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Effect of potassium solubilization bacteria with different K levels on yield of wheat in Vertisols

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Abstract

The present field experiment was conducted during the *rabi* season of 2025–26 at the Research Farm, Department of Soil Science, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola to evaluate the effect of KSB and different K levels on yield of wheat. The experiment was laid out in randomised block design with seven treatments replicated thrice. The treatment consisted of T₁-Absolute control, T₂-100% NP, T₃-100% NP + 20% K + seed treatment of KSB @10 ml kg⁻¹, T₄-100% NP + 40% K + Seed treatment of KSB @10 ml kg⁻¹, T₅-100% NP+ 60% K + seed treatment of KSB @10 ml kg⁻¹, T₆-100% NP + 80% K + seed treatment of KSB @10 ml kg⁻¹ and T₇-100% NPK. The results indicated that the significantly highest grain yield (32.08 q ha⁻¹) and straw yield (42.55 q ha⁻¹) of wheat was obtained in treatment T₆-100% NP + 80% K + seed treatment of KSB @10 ml kg⁻¹ and which was found at par with 100% NP+ 60% K + seed treatment of KSB @10 ml kg⁻¹. Thus, it can be concluded that the application of KSB seed inoculation @ 10 ml kg⁻¹ + 100% NP along with 80% or 60% recommended potassium was found equally effective in enhancing grain and straw yield of wheat in Vertisols.

Keywords: KSB, potassium, wheat, Vertisols, grain and straw

Introduction

Wheat (*Triticum aestivum* L.) is one of the most extensively cultivated cereal crops and plays a vital role in global food security. It is the third largest cereal crop in the world in terms of production, following maize and rice. Owing to its wide adaptability, high productivity, and diverse end uses, wheat has become a staple food for a large proportion of the world's population. In India, wheat is the second most important food grain after rice, contributing significantly to national food production and agricultural economy. The country has witnessed remarkable growth in wheat production over the past few decades, making it the second largest wheat producing nation globally.

Potassium is an essential macronutrient that plays an important role in several physiological processes of plants, including enzyme activation, water relations, photosynthesis, assimilate transport and stress tolerance. Adequate potassium availability is therefore important for achieving higher crop productivity. Field studies have demonstrated that potassium fertilization can increase wheat grain yield, although excessive K application may not provide additional yield benefits and may reduce potassium-use efficiency (Zhan *et al.*, 2016) [9].

Potassium is one of the three main pillars of balanced fertilizer use, along with N and P. The large proportion for K is partly because crops remove an average 1.5 times more K than N, and K application through fertilizer is much lower than that of N or P. Most of Indian soils are rated as medium to high in available K status. Potassium-solubilizing bacteria (KSB) are considered an important component of sustainable nutrient management because they can enhance the release of potassium from K-bearing minerals and convert relatively unavailable forms of K into forms more accessible to plants through mechanisms such as organic acid production, acidolysis, chelation and exchange reactions (Etesami *et al.*, 2017) [2]. Research synthesis has also shown that combined application of N, P and K can improve wheat yield and nutrient-use efficiency (Lollato *et al.*, 2019) [4].

Integrated application of KSB with different levels of potassium fertilizers is considered an efficient approach for improving potassium availability, increasing fertilizer use efficiency, and sustaining soil fertility (Meena *et al.*, 2015) [6]. Such integrated nutrient management practices promote balanced nutrient supply, improve soil biological activity, enhance potassium release, and ultimately increase grain and straw yield along with nutrient uptake by wheat (Parmar and Sindhu., 2013) [7].

Although several studies have demonstrated the beneficial effects of KSB on potassium solubilization, plant growth and nutrient acquisition, comparatively less information is available on the interaction between KSB inoculation and graded potassium application on wheat grown in Vertisols.

Material and Methods

A field experiment was conducted during *rabi* season 2025-26 at the Research Farm, Department of Soil Science, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola to evaluate the effect of KSB and different K levels on yield of wheat. Soils of experimental field was found slightly medium in organic carbon, slightly alkaline in nature with low nitrogen (N), phosphorus (P) and high content of potassium (K). The treatment were T₁-Absolute control, T₂-100% NP, T₃-100% NP + 20% K + Seed treatment of KSB @10 ml kg⁻¹, T₄-100% NP + 40% K + Seed treatment of KSB @10 ml kg⁻¹, T₅-100% NP+ 60% K + Seed treatment of KSB @10 ml kg⁻¹, T₆-100% NP + 80% K + Seed treatment of KSB @10 ml kg⁻¹ and T₇-100% NPK.

