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AGRONOMY | ORIGINAL ARTICLE

Effect of Different Levels of Potassium on Growth and Yield of Onion Varieties (*Allium cepa* L.) at Chitwan, Nepal

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ABSTRACT

Crop nutrition is an essential part of production that affects growth, yield and quality of the crops. A field experiment was conducted in the farmer's field at Krishnapur, Chitwan, Nepal to study the effect of different levels of potassium on growth and yield of onion during rabi season of 2019/2020. The experiment included two factors in two factorial randomized block design with total of 16 treatments replicated thrice. Four levels of potassium @ 0, 25, 50 and 75 kg ha^{-1} and four onion varieties namely Red Creole, Nasik-53, Dibya Gavran-11 and Fursungi were included in the experiment. Data on various growth and yield parameters were recorded. Application of 75 kg K ha^{-1} recorded maximum plant height (64.45 cm), maximum number of leaves (8.0) per plant and lowest number of days to harvesting (170.16 days) of bulbs. Similarly, application of 75 kg K ha^{-1} recorded maximum bulb length and maximum bulb diameter (3.77 cm and 4.21 cm), highest individual bulb weight (49.37 g) and highest marketable yield (24.14 mt ha^{-1}). Results showed significant differences among varieties on majority of growth and yield parameters. Dibya Gavran-11 recorded maximum plant height (63.47 cm) while lowest number of days to harvesting of bulbs (168.83 days) was recorded in Fursungi. Similarly, Fursungi recorded maximum bulb length (3.79 cm), highest individual bulb weight (49.44 g) and highest marketable yield per hectare (24.23 mt ha^{-1}). Field application of potassium @ 75 kg ha^{-1} depicted the best results with respect to growth and yield parameters of onion. Similarly, Fursungi responded and performed better than other three varieties.

1. Introduction

Onion (*Allium cepa* L.) is a widely cultivated bulbous vegetable that falls under class monocotyledon and family Amaryllidaceae. It has been cultivated for about 7000 years (Luttjohann 2017). Onion has become an important and indispensable part of every kitchen mainly due to its flavoring and seasoning properties. The characteristic pungent smell of onions is because of presence of sulphur compound allyl-propyl disulphide. Onion consists of phenolic compound catechol that has antifungal properties. Onions are rich sources of vitamin C and contain a compound called "quercetin" which are believed to prevent stomach and colorectal cancer (Manach et al. 2005). There has been tremendous increment in onion production over the last 50 years. The world average production has increased from 16.7 million tons in 1970 to 111.2 million tons in 2023 AD. India has the highest production of 30.2 million tons per year followed by China with 24.9 million tons production (FAOSTAT 2024).

The onion productivity of Nepal (13.95 mt ha^{-1}) is too low in comparison with the productivity of neighboring countries China (22.07 mt ha^{-1}) and India (17.36 mt ha^{-1}) (FAOSTAT 2024). The major reasons for this lower productivity are lack of quality planting materials, use of low yielding varieties, lack of sufficient supply of essential nutrients to the soil, climate fluctuation, incidence of insects and diseases, etc. Because of all these constraints affecting onion production, Nepal is largely dependent on India and China to meet the domestic requirements of the country. During the fiscal year 2022/2023, Nepal imported 1,80,190 tons of onion worth Rs. 6.75 billion (Prasain 2023) . As a result of this dependency on other countries, there is high fluctuation in supply as well as prices of onion throughout the year.

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In the context of Nepal, very few researches have been carried out in onions as compared to other vegetable crops. Researches in onions have mainly been confined to evaluation of the varieties with lesser consideration to agronomic practices like planting method, plant spacing, irrigation, nutrient management, etc. Out of the three major nutrients, K is the most neglected one and N and P are more prioritized for field application by the farmer, however K application is equally important for higher crop production. Potassium promotes the growth of the roots and the leaves, increases foliar activity for photosynthate accumulation, improves water absorption, and also protects the crop against diseases and adverse weather conditions (Hawkesford 2012). Application of potassium to the onion field enhances the leaf growth as well as stimulates the root growth and development (Bekele 2018).The yield parameters like length and diameter of bulbs, individual bulb weight, marketable yield as well as total bulb yield are significantly affected by potassium fertilization (Siddique et al. 2018). Likewise, onion is a sensitive crop and the two environmental variables i.e.; temperature and daylength are vital for onion bulb production (Khokhar 2017). Different cultivars show different responses to these environmental variables and therefore, selection of the suitable variety suited to the growing area is important for higher bulb production. Therefore, this experiment was aimed to study the effect of varying potassium levels on growth and yield of different onion varieties.

