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Role of potassium in solanaceous vegetables

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Abstract
India is the major producer of vegetable crops and ranks second in the world. But the productivity of vegetable crops is very low as compared to the leading producers. Low productivity may be caused by imbalanced nutrients supply. Proper nutrient management may enhance the productivity and quality of vegetable crops. Potassium is one of the essential plant macronutrients and is taken up by crops from soils in relatively large amounts. It is an essential nutrient for crops and plays an important role in several physiological processes in plants. In vegetables, potassium is an effective plant nutrient in two different ways; it improves the crop yield and improves crop quality. Besides that, it stimulates root growth, maintains tissue water relation, maintains electrochemical equilibria in cells and its compartments, regulates the enzyme activities, osmoregulation, improves the size and quality of fruit, translocate sugars and formation of carbohydrates. It also provides resistance against pest and diseases and drought as well as frost stresses (Hsiao and Lauchli, 1986) and (Imas and Bansal, 1999).

Keywords: Fertilizer, potassium, quality, solanaceous, vegetable, yield

Introduction
Vegetables, termed as “protective food” are the integral part of daily balance of human diet. In the world, India holds second rank in vegetable production. It occupies 11.37 lakh ha area having the production of 209.14 lakh MT with the productivity of 18.39 MT/ha (Anon., 2021) [3]. In India, solanaceous vegetables (Potato, Tomato, Chilli and Brinjal) are grown in tropical and sub-tropical region, which responds well to potassium fertilizers. They play a chief role in human nutrition and to cope with malnutrition, especially as sources of vitamins and dietary fibre. Moreover, solanaceous vegetable crops supplies many nutrients, provide variety to the diet and make the food attractive by their colour, texture and flavor. Strong antioxidants like lycopene, nasunin, solasodine, *etc.* are major phytochemicals present in solanaceous vegetables (Kumari *et al.* 2017) [12].

Among three essential plant macronutrients *i.e.* Nitrogen (N), Phosphorus (P) and Potassium (K); potassium is considered as quality macronutrient. Because, it plays an important role in several physiological processes in plant. It is known for its key role in insect-pest and disease resistance, quality and yield enhancement in crop. India has to import a large quantity of potassium. It is taken up by crops from soils in relatively large amounts. Mild deficiency of potassium in plants may cause thin shoot development, restricted shoot growth, necrotic and chlorotic appearance. Whereas, acute deficiency may lead to dieback of shoot, marginal scorching, stunted growth and little or no flowering (Bidari and Hebsur, 2011) [5].

Potato
Khan *et al.* (2010) [2] examined that the highest mean average yield (17.18 t/ha) was produced in plots where 150 kg K_2O/ha was applied along with 1% K_2O foliar spray of sulphate of potash.

Mahmoud and Hafez (2010) [13] observed that the number of leaves and shoots (13.11 and 5.03), fresh weight of leaves and shoots (68.27 g and 24.46 g) and dry weight of leaves and shoots (22.74 g and 5.46 g) were highest with the application of 120 kg K_2O/fed. (T_3). They also observed that the yield (9.72 t/fed.), weight (134.11 g), protein (11.09%), TSS (4.73%), carbohydrates (17.00 mg/100 g) and yield (11.25 t/fed.), weight (143.85 g), protein (11.09%), TSS (4.73%) and carbohydrates (17.00 mg/100 g) were highest in both the seasons with the treatment of 120 kg K_2O/fed. (T_3). In case of 120 kg K_2O/fed. (T_3) tuber size was found non-significant in first season whereas in second season it was found highest (160.52 cm^3).

Abd El-Latif *et al.* (2011) [1] obtained the highest significant values of yield (10.31 t/fed.) and (8.94 t/fed.) when plants were treated with 120 K_2O kg/fed. Compared to other treatments of potassium fertilizers in both the seasons. Nitrogen content in tuber was increased significantly (13.71 g/kg) and (13.23 g/kg) by adding 96 K_2O kg/fed., while phosphorus content was increased (3.03 g/kg) and (2.95 g/kg) when 72 K_2O kg/ha was applied and potassium content in tuber was increased (14.39 g/kg) and (14.31 g/kg) in 120 K_2O kg/fed. In both the seasons, respectively.
Bansal and Trehan (2011) [4] revealed that Kufri Pukhraj variety of potato on application with 150 kg K_2O/ha as muriate of potash gave significantly increased number of large tubers (102.30) and medium-large tubers (200.83) as well as tuber yield (169.54 q/ha) of large and medium-large tubers (152.42 q/ha) and there was less number of tubers of small (119.25) and very small (115.76) and less yield of small tubers (42.12 q/ha) which resulted in increase in overall tuber yield (377.71 q/ha). Moreover, highest final weight of healthy tubers (3.636 kg) and less weight loss (1.364 kg), total weight loss (27.28%), rottage of tubers (0.696 kg) and rottage loss (13.92%) under ordinary storage condition at ambient temperature were recorded in the same treatment.
Sharma and Sud (2011) [19] showed that the application of potassium in two splits *i.e.* ½ at planting (37.5 kg/ha) and ½ at earthing up (37.5 kg/ha) increased potato yield (295 q/ha) and also enhanced potassium uptake (107 kg/ha).
Singh and Chinna (2021) [20] showed that the application of 100% RDK in potato @ 120 kg/ha resulted in higher potassium content in tubers (2.31%), potassium content in haulms (1.65%), processable yield (138.12 q/ha) and less non-processable yield (52.55 q/ha).

