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# Effect of Potash Application on Yield of Different Varieties of Onion (*Allium cepa* L.)

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**Abstract:** An experiment was conducted to study the effect of applied potassium fertilizer on three bulb sizes (10-15, 15-20 and 20-25 mm) of five varieties of onion at the National Agricultural Research Centre (NARC), Islamabad during 1999. Nitrogen and phosphorus were applied @ 150 N and 100 $P_2O_5$ kg $ha^{-1}$ as basal fertilizers. Potash was applied @ 200 kg $K_2O$ $ha^{-1}$. The positive effect of applied K was noted on all the varieties of onion. Maximum yield of 61.11 t $ha^{-1}$ was obtained when K was applied along with N and P to Phulkara variety of bulb size 15-20 mm. The lowest yield of 12.03 t $ha^{-1}$ was observed in no-K fertilizer treatment in Swat No. 1 of bulb size 20-25 mm. It was observed that the application of K @ 200 kg $ha^{-1}$ along with N and P fertilizers significantly increased the yield of all varieties of onion irrespective of seedling bulb sizes.

**Key words:** Onion, bulb size, K fertilizer, varieties, yield

## Introduction

The onion (*Allium cepa*) is one of the oldest vegetables used by human beings as a raw vegetable and seems to have been in cultivation several thousand years before Christ (Ginai, 1970). Onion is probably a native of Asia (McCollum, 1976). It has been grown for food since the recorded history of mankind and is mentioned in the Bible.

The leading onion producing countries in order of importance are USA, Japan, Spain, Egypt, Turkey, Netherlands and Italy. The main onion exporting countries are Egypt, Netherlands, Spain, USA and Italy.

In Pakistan, onions are being grown since time immemorial as a basic condiment for culinary purposes. The area under onion was 109.8 thousand hectares with production of 1648 thousand tones per annum. Its national average yield for the last five years is 752 kg per hectare (Anonymous, 2000). Pakistan is also an onion exporter country (Ginai, 1970). However, the national average yield in Pakistan is low as compared to other countries.

Onion is an exhaustive crop in nature and a crop producing 41 t $ha^{-1}$ would remove 102 kg N, 41 kg $P_2O_5$ and 112 kg $K_2O$ $ha^{-1}$ from soil (Halliday and Trenkel, 1992). Hence, fertilizers can play an important role in onion production. Keeping in view the above facts, study was planned to assess the impact of potash fertilizer on yield of five varieties of onion grown from different size seedlings.

## Materials and Methods

The study was conducted in the research area of the National Agricultural Research Centre (NARC), Islamabad during 1999-2000. Soil was sampled from 0-15, 15-30 and 30-60 cm depths to determine different soil chemical characteristics e.g., nitrogen, phosphorus, potash, $pH_s$, $EC_e$, S etc. Chemical characteristics of the soil were determined (Anonymous, 1954), $NO_3$-N, P and K were extracted with AB-DTPA extractant for analysis (Soltanpour, 1985). Nitrogen and phosphorus were determined colorimetrically and K by flame photometer and sulphur by colorimetrically (Winkleman *et al*., 1990). Five onion varieties Phulkara, Burgundy, White Creole, Swat 1 and Texas Early Grano were planted in the field under split-split plot design with three replications. Two fertilizer treatments N, P @ 150 N and $P_2O_5$ 100 kg $ha^{-1}$ as urea and di-ammonium phosphate with and without K were studied. Muriate of potash was applied @ 200 kg $K_2O$ $ha^{-1}$ after four weeks of transplanting. All other agronomic practices were kept uniform for all the varieties.

The data recorded for yield were statistically analyzed on split-split plot design for analysis of variance (Steel and Torrie, 1980), while the treatment effects were compared by Duncan's New Multiple Range Test (Duncan, 1995) at 5 % probability level.

## Results and Discussion

**Chemical characterization of the experimental site**: The soil of the experimental site was normal with $pH_s$ 7.73 and $EC_e$ 0.59 dS $m^{-1}$ while extractable $NO_3$ - N, P and K were 30, 9.7 and 214 mg $kg^{-1}$ (Table 1). Soil was a variant of Nabipur series: coarse-loamy, mixed, hyperthermic, udic ustocrept. The soil analysis shows that soil had adequate major plant nutrients. The upper surface had higher nutrient contents as compared to the sub-surface, because of regular use of manures and fertilizers.

**Effect of fertilizers on yield**: The results of the study showed that the yield differences of various varieties were highly significant. The maximum yield was produced by Phulkara followed by Texas Early Grano, Burgundy, White Creole and Swat 1. The yield, on aggregated basis, ranged from 58.64 to 14.51 t $ha^{-1}$ in different varieties (Fig. 1). In all the varieties, K fertilizer application significantly increased the yield as compared to basal N and P fertilizer treatment. Onions, remove almost as much potash as nitrogen for production (Halliday and Trenkel, 1992). Hence, for high yield the application of fertilizers in a balanced ratio is required. The results show that potash application is an integral component of balanced fertilizers application for high yield. These results are in line with the findings of Saimbhi and Randhawa (1983), Spittstoesser (1979), Berhoyen (2000), Suojala *et al*. (1998), Nagaich *et al*. (1999), Singh and Mohanty (1998) and Varu *et al*. (1997), who reported higher yields of better quality onion with N, P and K application.