2. Materials and Methods

2.1. Experimental site

A varietal cum nutrient trail was carried out at farmer's field situated at Krishnapur, Chitwan, Nepal from the month of October 2019 to April 2020. The experimental site is situated at 27^0 37' North latitude and 84^0 25' East longitudes with an elevation of 256 meters above mean sea level.

2.2. Climatic conditions

The maximum temperature (33.5^{0}C) was recorded in the month of April while minimum temperature (11.5^{0}C) was recorded in the month of January (Figure 1). Likewise, the relative humidity ranged from 56.2-87.9% with highest RH (87.9%) recorded in the month of December. Similarly, the highest rainfall was recorded in month of April (97.1 mm).

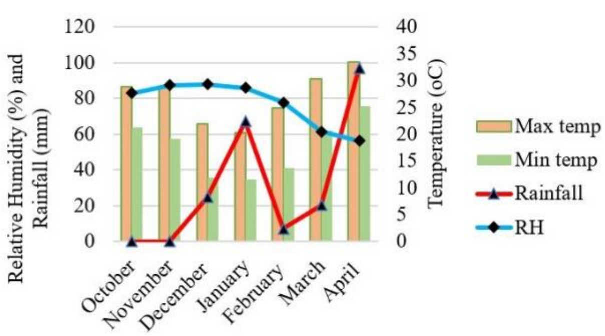

Figure 1. Agro-meteorological condition during onion growing period from October 2019 to April 2020

2.3. Soil characteristics

According to the results of soil test from Soil and Fertilizer Testing Laboratory, Hetauda, Makawanpur, Nepal, the soil present in the plot was sandy loam with pH reading value of 6.3. The nitrogen content (0.16 %) and potassium content (239.20 kg K_20 ha^{-1}) of the soil was medium in range while the soil was high in phosphorus content (291.61 kg P_20_5 ha^{-1}). Likewise, the reading for organic matter content was 2.80 %.

2.4. Experimental design

The design of the experiment was two factorial Randomized Complete Block Design with 16 treatments replicated thrice. The trail consisted of two factors- potassium levels and varieties. Four levels of potassium i.e., 0, 25,50 and 75 kg ha^{-1} and four varieties namely Red Creole, Nasik -53, Dibya Gavran-11 and Fursungi were used in the experiment. The area of the individual plot was 1.44 m^2 and the net experimental area was 69.12 m^2.

2.5. Nursery raising and transplanting

Seeds were sown on the nursery and six weeks old seedlings were transplanted to the main field. The rows were maintained at a distance of 15 cm within the plot and plants were spaced at a distance of 10 cm within the rows.

2.6. Land preparation

Land was prepared by 2-3 harrowing with disc plough followed by planking and the field was divided into 48 different experimental plots.

2.7. Manuring and Fertilization

Urea, diammonium phosphate (DAP) and muriate of potash (MOP) were used for providing nitrogen, phosphorus and potassium respectively. Farmyard manure i.e., 20 mt ha^{-1} was applied uniformly to the experimental field. Recommended dose of nitrogen and phosphorus i.e., 100 kg ha^{-1} and 40 kg ha^{-1} respectively with varying levels of potassium @ 0, 25, 50 and 75 kg ha^{-1} were applied to the experimental plots. The nitrogen was provided in two splits as top dressing. Half of the nitrogen was applied as basal dose and other half in two splits at 30 and 60 days after transplanting. Entire amount of other two nutrients i.e., P and K were incorporated during final field preparation.

2.8. Intercultural operations

2.8.1. Gap filling

Gap filling was carried out within a week of transplanting wherever necessary.

2.8.2. Irrigation

Light irrigation was provided immediately after transplanting and on daily basis for a period of one week. After that period, irrigation was provided at an interval of

15 days and it was completely stopped one month before harvesting of the bulbs.

