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Effect of foliar application of phosphorus and potassium on yield and economics of wheat (*Triticum aestivum* L.)

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Abstract
A field experiment entitled "Effect of foliar application of phosphorus and potassium on yield and economics of wheat (*Triticum aestivum* L.)" was conducted at the Agricultural Research Station (ARS), Dhadesugur, during the *rabi* season of 2024. The study aimed to evaluate the effect of foliar application of phosphorus and potassium using Potassium Salt of Active Phosphorus (PSAP, KH_2PO_3) and Mono Potassium Phosphate (MKP, KH_2PO_4) on the yield and economics of wheat. The experiment was laid out in a Randomized Complete Block Design (RCBD) with eight treatments replicated thrice. Results revealed that treatment T_3 (100% Recommended Package of Practices + foliar spray of MKP @ 5 g l^{-1} at 30 and 60 DAS) recorded significantly higher grain yield (3894 kg ha^{-1}), straw yield (4986 kg ha^{-1}) and harvest index (0.44). The same treatment also registered higher economic returns with gross returns of ₹ 1,60,128 ha^{-1}, net returns of ₹ 1,06,398 ha^{-1}, and a benefit-cost ratio of 2.98 and was statistically on par with treatment T_2 (100% Recommended Package of Practices + foliar spray of PSAP @ 5 g l^{-1} at 30 and 60 DAS). The lower yield and economic performance were recorded in treatment T_8 (absolute control). Overall, the study concluded that foliar application of MKP @ 5 g l^{-1} at 30 and 60 DAS, along with the recommended package of practices significantly enhanced the yield and profitability of wheat.

Keywords: Foliar spray, wheat, MKP, PSAP, grain yield, economics

Introduction
Wheat (*Triticum aestivum* L.) is the world's largest cereal crop and the second most important in India playing a vital role in food security. About 95% of global wheat is hexaploid bread wheat while, 5% is tetraploid durum wheat. In India, major types are *Triticum aestivum*, *Triticum durum* and *Triticum dicoccum*, mainly grown in Uttar Pradesh, Punjab, Haryana, Rajasthan and parts of Maharashtra and Karnataka. India ranks third in global wheat production with 31.87 million ha area, 112.18 million tonnes production and 3,530 kg ha^{-1} productivity (Anon., 2023a) [2]. In Karnataka, wheat covers 1.72 lakh ha, producing 2.13 lakh tonnes with 1,242 kg ha^{-1} yield (Anon., 2023b) [3]. Major districts include Vijayapura, Belagavi, Dharwad, Gadag and Bagalkot.
Nutrient management is an important practice to attain higher yields in crop production. Nowadays, farmers are exuberantly using chemical fertilizers and this is considered as the main cause of environmental pollution and also deteriorating the soil health (Rekha *et al*., 2018) [15]. Foliar feeding is a technique where liquid fertilizers are applied directly to plant leaves, allowing plants to absorb essential nutrients through their stomata and epidermis.
Mono Potassium Phosphate (MKP) (also potassium dihydrogen phosphate, KDP, or monobasic potassium phosphate), KH_2PO_4, is a soluble salt of potassium and the dihydrogen phosphate ion. It is a source of phosphorus and potassium as well as a buffering agent. It can be used in fertilizer mixtures to reduce escape of ammonia by keeping pH low. Mono potassium phosphate (KH_2PO_4) is the formulation with the lowest salt index and thus the foliar fertilizer of choice for many crops. It is an excellent and fast source of P and K when applied as a foliar fertilizer. Foliar application with KH_2PO_4 may protect against various pathogens in several host-pathogen interactions (Janisiewicz *et al*., 2005) [10].
Potash Salt of active Phosphorus (PSAP) is an important invention as through its foliar applications both these nutrients get absorbed quickly in the plants and did their jobs of

regulating the different activities, reducing the incidence of insect pests, and finally enhancing overall yields and quality of crops. In PSAP, phosphorus is activated by a catalytic process, and by using the split technique, potash is attached to this activated phosphorus, which is extremely water soluble. The PSAP is 100 per cent water soluble and gets absorbed 100% in foliage. The phosphorus and potassium nutrients become instantly available to crop plants in the spray.

Materials and Methods

Experimental site and location

The experiment was carried out at Agricultural Research Station, Dhadesugur, University of Agricultural Sciences, Raichur, Karnataka. The research centre is located in agroclimatic zone III (Northern Dry Zone) of Karnataka and it is situated at latitude of 15° 69' N and 76° 89' E longitude with an altitude of 358 meters above the mean sea level.

