spray of Phule Liquid Micronutrient Grade II @ 1% and 1 Foliar spray of 19:19:19 @ 1% at 45 DAS	11.89	582.37
T <sub>7</sub> - 50% GRDF + 2 Foliar spray of 19:19:19 @ 1% at 45 DAS and 65 DAS	11.37	439.90
T <sub>8</sub> - 50% GRDF + 2 sprays of Phule Liquid Micronutrient Grade II @ 1% at 45 DAS and 65 DAS	11.29	426.53
T <sub>9</sub> - 50% GRDF + 1 Foliar spray of 19:19:19 @ 1% at 45 DAS	11.62	412.04
S.E. ±	0.11	25.42
C.D. at 5%	NS	76.26
General mean	11.48	444

**Table 3.** Effect of different foliar application on Gross monetary return, cost of cultivation, net monetary return and B:C ratio of wheat

Treatments	Gross monetary returns (Rs. ha <sup>-1</sup> )	Cost of cultivation (Rs. ha <sup>-1</sup> )	Net monetary return (Rs. ha <sup>-1</sup> )	B:C ratio
T <sub>1</sub> - Absolute control	70,552	38,144	32,408	1.84
T <sub>2</sub> - Only water spray	71,852	38,849	33,003	1.85
T <sub>3</sub> - GRDF only (120:60:40 kg N:P <sub>2</sub> O <sub>5</sub> :K <sub>2</sub> O ha <sup>-1</sup> + FYM 10 ton ha <sup>-1</sup> )	1,02,326	50,167	52,159	2.03
T <sub>4</sub> - 75% GRDF + 2 sprays of Phule Liquid Micronutrient Grade II @ 1% at 45 DAS and 65 DAS	1,05,820	51,627	54,493	2.04
T <sub>5</sub> - 75% GRDF + 2 Foliar spray of 19:19:19 @ 1% at 45 DAS and 65 DAS	1,07,386	49,270	58,116	2.17
T <sub>6</sub> - 75% GRDF + 1 foliar spray of Phule Liquid Micronutrient Grade II @ 1% and 1 Foliar spray of 19:19:19 @ 1% at 45 DAS	1,19,658	50,476	69,182	2.37
T <sub>7</sub> - 50% GRDF + 2 Foliar spray of 19:19:19 @ 1% at 45 DAS and 65 DAS	94,576	46,363	48,213	2.03
T <sub>8</sub> - 50% GRDF + 2 sprays of Phule Liquid Micronutrient Grade II @ 1% at 45 DAS and 65 DAS	92,354	48,617	43,737	1.89
T <sub>9</sub> - 50% GRDF + 1 Foliar spray of 19:19:19 @ 1% at 45 DAS	86,682	45,871	40,811	1.88
S.E. ±	5044.28	-	5044.28	0.06
C.D. at 5%	14795.5	-	14745.5	0.15
General mean	94578	46,547	47,303	1.99

application of spray of treatment T<sub>6</sub> i.e. 75% GRDF + 1 Foliar spray of 19:19:19 @ 1% + 1 foliar spray of Phule Liquid Micro Grade II @ 1% at 45 DAS and 65 DAS produced significantly higher net monetary returns (Rs. 69182 ha<sup>-1</sup>). The B:C ratio is related with gross monetary returns and cost of cultivation. The wheat crop applied with application of treatment T<sub>6</sub> i.e. 75% GRDF + 1 Foliar spray of 19:19:19 @ 1% + 1 foliar spray of Phule Liquid Micro Grade II @ 1% at 45 DAS and 65 DAS documented the highest B:C ratio (2.37). These results are in conformity with Surve and Bhosale (2015), Sharma and Singh (2016) and Nitharwal *et al.* (2022).

### References

- Asad, A. and Rafique, R., 2000. Effect of zinc, copper, manganese and boron on the yield and yield components of wheat crop in Tehsil. Pakistan Journal of Biological Science 3: 1615-1620.
- Dhaker, S. K., Sharma, K. M., Meena, B. S., Sharma, M. K. and Meena, L. K. 2022. Effect of nutrient management on growth and productivity of wheat (*Triticum aestivum* L.) grown under rice-wheat based cropping system in south-eastern Rajasthan. The Pharma Innovation Journal 11(12): 2990-2994.
- Hansch, R. and Mendel, R.R. 2009. Physiological functions of mineral micronutrients (Cu, Zn, Mn, Fe, Ni, Mo, B, Cl). Current Opinion of Plant Biology 12(1): 259-266.
- Hasina Gul, Ahmad Said, Beena Saeed, Ijaz Ahmad and Khalid Ali. 2011. Response of yield and yield components of wheat towards foliar spray of nitrogen, potassium and zinc. Journal of Agricultural and Biological Science 6(2): 121-128.
- Muhammad Arif, Muhammad, A., Chohan, S.A., Rozina, G. and Sajjad, K. 2006. Response of wheat to foliar application of nutrients. Journal of Agronomy 45(1): 107-113.
- Nitharwal, P.K., Chauhan, P.S., Mandeewal, R.L., Hansraj Shivran, Sharma, A.K., Ramniwas and Sunita. 2022. Influence of different levels and methods of NPK fertilizer application on growth and production of wheat (*Triticum aestivum* L.) in arid region of Rajasthan. International Journal of Plant and Soil Science 34(16): 107-114.
- Rahman, M. Z., Islam, M. R., Karim, M. A. and Islam, M. T. 2014. Response of wheat to foliar application of

- urea fertilizer. Journal of Sylhet Agricultural University 1(1): 39-43.
- Sabir, G. K., Peter, J. D., and Wiqar, A. 2015. Effect of Zn as soil addition and foliar application on yield and protein content of wheat in alkaline soil, Journal of the National Science Foundation Sri Lanka 43(4): 303-312.
- Sadaphal, M. N. and Das, N. B. 2002. Effect of spraying urea on winter wheat (*Triticum aestivum* L.) Agronomy Journal 58(2): 137-141.
- Sharma, K. M. and Mahendra Singh 2016. Assessment of water soluble NPK foliar nutrition in wheat (*Triticum aestivum* L.) through on-farm testing for improving yield and economic returns. International Journal of Science, Environment and Technology 9(3): 510-515.
- Surve, U. S. and Bhosale, D.S . 2015. Effect of foliar sprays of fertilizers on growth, yield and quality of wheat, Bioinfolet. 12(2 b): 452-453.
- Vikas Abrol, Singh, A. P., Anil Kumar, Ravinder Charya, Ch Nivasarao, Peeyush Sharma, Brinder Singh, Sanjeev Salgotra, Jai Kapoor and Hemant Dhachich 2019. Effect of foliar application of nutrients on wheat crop performance, economics, resource use efficiency and soil properties under rainfed conditions. Indian Journal of Agricultural Sciences 90(1): 138-41.
- Wagan, Z. W., Mahmoods, B., Wagan, T. A., Wagan, Z. A., Jamor, S. A., Memon, Q. U. and Wagan, S. A. 2017. Effect of foliar applied urea on growth and yield of wheat (*Triticum aestivum* L.) International Journal of Bioorganic Chemistry 2(4): 185-191.
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