



Impact of Potassium on the Growth and Yield Contributing Attributes of Onion (*Allium cepa* L.)

**Samra Aftab¹, F. S. Hamid², Samavia Farrukh³, Abdul Waheed²,
Naveed Ahmed^{2*}, Nadia Khan², Seemab Ali², Madiha Bashir², Saqib Mumtaz⁴,
Hina Gul⁵ and Muhammad Adil Younis⁶**

¹Agricultural Research Station Baffa, Mansehra, KPK, Pakistan.

²National Tea and High Value Crops Research Institute, Shinkiari, Mansehra, KPK, Pakistan.

³Department of Biochemistry, Hazara University, Mansehra, KPK, Pakistan.

⁴COMSATS Institute of Information Technology, Park Road, Islamabad, Pakistan.

⁵Department of Genetics, Hazara University, Mansehra, KPK, Pakistan.

⁶Department of Agriculture, Hazara University, Mansehra, KPK, Pakistan.

Authors' contributions

This work was carried out in collaboration between all authors. Author SF designed and practically conducted the study. Author FSH helped in designing and supervised the complete experiment. Authors SF and AW practically involved in experiment. Author NA performed the statistical analysis and wrote the first draft of the manuscript. Authors NK, SA and MB helped in samples and data collection. Authors SM and HG managed the literature searches. Author MAY critically analyze the data statistically. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/ARJA/2017/38322

Editor(s):

(1) Rasmia Sayed Sayed Darwesh, Professor, Agriculture Research Center, Giza, Egypt.

Reviewers:

(1) Mrityunjoy Biswas, Sylhet Agricultural University, Bangladesh.

(2) Khalid A. Khalid, Egypt.

Complete Peer review History: <http://www.sciencedomain.org/review-history/22438>

Original Research Article

Received 22nd November 2017
Accepted 21st December 2017
Published 26th December 2017

ABSTRACT

The field experiment was conducted to study the effect of different levels of potassium on growth and yield of onion at Agricultural Research Station Baffa, Mansehra, Khyber Pakhtunkhwa, during the year 2016- 2017. Four levels of potassium i.e. 0, 60, 120 and 180 kg ha⁻¹ were used as treatments in the experiment. It was observed that there was significant increase in growth and yield of onion in response to different levels of potassium. The results indicated that maximum average bulb weight (78.44 g), maximum bulb diameter (5.20 cm), and maximum yield (24.67 t ha⁻¹) was

*Corresponding author: E-mail: naveedahm89@gmail.com;

noted in plots applied with potassium at the rate of 120 kg ha⁻¹. The lowest onion yield (10.40 tons ha⁻¹) was obtained with control. It may be concluded that the highest dose of potassium application for the soil medium of Agricultural Research Station Baffa, Mansehra is empirical proved 120 kg ha⁻¹ which has significant effects on bulb diameter, bulb weight and yield of onion. Therefore potassium application of 120 kg ha⁻¹ is recommended as the most suitable dose for obtaining maximum yield of onion in Mansehra.

Keywords: Onion; potassium; growth; yield.

1. INTRODUCTION

Onion (*Allium cepa* L.) belongs to family Amaryllidaceae. It is important cool season and monocotyledon vegetable crop. Onion have diploid chromosomes number 2n=16. Onion is a biennial herb with more than 600 species distributed worldwide. Onion has shallow root system, long, linear and hollow leaves, as it grows the compacted stem at the base increases in diameter. It can be grown from seeds or bulbs depending on the purpose and variety. Onions are best cultivated in fertile soils that are well-drained. The optimum pH range, regardless of soil type, is 6.0 to 6.8, although alkaline soils are also suitable. Onions do not thrive in soils below pH 6.0 because of trace element deficiencies, or occasionally, aluminum or manganese toxicity. Sandy loams are good as they are low in sulphur, while clay soils usually have high sulphur content and produce pungent bulbs. Onions require a high level of nutrients in the soil [1]. In Pakistan onion crop is grown over an area of 147.6 thousand hectares with production of 1939.6 thousand tons and average yield/ha was 13.1 tons, while the per hectare yield in Khyber Pakhtunkhwa is 16.5, Baluchistan 18.4, Punjab 8.2 and Sindh 13.6 t ha⁻¹[2].