Experimental Details and Treatments

The experiment was laid out in randomized complete block design (RCBD) with three replications. There were eight treatments consisting of different doses of RDF and Foliar spray of PSAP and MKP were given at 30 and 60 DAS as per the treatments. Table (1). The crop variety chosen was UAS-304, sown at a spacing of 30 × 10 cm in plots measuring 3.6 m × 4.0 m (gross plot) and 2.4 m × 3.6 m (net plot). The specific feature of the variety is medium duration (120 days) resistant to high temperature and Rust disease, seeds are bold, long and partly shining.

Following the statistical analysis methods outlined by Gomez and Gomez (1984) [9], were examined the data collected on various characters involved in the study. Whenever the analysis revealed statistically significant differences between the treatments, critical differences (CD) was calculated at 0.05 probability level to compare the groups.

Table 1: Treatment details

Tr. No	Treatment Details
T_1	Recommended package of practices
T_2	100% RPP + Foliar spray of PSAP @ 5 g l^{-1} at 30 and 60 DAS
T_3	100% RPP + Foliar spray of MKP @ 5 g l^{-1} at 30 and 60 DAS
T_4	100% RDN + 75% of Recom. P & K + Foliar spray of PSAP @ 5 g l^{-1} at 30 and 60 DAS
T_5	100% RDN + 75% of Recom. P & K + Foliar spray of MKP @ 5 g l^{-1} at 30 and 60 DAS
T_6	100% RDN + 50% of Recom. P & K + Foliar spray of PSAP @ 5 g l^{-1} at 30 and 60 DAS
T_7	100% RDN + 50% of Recom. P & K + Foliar spray of MKP @ 5 g l^{-1} at 30 and 60 DAS
T_8	Absolute control

Results and Discussion

Grain and straw yield (kg ha^{-1})

The grain and straw yields of wheat were significantly influenced by different levels of conventional fertilizers and foliar nutrient sprays of phosphorus and potassium through MKP and PSAP (Table 2). The highest grain yield (3894 kg ha^{-1}) and straw yield (4986 kg ha^{-1}) were recorded in treatment T_3, which received 100% Recommended Package of Practices (RPP) along with foliar spray of MKP @ 5 g l^{-1} at 30 and 60 DAS, and was found on par with T_2 (3835 kg ha^{-1} and 4939 kg ha^{-1}, respectively) that received PSAP foliar spray. The lowest yields were observed in the control treatment (T_8), with grain yield of 1980 kg ha^{-1} and straw yield of 2800 kg ha^{-1}.

The higher grain and straw yields recorded in treatment T_3 (100% RPP + foliar spray of MKP @ 5 g l^{-1} at 30 and 60 DAS) can be attributed to the synergistic effect of balanced soil fertilization and timely foliar nutrient supply of phosphorus and potassium. MKP, being a fully water-soluble source ensured rapid nutrient absorption during critical growth stages such as tillering, flowering and grain filling. The readily available phosphorus enhanced root development, energy transfer and photosynthetic efficiency, while potassium improved enzyme activation, osmotic regulation and translocation of assimilates. This resulted in improved spike length, higher number of grains per spike, greater test weight and efficient grain filling, ultimately increasing grain yield. Simultaneously, the adequate nutrient availability promoted vigorous vegetative growth, reflected in higher plant height, more productive tillers, greater leaf area index and increased dry matter accumulation, which contributed to higher straw yield. Potassium also played a vital role in maintaining cell turgidity and strengthening plant tissues, leading to better biomass partitioning and structural stability. Thus, the combined application of MKP with the recommended package of practices optimized nutrient use efficiency, enhanced photosynthetic activity and promoted both reproductive and vegetative growth, culminating in significantly higher grain and straw yields. These findings are in close agreement with those of Choudhary *et al.* (2018) [8], Banerjee *et al.* (2018) [4], Kundu *et al.* (2020) [12], Bhatt *et al.* (2022) [5], Shah *et al.* (2022) [16] and Bhavya *et al.* (2024) [5], who reported similar improvements in yield and biomass in crops such as sugarcane, pulses and cereals due to foliar application of MKP in conjunction with recommended agronomic practices.

Economics

The acceptance of generated technology by the farmers ultimately depends on the economics involved in the production. Among the different indicators of monetary efficiency in any production system, the economics in terms of net returns has a greater impact on the practical utility and acceptance of the technology.

Net returns (₹ ha^{-1})

The net returns of wheat were markedly affected by the different levels of conventional fertilizers and foliar nutrient sprays of phosphorus and potassium through MKP and PSAP. The highest net return (₹ 1,06,398 ha^{-1}) was recorded in treatment T_3, which received 100% Recommended Package of Practices (RPP) along with foliar spray of MKP @ 5 g l^{-1} at 30 and 60 DAS and was found on par with treatment T_2 that received 100% RPP + Foliar spray of PSAP @ 5 g l^{-1} at 30 and 60 DAS(₹ 1,00,986). The lowest net return (₹ 40,690 ha^{-1}) was observed in the control treatment (T_8).