The experiment was laid out in RBD with seven treatments replicated thrice. The recommended dose of fertilizer for wheat was 120:60:60 kg N:P:K ha⁻¹. Half dose of nitrogen and full dose of P and K was applied at the time sowing. Remaining half dose of nitrogen was applied at crown root initiation stage. The potassium solubilizing bacteria were applied as a seed treatment 10 ml per kg seed.

The grain and straw yields were expressed in q ha⁻¹. The recorded data on grain yield and straw yield were statistically analysed using analysis of variance (ANOVA) appropriate for a Randomized Block Design (RBD), as described by Gomez and Gomez (1984) [3]. Treatment means were compared using the critical difference (CD) at the 5 per cent level of significance.

Results and Discussion

Effect of KSB and different K levels on yield of wheat

The data in relation to effect of inoculation of KSB @ 10 ml kg⁻¹ seeds and different K levels on yield of wheat have been presented

in Table 1 and depicted graphically in fig 1 and 2.

Grain yield of wheat (q ha⁻¹)

The data presented in Fig.1 revealed that grain yield of wheat was significantly influenced by due to inoculation of KSB @ 10 ml kg⁻¹ seeds with different K levels and ranged from 17.38 to 32.08 q ha⁻¹. The significantly higher grain yield of wheat (32.08 q ha⁻¹) was observed with application of KSB seed inoculation along with 100% NP + 80% K through fertilizer followed by KSB inoculation + 100% + NP + 60% K (31.44 q ha⁻¹), KSB seed inoculation + 100% NP + 40% K (28.85 q ha⁻¹) and 100% NPK (28.16 q ha⁻¹) which were statistically at par with each other.

Inoculation of KSB + 100% NP + 80% K recorded an average of 11.20% and 22.68% over 100% NPK through chemical fertilizer and 100% NP without K respectively. On the contrast, lowest yield was recorded in absolute control (17.38 q ha⁻¹).

These results clearly indicated that seed inoculation of KSB along with 100% NP can reduced the recommended dose of potassium up to 40%. The significant increase in wheat yield with KSB seed inoculation along with 100% NP and 80% and 60% K might be due to solubilization of inorganic source of K from fertilizer. By KSB thereby, produced organic acids and enhanced yield (Archana *et al.*, 2008; Sindhu *et al.*, 2013) [1,8] and insoluble pools of aggregate soil K.

Straw Yield of wheat (q ha⁻¹)

The data presented in fig. 2 revealed that straw yield of wheat was significantly influenced by the different treatments. The straw yield ranged from 26.13 to 42.55 q ha⁻¹.

Table 1: Effect of KSB and different K levels on yield of wheat

Treat No.	Treatments details	Grain	Straw
		Yield (q ha ⁻¹)	
T ₁	Absolute control	17.38	26.13
T ₂	100% NP	26.15	35.44
T ₃	100% NP + 20% K	26.65	36.01
T ₄	100% NP + 40% K	28.85	39.07
T ₅	100% NP + 60% K	31.44	41.63
T ₆	100% NP + 80% K	32.08	42.55
T ₇	100% NPK	28.16	37.44
	S.E(m) ±	1.49	2.65
	CD at 5%	4.61	8.17

Note: Seed treatment of KSB @10 ml kg⁻¹ wheat seed was applied to treatment T₃ to T₆.