There is a significant response of onion to both inorganic and organic fertilizer. Generally a heavy dose of fertilizer is recommended for onion cultivation [3]. Among the major nutrients, potassium plays a vital role in plant metabolism such as photosynthesis, translocation of photosynthetic substrates regulation of plant pores, activation of plant catalysts and resistance against pests and diseases. It is also considered as a quality element as it improves quality parameters of many crops including onion. Potassium improves color, glossiness and dry matter accumulation besides improving, it also keeping bulb quality of onion [4]. Potassium is also important role in respiration, energy storage, protein synthesis and assimilates translocation [5]. Potassium application also improved the post-harvest life of onion and some other

horticultural commodities by reducing rotting, sprouting and weight loss during storage. Onion requires large quantities of nutrients and is a high yielding crop. In Pakistan per hectare yield of onion is low compared to other countries. The low production may be due to improper fertilizer usage, improper use of micro and macro nutrients [6]. Therefore, present study was designed to check the effect of different levels of potassium on growth and yield and to determine the optimum dose of potassium to obtain maximum yield of onion.

2. MATERIALS AND METHODS

The field experiment was conducted at Agricultural Research Station Baffa, Mansehra to observe the impact of potassium on the growth, yield and yield contributing attributes of onion (*Allium cepa* L.) during the year 2016-17. The soil of experimental site is clay loam with pH: 6.70, EC: 2.1 ds/m, Organic matter: 1.01%, Nitrogen: 1.26%, Potassium: 0.9% and Phosphorous 0.15%.

The experiment was laid out in Randomized Complete Block Design (RCBD) by using the onion variety "Swat-1" and four different doses of K (T₁- Control, T₂- 60 kg ha⁻¹, T₃- 120 kg ha⁻¹ and T₄- 180 kg ha⁻¹) with three replications. Seed beds were prepared to raise onion seedling and seeds were sown on 15th November, 2016 for the production of seedlings. The experimental field was properly ploughed and leveled by the application of cultural practices. Recommended doses of urea were applied to field in two split doses 60 kg ha⁻¹ at the time of transplantation and another 60 kg ha⁻¹ after 30 days. One month old uniform and healthy seedling of onion were planted on each subplots 15 cm apart between the rows and plant to plant distance 15 cm. Each subplot size was 6 m², 3 m length and 2 m width. All the cultural practices were uniformly applied to all plots including irrigation, hoeing, weeding, spraying of insecticides and fungicides. Parameters which were studied are leaf length, plant height, number of leaves plant⁻¹,

average bulb diameter, average bulb weight and yield t ha⁻¹.

2.1 Statistical Analysis

The experiment was laid out in accordance with Randomized Complete Block Design (RCBD), replicating three times. All the data was statistically analyzed at 5% level of probability through statistics software "statistix-8.1".

3. RESULTS AND DISCUSSION

3.1 Leaf Length (cm)

The mean data regarding leaf length are presented in Table 1. The mean data regarding leaf length showed significant variation. Application of potassium 120 kg ha⁻¹ had obtained the maximum leaf length (32.00 cm), which graduated by treatments 180 and 60 kg ha⁻¹ as 29.46 and 25.26 cm respectively. Whereas, the plot treated with no potash application gave minimum leaf length (21.16 cm). The present study was in close agreement with findings [7].

3.2 Plant Height (cm)

The mean data regarding plant height is presented in Table 1. Maximum plant height (48.16 cm) was obtained in the plots fertilized with K at the rate of 120 kg ha⁻¹, followed by treatments 180 and 60 kg ha⁻¹ as 41.50 and 38.08 cm respectively. However, minimum plant height (33.91 cm) was recorded in the plots received no potash (control). Similar results [8] and positive effect of K on growth of onion applied at the rate of 150 kg ha⁻¹ were observed by the other scientist [9].

3.3 Number of Leaves Plant⁻¹

The mean data regarding number of leaves plant⁻¹ are presented in Table 1. The data revealed that maximum number of leaves plant⁻¹ (7.50) was obtained in T₂ where K was applied at

the rate of 120 kg ha⁻¹, followed by 6.80 and 6.06 when treated with potassium at the rate of 180 and 60 kg ha⁻¹ respectively. While minimum number of leaves plant⁻¹ (5.30) was recorded in control treatment. The results are in conformity with that of 150 kg N and 120 kg K ha⁻¹ in which maximum plant height was obtained [10].

3.4 Single Bulb Weight (g)

The mean data regarding single bulb weight are presented in Table 1. The results showed that potassium levels have significantly affected average bulb weight. Maximum bulb weight (78.44 g) was observed in plots applied with potassium at the rate of 120 kg ha⁻¹, closely followed by the treatment 180 kg ha⁻¹ (77.11 g), while minimum single bulb weight (50.88 g) was recorded in plots received no potash (control). It was reported that 120 kg ha⁻¹ K produced the maximum bulb weight [11].

3.5 Bulb Diameter (cm)

The mean data regarding bulb diameter are presented in Table 1. The data showed that potassium levels significantly affected bulb diameter of onion. Maximum bulb diameter (5.20 cm) was observed in plots applied with K at the rate of 120 kg ha⁻¹ followed by 4.80 cm when graduated with potassium of 180 kg ha⁻¹. While minimum bulb diameter (4.20 cm) was recorded in plots received no potassium (control). These results are in agreement with those of [12] who reported that application of potash gave the best results with regard to bulb diameter.