The increase in net returns under treatments receiving foliar sprays of MKP and PSAP, in combination with soil-applied nutrients, may be attributed to improved nutrient uptake and enhanced physiological efficiency during critical growth stages. Foliar application of phosphorus and potassium supplements the nutrient supply when root absorption is restricted, thereby promoting photosynthesis, assimilate translocation and grain

filling, which collectively result in higher yields and economic returns. Similar observations were reported by Abrol *et al*. (2020) [1], who found that foliar application of nutrients in wheat significantly improved crop performance, resource-use efficiency and profitability under rainfed conditions. Meena *et al*. (2020) [13] also demonstrated that foliar application of potassium enhanced water productivity and net returns in wheat grown under rice residue-retained systems in northwestern India. Likewise, Navaz *et al*. (2018) [14] reported that foliar nutrition improved phosphorus uptake, physiological performance and yield, leading to better economic returns in lathyrus under relay cropping systems.

Benefit cost ratio

Benefit-cost ratio (B:C) was significantly influenced by different nutrient management practices. The higher benefit-cost ratio (2.98) was recorded in T_3 (100% RPP + foliar spray of MKP @ 5 g l^{-1} at 30 and 60 DAS), while the least B:C ratio (1.97) was observed in T_8 (Absolute control).

The higher B:C ratio in T_3 can be attributed to the synergistic effect of combining 100% Recommended Package of Practices (RPP) with foliar spray of MKP. Foliar application of MKP enhanced the availability and uptake of phosphorus and potassium during critical growth stages, which improved photosynthesis, assimilate translocation and grain filling. This led to higher grain and straw yields, increasing gross returns relative to the cost of cultivation. In contrast, T_8 (Absolute control) lacked both soil-applied and foliar nutrients, resulting in limited nutrient availability, lower crop growth and reduced yield, which caused minimal gross returns relative to the cost, thereby producing the lowest B:C ratio. These findings are consistent with the observations of Chavan *et al*. (2023) [7] and Kumar *et al*. (2024) [11], who reported that foliar nutrient application improves physiological efficiency, yield and economic returns in field crops.

Table 2: Grain yield, Straw yield and Harvest index of wheat as influenced by conventional fertilisers and foliar nutrient spray

Treatments	Grain yield (kg ha^{-1})	Straw yield (kg ha^{-1})	Harvest Index
T_1: Recommended package of practices	3510	4525	0.44
T_2: 100% RPP + Foliar spray of PSAP @ 5 g l^{-1}at 30 and 60 DAS	3835	4939	0.44
T_3: 100% RPP + Foliar spray of MKP @ 5 g l^{-1} at 30 and 60 DAS	3894	4986	0.44
T_4: 100% RDN + 75% of Recom. P & K + Foliar spray of PSAP @ 5 g l^{-1} at 30 and 60 DAS	3052	4025	0.43
T_5: 100% RDN + 75% of Recom. P & K + Foliar spray of MKP @ 5 g l^{-1} at 30 and 60 DAS	3143	4112	0.43
T_6: 100% RDN + 50% of Recom. P & K + Foliar spray of PSAP @ 5 g l^{-1} at 30 and 60 DAS	2610	3600	0.42
T_7: 100% RDN + 50% of Recom. P & K + Foliar spray of MKP @ 5 g l^{-1} at 30 and 60 DAS	2685	3620	0.43
T_8: Absolute control	1980	2800	0.41
S.Em. ±	100	127	0.02
C.D. at 5%	305	387	NS

Table 3: Net returns and BC ratio of wheat cultivation as influenced by conventional fertilisers and foliar nutrient spray

Treatments	Net returns (₹ ha^{-1})	BC ratio
T_1: Recommended package of practices	94130	2.87
T_2: 100% RPP + Foliar spray of PSAP @ 5 g l^{-1}at 30 and 60 DAS	100986	2.78
T_3: 100% RPP + Foliar spray of MKP @ 5 g l^{-1} at 30 and 60 DAS	106398	2.98
T_4: 100% RDN + 75% of Recom. P & K + Foliar spray of PSAP @ 5 g l^{-1} at 30 and 60 DAS	70456	2.27
T_5: 100% RDN + 75% of Recom. P & K + Foliar spray of MKP @ 5 g l^{-1} at 30 and 60 DAS	77180	2.47
T_6: 100% RDN + 50% of Recom. P & K + Foliar spray of PSAP @ 5 g l^{-1} at 30 and 60 DAS	54156	2.00
T_7: 100% RDN + 50% of Recom. P & K + Foliar spray of MKP @ 5 g l^{-1} at 30 and 60 DAS	60036	2.17
T_8: Absolute control	40690	1.97
S.Em±	4138	0.08
C.D. at 5%	12552	0.24