Tomato

Akhtar *et al.* (2010) [2] noted that the disease incidence was less (4.3%) on the plants treated with potassium as muriate of potash. They also found significant increase in tomato yield (24.9 t/ha) and higher marketable tomatoes (24.0 t/ha) with potassium applied @ 100 kg K/ha as muriate of potash as compared to sulphate of potash and control. However, infestation of fruit borer was found less (624 kg/ha) with the treatment of sulphate of potash @ 200 kg K/ha. Sugar content (4.21%) and vitamin C (25.99 mg/100 g) were found highest with control and where potassium as muriate of potash was applied @ 100 kg/ha respectively.
Javaria *et al.* (2012) [9] observed that lycopene (5.06 mg/100 g), vitamin C (31.14 mg/100 g), titrable acidity (0.82%) and TSS (6.97 °Brix) were increased significantly with increasing rates of potassium up to 375 kg/ha but thereafter decreased when K_2O was applied @ 450 kg/ha.
Qihou *et al.* (2012) [17] revealed that potash applied @ 450 kg/ha at flowering phase (T_2) significantly increased single plant yield (2.14 kg/plant), soluble sugar (2.07%), organic acid (0.67%) and soluble solid (5.23%).
Woldemariam *et al* (2018) [21]. revealed that the highest fruit diameter (4.76 cm), fruit weight per plant (1.39 kg), fruit yield (15.45 t/ha), total soluble solids (3.84° Brix), dry matter (5.68), fruit moisture content (95.47%) with the treatment of 150% K_2O kg/ha in tomato.
Nisar *et al.* (2015) [15] revealed that the application of single dose of potash @ 120 kg/ha at the time of transplanting resulted in higher yield (23.30 t/ha), firmness (8.32 kg) and fruit weight (83.24 g/fruit) in tomato.
Navitha *et al.* (2019) [14] found noted that the highest plant height (113.28 cm), number of branches per plant (11.20), number of flowering clusters per plant (15.12), fruit weight (96.40 g) and fruit yield (2.88 g/plant and 88.96 t/ha) in tomato were recorded with the application of 125% potassium (polysulphate).

Chilli

Prabhavathi *et al.* (2007) [16] recorded highest total dry matter production at 75 DAS (54.06 g/plant) and at 140 DAS (109.22 g/plant), uptake of nitrogen (67.93 kg/ha), potassium (106.77 kg/ha) and sulphur (15.30 kg/ha), highest yield (10.71 q/ha), weight of 100 dry chilli fruits (131.74 g) and highest numbers of fruits per plant per picking (36.74) with the application of 150% RDK through sulphate of potash in 2 split doses by ½ basal + ½ 45 DAT.
Bidari and Hebsur (2011) [5] revealed that the ascorbic acid content (175.16 mg/100), colour value (225.28 ASTA units) and oleoresin content (16.79%) were found highest with the application of 150% potassium through sulphate of potash in 2 splits by ½ basal + ½ 45 DAT.
Khan *et al.* (2014) [10] concluded that the highest number of fruits per plant (47.7), fruit length (5.76 cm), seeds per fruit (109), yield (7.102 t/ha) could be recorded with the application of 50 kg/ha potassium in chilli.

Brinjal

Shaikh and Patel (2012) [18] observed that the highest level of potash (80 kg/ha) yielded significantly higher fruit yield (360.49 q/ha) and lowest population of aphid (2.81 aphids per leaf), jassid (1.90 jassid per leaf) and white fly (1.96 white fly per leaf).
Chaitanya *et al.* (2019) [6] revealed that the fruit yield (11.21 t/ha), ascorbic acid value (5.8 mg/100g), net returns (Rs. 88490/ha) and B:C ratio (1.92) were highest in treatment with application of 127.5 kg K_2O/ha.

Conclusion

Potassium played a significant role in solanaceous vegetables in the terms of growth, yield and quality. In potato, the dose of potassium at the rate of 120 kg K_2O/fed. Increased growth, yield and quality parameters of the crop. Moreover, 120 kg/ha potassium dose improved processable yield and quality parameters and decreased unprocessable yield. Whereas, in tomato, the treatment of 100 kg K/ha and 375 kg K_2O/ha has been observed with less disease-pest incidence and improved yield and quality characters. While, firmness and yield were increased by 120 kg/ha. In chilli, 150% recommended dose of potassium through sulphate of potash in 2 split doses by ½ basal + ½ 45 days after transplanting improved yield and quality attributes. In brinjal, 80 kg K_2O/ha and 127.5 kg K_2O/ha respectively, gave highest economic return, improved yield, quality and reduced disease-pest incidence. Different forms of potassium fertilizer, at different doses, could enhance yield and quality attributes.

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