**Effect of fertilizers and seedling bulb sizes on yield:** The performance of different varieties varied significantly in terms of yield. It was in the order of Phulkara > Texas Early Grano > Burgundy > White Creole > Swat 1 (Table 2). Effect of fertilizer doses i.e., N, P alone @ 150:100 and N, P and K 150: 100: 200 kg $ha^{-1}$ and bulb sizes were also highly significant. Onion variety Phulkara produced the maximum bulb yield of 61.11 t $ha^{-1}$ from the bulb size 15-20 mm with NPK 150:100:200, whereas the minimum yield of 12.03 t $ha^{-1}$ was obtained from Swat No.1 from the bulb size of 20-25 mm with no-K fertilizer treatment. Application of N, P and K @ 150:100:200 kg $ha^{-1}$ produced significantly higher yield than N, P alone @ 150:100 in all the varieties.

The increase in yield with potash application in different varieties varied amongst various seedling bulb sizes. In small size bulb seedlings (10-15 mm) the response observed was in the order of Burgundy > Phulkara > Texas Early Grano > White Creole > Swat 1 > White Creole. In medium size seedlings the order was; Texas Early Grano > Phulkara > Burgundy > Swat 1 > White Creole. While in large size seedlings the order of response was; Texas Early Grano > White Creole > Swat 1 > Phulkara = Burgundy.

Table 1: Chemical characteristics of the experiment soil at NARC

| Depth (cm) | pH | Ece ($dSm^{-1}$) | K | $NO_3$-N | P | S | $CO_3$ | $HCO_3$ | Cl | Ca+Mg |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | ($mg\ kg^{-1}$) | | | | ($mel^{-1}$) | | | |
| 0-15 | 7.73 | 0.59 | 214 | 30.57 | 9.70 | 18.4 | 2.0 | 3.0 | 3.00 | 7.5 |
| 15-30 | 7.81 | 0.44 | 198 | 21.30 | 9.80 | 8.0 | - | 2.5 | 2.75 | 4.5 |
| 30-60 | 7.80 | 0.40 | 112 | 19.00 | 8.00 | 8.8 | - | 3.0 | 3.00 | 5.0 |

Table 2: Effect of balanced fertilizers on yield ($t\ ha^{-1}$) of different varieties of onion

| Seedlings bulb sizes (mm) | Fertilizer treatment N $P_2O_5$ $K_2O$ ($kg\ ha^{-1}$) | Varieties | | | | | |
|---|---|---|---|---|---|---|---|
| | | Phulkara | Burgundy | White Creole | Swat. 1 | Texas E. Grano | Mean |
| 10-15 | 150 -100 -00 | 45.4a | 30.6j | 17.6no | 14.8p | 42.6g | 30.2 |
| | 150 -100 -200 | 55.1cd | 42.1g | 23. 6 | 19.4mn | 49.5e | 38.0 |
| 15-20 | 150 -100 -00 | 52.8d | 40.7g | 31.5j | 16.7op | 50.0e | 38.3 |
| | 150 -100 -200 | 61.1a | 48.6e | 38.0h | 23.6l | 59.3ab | 46.1 |
| 20-25 | 150 -100 -00 | 54.6cd | 20.4m | 26.8k | 12.0q | 48.2e | 32.4 |
| | 150 -100 -200 | 59.7a | 25.5kl | 35.2i | 17.1nop | 57.0bc | 38.9 |
| | Mean | 54.8 | 34.7 | 28.8 | 17.3 | 51.1 | |

LSD value at 5% 2.44 — Means with different letters differ significantly at 5% level of probability

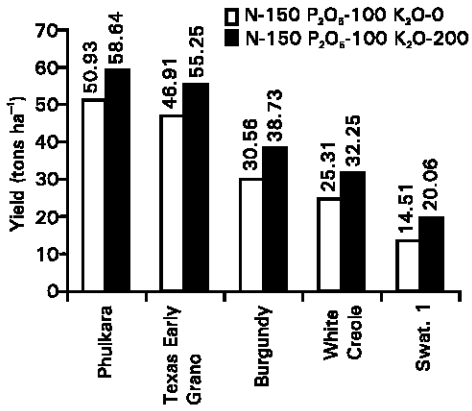


Fig. 1: Effect of NP and NPK fertilizers on onion: aggregated basis

In general the magnitude of response to K fertilizer was higher in small seedlings bulb as compare to medium and large size seedlings.

No previous work has been reported on the interaction between K fertilizer and seedling bulb sizes. However, a number of scientists; Singh and Mohanty, 1998; Saimbhi and Randhawa, 1983; Berhoyen, 2000; Suojala *et al.*, 1998; Varu *et al.*, 1997) reported higher yield and better quality of onion when K fertilizer was also applied along with N and P. Onions are produced almost all over the world under a wide range of agro-ecological conditions. There are two main groups of onion varieties, short-day and long-day varieties, hence their yield potential and fertilizer requirement would vary in different agro-ecological zones. The results show a great diversity in their yield and response to potash. The yield was further affected significantly by the interaction of potash fertilizer and seedling bulb sizes (Table 2). From these results, it is evident that more research work is needed to study the suitability of different varieties in various agro-ecological zones along with their fertilizer requirement for maximum economic yield.

In conclusion, yield of all the varieties differed significantly. Potash application increased yield across all the varieties and seedling bulb sizes. Response of different varieties to K application in terms of yield followed the order: Burgundy > Phulkara = Texas Early Grano > White Creole > Swat 1. Balanced fertilizers, including K application increased onion yield and higher response to K application was observed in small size bulbs used as seedlings. Application of 200 kg $K_2O$ along with 150 kg N and 100 kg $P_2O_5$ $ha^{-1}$ fertilizers is suggested for onion production in Pakistan.

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