3.6 Yield (t ha⁻¹)

The mean data regarding yield t ha⁻¹ are presented in Table 1. The data showed that increasing K rate up to 120 kg ha⁻¹ significantly increase yield tons ha⁻¹. Maximum Yield (24.673 t ha⁻¹) was noted in plots applied with potassium at the rate of 120 kg ha⁻¹, which graduated by treatments 180 and 60 kg ha⁻¹ as 20.42

Table 1. Leaf length (cm), plant height (cm), number of leaves plant⁻¹, single bulb weight (g), bulb diameter (cm) and yield t ha⁻¹ affected by different levels of Potassium

Treatments (K Levels)	Leaf length (cm)	Plant height (cm)	Number of leavesplant ⁻¹	Single bulb weight (g)	Bulb diameter (cm)	Yield t ha ⁻¹
T ₀ -Control	21.16 d	33.91 d	5.30 d	50.88 c	4.20 d	10.40 d
T ₁ -60 kg ha ⁻¹	25.26 c	38.08 c	6.06 c	62.77 b	4.50 c	16.59 c
T ₂ -120 kg ha ⁻¹	32.00 a	48.16 a	7.50 a	78.44 a	5.20 a	24.67 a
T ₃ -180 kg ha ⁻¹	29.46 b	41.50 b	6.80 b	77.11 a	4.80 b	20.42 b
LSD _{α0.05}	1.04	2.37	0.26	0.81	0.19	1.43

and 16.59 t ha⁻¹ respectively. However, minimum yield (12.403 t ha⁻¹) was recorded in plots received no Potash (control). The results are in agreement that the application of potash at the rate of 120 kg ha⁻¹ significantly increased the yield and yield component of onion [13]. Sulphate of potash gave best results regarding bulb yield as compared to muriate of potash. Carbohydrate content and bulb pungency were significantly increased with increasing potash level.

4. CONCLUSION

The best dose of potassium application for the soil medium of Agricultural Research Station Baffa, Mansehra is empirical proved 120 kg ha⁻¹ which has significant effects on bulb diameter, bulb weight and yield of onion.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Akhtar MA, Bashir K, Khan MZ, Khokhar KM. Effect of potash application on different varieties of onion. Asian J. Plant Sci. 2002;1(4):324-325.
2. Agriculture Statistics MINFA, (2010-2011).
3. Nasreen S, Hossain AKM. Influence of chemical fertilizers and organic manure on the growth and yield of onion. Bangladesh J. Agric. Res. 2000;25(2):221-231.
4. Dorais M, Papadoulos AP, Gosselin A. Greenhouse tomato fruit quality. Hort. Rev. 2001;26:262-319.
5. Desuki MEL, Mouty MMA, Ali AH. Response of onion plants to additional dose of potassium application. J. Appl. Sci. Res. 2006;2(9):592-597.
6. Ghafoor A, Jilani MS, Khaliq G, Waseem K. Effect of different NPK levels on the growth and yield of three onion varieties. Asian J. Plant Sci. 2003;2(3):342-34.
7. Ali MK, Alam MF, Alam MN, Islam MS, Khandaker SMAT. Effect of nitrogen and potassium level on yield and quality seed production of onion. J. of Applied Sci. Res. 2007;3(12):1889-1899.
8. Rathod S. Studies on improvement of shelf life in onion (*Allium cepa* L.). M.Sc (Agri) Thesis, Univ. Agric. Sci. Dharwad (India); 2010.
9. Yadav RL, Son NL, Yadave BL. Response of onion to nitrogen and potassium fertilization under semi-arid condition of Rajasthan. Indian J. Hortic. 2003;60(2): 176-178.
10. Al- Abdulsalam MA, Hamaiel AF. Effect of planting dates and compound fertilizers on growth, yield and quality of hassawi onion. Scient. J. King Faisal Univ. 2004;5(1):65-78.
11. Kumar S, Sushant CP, Tiwari, Singh V. Bulb yield and quality of onion (*Allium cepa* L.) as affected by application rates of nitrogen and potassium fertilizer. Agri. Sci. Digest. 2006;26(1):11-14.
12. Kale L. Studies on effect of different sources of nitrogen and potassium on productivity and shelf life of onion (*Allium cepa* L.) M.Sc (Agri) Thesis, Univ. Agric. Sci., Dharwad (India); 2010.
13. Singh SP, Verma AB. Response of onion (*Allium cepa*) to potassium application. Indian. J. of Agron. 2001; 46(1):182-185.

© 2017 Aftab et al.; This is an Open Access article distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Peer-review history:

The peer review history for this paper can be accessed here:
<http://sciencedomain.org/review-history/22438>