Conclusion

The study exhibited that foliar application of phosphorus and potassium significantly improved the yield and economic performance of wheat. The combined use of 100% Recommended Package of Practices with foliar spray of MKP @ 5 g l^{-1} at 30 and 60 DAS proved most effective, resulting in the highest grain and straw yields as well as superior gross and net returns and benefit-cost ratio. These practices highlight the importance of integrating foliar nutrient application with recommended soil fertilization to enhance wheat productivity and profitability.

References

1. Abrol V, Singh AP, Kumar A, Chary R, Srinivasarao CH, Sharma P, *et al*. Effect of foliar application of nutrients on wheat (*Triticum aestivum*) crop performance, economics, resource use efficiency and soil properties under rainfed conditions. Indian J Agric Sci. 2020;90(1):138-141.
2. Anonymous. Indiastat, India - Area, Yield and Production for the year 2022-23. 2023a. https://www.indiastat.com/
3. Anonymous. Indiastat, Karnataka - Area, Yield and Production for the year 2022-23. 2023b. https://www.indiastat.com/
4. Banerjee H, Ray K, Dutta SK, Majumdar K, Satyanarayan T, Timsina J. Optimizing potassium application for hybrid rice (*Oryza sativa* L.) in coastal saline soils of West Bengal. J Agron. 2018;8:1-14.
5. Bhatt R, Verma KK, Kumar R, Sanghera GS. Foliar application of potassium salt of active phosphorus (PSAP) mitigates insect pests and improves yield along with sugarcane quality in response to agroclimatic conditions of Punjab. Sugar Tech. 2023;25(3):660-669.
6. Bhavya M, Vidya NT, Doni YB. Influence of foliar application of 19:19:19 and mono-potassium phosphate on growth and yield of green gram (*Vigna radiata* L.). J Sci Res Rep. 2024;30(2):1-8.

7. Chavan PM, Waghmare YM, Maindale SD, Shinde LR. Studies on effect of foliar application of nano N fertilizer on growth and yield of sorghum (*Sorghum bicolor* L.). Pharma Innov J. 2023;12(3):1501-1504.
8. Choudhary DK, Karmakar S, Kumar B. Intercession of legume-based intercropping and nano phosphorus as managerial input for upland of Jharkhand. Chem Sci Rev Lett. 2018;7(28):941-946.
9. Gomez KA, Gomez AA. Statistical Procedures for Agricultural Research. 2nd ed. New York (USA): Wiley Inter-Science Publications; 1984.
10. Janisiewicz WJ, Peterson DL, Yoder KS, Miller SS. Experimental bin drenching system for testing biocontrol agents to control postharvest decay of apples. Plant Dis. 2005;89(5):487-490.
11. Kumar N, Rana L, Kumar J, Singh AK. Photosynthetic parameters, productivity and plant macronutrient acquisition in sugarcane as affected by potassium salt of active phosphorus (PSAP) under North Central and Eastern zones of India. Sugar Tech. 2024;26(6):1580-1589.
12. Kundu A, Raha P, Dubey AN, Rani M, Paul A, Patel R. Differential responses of rice (*Oryza sativa* L.) to foliar fertilization of organic potassium salts. J Plant Nutr. 2020;44(9):1330-1348.
13. Meena RP, Venkatesh K, Khobra R, Tripathi SC, Prajapat K, Sharma RK, *et al*. Effect of rice residue retention and foliar application of K on water productivity and profitability of wheat in North West India. Agronomy. 2020;10(3):434-442.
14. Navaz M, Kumar S, Shrivastava GK, Mandavi M, Salam PK, Pandey N. Impact of foliar spray of nutrients and seed treatment on uptake of phosphorus of plant and seed of lathyrus (*Lathyrus sativus* L.) under relay cropping system. Int J Fauna Biol Stud. 2018;5(2):1-2.
15. Rekha DLM, Lakshmipathy R, Gopal GA. Effect of integrated use of biofertilizers, chemical fertilizers and farmyard manure on soil health parameters of pearl millet (*Pennisetum glaucum* L.). J Soil Sci Plant Health. 2018;2(2):1-6.
16. Shah KA, Nayaka P, Lad A. Effect of foliar spray of potassium silicate on growth and yield of paddy (*Oryza sativa* L.). Ann Plant Soil Res. 2022;24:476-480.