



Indian Farmer
Volume 9, Issue 06, 2022, Pp. 245-247.
Available online at: www.indianfarmer.net
ISSN: 2394-1227 (Online)

ORIGINAL PAPER



The Role of Phosphorus and Sulphur in Potato (*Solanum tuberosum*) Nutrition

Preeti Singh^{1*}, Santosh Kumar¹, Mona Nagragade², Vishal Tyagi² and Jagdev Sharma³

¹ICAR-IARI, Jharkhand-825405, India

²ICAR-IARI, New Delhi-110012, India

³ICAR-CPRI, Shimla, Himachal Pradesh, India

*Corresponding author: singh.preeti8888@gmail.com

Article Received: 18 June 2022

Published Date: 22 June 2022

ABSTRACT

Phosphorus is associated with complex energy transformations in plants. Adding phosphorus to soil low in available phosphorus promotes root growth and winter hardiness, and often hastens maturity. Similarly, sulphur (S) is an essential element in forming proteins, enzymes, vitamins, and chlorophyll in plants. Sulphur is also important in photosynthesis and contributes to crop winter hardiness. An adequate supply of sulphur is critical for crops with high nitrogen requirements, which cannot optimise nitrogen utilisation without sulphur. Taking into consideration the relevance of two nutrients, a field study was conducted at Shimla to evaluate the effects of P and S on tuber yield, quality, and nutrient uptake by potato (*Solanum tuberosum* L) as well as to work out the relationship between P and S ratio in yield parameters under the rainfed conditions of the Shimla hills. The results indicated that application of phosphorus and sulphur improved the potato growth and yield. The interaction between P and S was found to be significant in terms of potato tuber yield.

Keywords: Interaction, Potato, phosphorus, sulphur, root growth.

The potato crop has a high nutrient demand due to its short development cycle and high yield. Although nutrients such as potassium (K), nitrogen (N), and calcium (Ca) are taken up in high amounts, phosphorus (P) and sulphur (S) are the nutrients that contribute the most to an increase in tuber yield (Fleisher et al. 2013). Potato plants

have a relatively small root system and a reduced root-to-shoot ratio. They also have a low efficiency of uptake of P and S, especially from soils deficient in these nutrients (Dechassa et al, 2003). Therefore, high levels of P and S fertilisers are applied at planting in order to increase the P and S availability in the soil, because most of the P applied in the soil is unavailable for plants, especially in tropical regions (Novais and Smyth, 1999). Research indicated that only 4 to 6.5% of applied P was taken up by potato plants, without considering the P previously available in the soil (Fernandes et al. 2011). Also, excessive rates of P fertilisers in potato crops might result in economic and environmental problems, such as contamination and eutrophication of water (Rosen et al. 2014). Phosphorus is an essential nutrient for plants and plays a role in the process of cells energy transfer, respiration, and photosynthesis reactions. It is also a component of nucleic acids, nucleotides, phospholipids, and phosphorylated sugars, being important for processes related to carbohydrate formation and its storage in the tubers (Marschner, 2012). Optimum potato plant growth and tuber yield are reached when the P demand for these functions is well satisfied. This depends on P availability in the soil and the ability of the plant to uptake P from the soil (Rosen and Bierman, 2008). The plant's nutritional status in terms of P could affect how well it absorbs other nutrients. Interactions between P and other nutrients like nitrogen (N), magnesium (Mg), iron (Fe), zinc (Zn), manganese (Mn), and copper (Cu) have been reported in the literature for several crops (Islam et al. 2012). In the same way, plants need the element sulphur (S) to make proteins, enzymes, vitamins, and chlorophyll. Sulphur is also important in photosynthesis and contributes to crop winter hardiness. An adequate supply of sulphur is critical for crops with high nitrogen requirements, which cannot optimise nitrogen utilisation without sulphur. In potato crops, P and S supply affect dry matter (DM) production and P uptake (Fernandes and Soratto, 2012). Its nutrition also causes changes in nutrient concentrations in different plant organs. The study was carried out at ICAR-CPRI, Shimla, with the goal of evaluating the effect of P and S on tuber yield, quality, and nutrient uptake by potato (*Solanum tuberosum* L), as well as working out the relationship between the P and S ratio indicated that combined application of P and S produced a significantly higher yield of potato than that obtained with a single application of S or P, indicating synergistic interaction between these nutrients.

CONCLUSION

Sulfur is a nutrient most overlooked in agricultural areas. High P and S availability in the soil increases P and S concentrations in all plant organs, uptake of P and Cu, and dry matter production. In the last five decades, agriculture in India depended solely on imported fertiliser products, only urea and di-ammonium phosphate (DAP), as sources of N and P. In soils with low P and S availability, that is, when P was not supplied in the planting furrow, potato cultivars exhibited very low dry matter accumulations, tuber yields, and nutrient uptake and allocation to the tubers. A combined application of P and S produced a significantly higher yield of potato than that obtained with a single application of S or P, indicating synergistic interaction between these nutrients.

Recently, it is perceived that the production of such high nutrient-uptaking crops like potatoes can be limited by the deficiency of S and other nutrients. The results of the experiment showed that adding P and S fertiliser significantly increased potato yield, nutrient uptake, and nutrient use efficiency compared to a control plot that wasn't fertilized. This shows that the soil doesn't have enough P and S for optimal potato production.

REFERENCES

Dechassa N, Schenk MK, Claassen N, Steingrobe B (2003) Phosphorus efficiency of cabbage (*Brassica oleraceae* L. var. capitata), carrot (*Daucus carota* L.), and potato (*Solanum tuberosum* L.). *Plant Soil* 250: 215–224.

Fernandes AM, Soratto RP (2012) Nutrition, dry matter accumulation and partitioning and phosphorus use efficiency of potato grown at different phosphorus levels in nutrient solution. *Rev Bras Cienc Solo* 36:1528–1537. doi:10.1590/S0100-06832012000500017.

Fernandes AM, Soratto RP, Silva BL (2011) Extrac, ão e exportac, ão de nutrientes em cultivares de batata: I - Macronutrientes. *Rev Bras Cienc Solo* 35: 2039–2056.

Fleisher D, Wang Q, Timlin D, Chun JA, Reddy V (2013) Effects of carbon dioxide and phosphorus supply on potato dry matter allocation and canopy morphology. *J Plant Nutr* 36 (4): 566–586. 10.1080/01904167.2012.751998

Islam M, Mohsan S, Ali S, Khalid R, Afzal S (2012) Response of chickpea to various levels of phosphorus and sulphur under rainfed conditions in pakistan. *Romanian Agricultural Research* 29:175–83.

Marschner P (2012) Marschner's mineral nutrition of higher plants. Elsevier, Amsterdam.

Novais RF, Smith TJ (1999) Fósforo em solo e planta em condições tropicais. Sociedade Brasileira de Ciência do Solo Publisher, Viçosa, Minas Gerais Brasil, 399 p.

Rosen CJ, Kelling KA, Stark JC, Porter GA (2014) Optimizing phosphorus fertilizer management in potato production. *Am J Potato Res* 91:145–160. <https://doi.org/10.1007/s12230-014-9371-2>

Rosen CJ, Bierman PM (2008) Potato yield and tuber set as affected by phosphorus fertilizer. *Am J Potato Res* 85: 110-120.