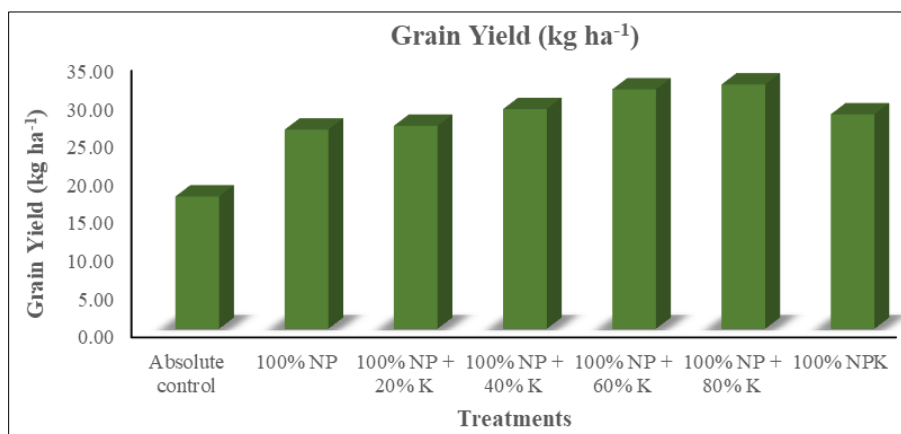


Fig 1: Effect of KSB and different K levels on grain yield of wheat

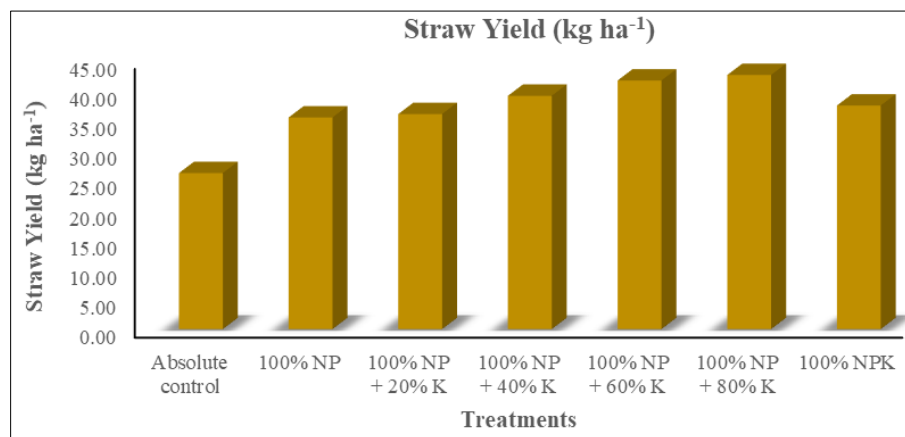


Fig 2: Effect of KSB and different K levels on straw yield of wheat

The application of KSB @ 10 ml kg⁻¹ seed inoculation + 100% NP + 80% K recorded significantly highest straw yield of wheat (42.55 q ha⁻¹) which was statistically at par with all treatments except absolute control. The results further revealed that application of 80% and 60% K along with KSB and 100% NP enhanced the straw yield of wheat to the tune of 20.06 and 17.47% over 100% NP i.e. without K.

The beneficial role of KSB may be related to their ability to solubilize or mobilize relatively unavailable soil K through the production of organic acids and other metabolites. Indian studies have identified efficient KSB strains capable of releasing fixed K and possessing additional plant growth and yield promoting characteristics. Similar findings have been reported in wheat by Maheta *et al.* (2020) [5].

Conclusion

The results of the present study indicate that KSB seed inoculation @ 10 ml kg⁻¹ seed + 100% NP along with 80% recommended dose of potassium was found most effective for enhancing grain and straw yield of wheat on Vertisols. However, KSB seed inoculation @ 10 ml kg⁻¹ seed + 100% NP along with 60% recommended dose of potassium also found equally beneficial for increasing the yield of wheat.

References

1. Archana DS, Savalgi VP, Alagawadi AR. Effect of potassium solubilizing bacteria on growth and yield of maize. *Soil Biol Ecol.* 2008;28(1-2):9-18.
2. Etesami H, Emami S, Alikhani HA. Potassium solubilizing bacteria (KSB): mechanisms, promotion of plant growth, and future prospects: a review. *J Soil Sci Plant Nutr.* 2017;17(4):897-911.
3. Gomez KA, Gomez AA. Statistical procedures for agricultural research. 2nd ed. New York: John Wiley and Sons; 1984. 680 p.
4. Lollato RP, Figueiredo BM, Dhillon JS, Arnall DB, Raun WR. Wheat grain yield and grain-nitrogen relationships as affected by N, P, and K fertilization: a synthesis of long-term experiments. *Field Crops Res.* 2019;236:42-57.
5. Maheta A. Effect of potassium and potassium solubilizing bacteria (KSB) on yield and nutrient uptake by wheat (*Triticum aestivum* L.) var. GW 366 [MSc thesis]. Junagadh: Junagadh Agricultural University; 2020.
6. Meena VS, Maurya BR, Verma JP. Potassium solubilizing microorganisms for sustainable agriculture. *Ecol Eng.* 2015;81:276-281.
7. Parmar P, Sindhu SS. Potassium solubilization by

rhizosphere bacteria: influence of nutritional and environmental conditions. *J Microbiol Res.* 2013;3(1):25-31.

8. Sindhu SS, Parmar P, Phour M. Nutrient cycling: potassium solubilization by microorganisms and improvement of crop growth. In: *Geomicrobiology and biogeochemistry*. Berlin, Heidelberg: Springer; 2013. p.175-198.
9. Zhan A, Zou C, Ye Y, Liu Z, Cui Z, Chen X. Estimating on-farm wheat yield response to potassium and potassium uptake requirement in China. *Field Crops Res.* 2016;191:13-19.