2.8.3. Weeding

Three hand weeding were carried out at an interval of 30 days from transplanting.

2.8.4. Plant protection

Mancozeb 75% WP @2.5 g L^{-1} of water and Spinosad @ 0.6 ml L^{-1} of water were sprayed thrice on the field at an interval of 15 days to protect the crop from fungal diseases and thrips respectively.

2.9. Data Collection

The data were collected from 10 randomly sampled plants from each plot. The plants of outer two rows on each of the sides of the plots were not considered for measurements to eliminate border effect. Various observations were made and measurements were taken with respect to growth parameters i.e., plant height (cm), number of leaves and days to harvesting (days) and yield parameters such as bulb length (cm) and bulb diameter (cm), individual bulb weight (g) and marketable yield per hectare (mt ha^{-1}) during the growth stages and post-harvest of the onions. Plant height and number of leaves were measured at 30,60 and 90 days after transplanting whereas the yield and yield attributing parameters were recorded after the harvest. The days to harvesting was obtained by counting number of the days from the day of transplanting to 50% neck fall from each plot. The data collected from 10 different sampled plants were averaged and the mean data was used for analysis.

2.10. Harvesting

Harvesting of the onions was carried out in the month of April followed by seven days of shade curing.

2.11. Statistical analysis

The data obtained from the study were analyzed using R-stat (version 1.1.423.0). Tables and figures were prepared using MS Excel and used for interpretation of the results. Duncan multiple range test (DMRT) was used for mean comparison at 5% level of significance while significance was determined based on the results of analysis of variance (ANOVA).

3. Results and Discussion

3.1. Effect of potassium and varieties on growth parameters

3.1.1. Plant height and number of leaves

The height of the onion plants differed significantly with varying levels of potassium at different days after transplanting (Table 1). At 90 DAT, application of potassium @ 75 kg ha^{-1} recorded maximum plant height (64.45 cm) while minimum plant height (54.35 cm) was recorded with Red creole ($p \leq 0.01$). Application of potassium showed no significant differences on number of leaves per plant at 30 and 60 DAT however significant differences were observed at 90 DAT (Table 2). At 90 DAT, application of K @ 75 kg ha^{-1} recorded maximum number of leaves per plant (8.01) followed by K application @ 50 kg ha^{-1} (7.57) and minimum number of leaves per plant (7.11) was recorded with K application @ 0 kg ha^{-1} ($p \leq 0.001$).

Better vegetative growth at higher levels of potassium may be the result of role played by K in different physiological processes occurring in plants including cell division, cell elongation and transport of water, nutrients and other substances from root to the leaves of the plants (Amare 2020). Higher uptake at higher levels led to the synthesis of new cells resulting larger plant height and greater number of the leaves (Margray 2015). In plants with potassium deficiency, photosynthesis is reduced and plant respiration increases conversely resulting in the reduced growth and developments of the plants. Similarly, reduced vegetative growth with control may be due to lack of availability of sufficient potassium which has been found to be associated with reduced nutrient and water use efficiency in plants leading to reduced growth of the plants (Mandal et al. 2020). The other reason for enhanced vegetative growth at higher K levels may be due to positive influence of potassium on nitrogen uptake and utilization as reported by Barker et al. (1967) which resulted in taller plants with better growth. Similar results of increased plant height with increasing K levels were presented and discussed by Manik et al. (2024) in onion and Tania et al. (2021) in turmeric.

Among the varieties, Dibya Gavran-11 recorded maximum plant height (63.47 cm) and minimum plant height (57.23 cm) was recorded with Red Creole. The interaction effect of potassium levels and varieties on plant height was found to be non-significant (Table 1). Likewise, there were non-significant differences among varieties with respect to number of leaves per plant. Similarly, the interaction effect of potassium levels and varieties on number of leaves was found to be non-significant (Table 2). The differences among the varieties with respect to vegetative characters may be attributed to genetic variability among the varieties (Shah et al. 2012). The interaction effect of potassium levels and varieties on plant height and number of leaves was found to be non-significant (Table 1).

3.1.2. Days to harvesting

There was significant variation in number of days to harvesting with respect to both potassium levels and varieties ($p \leq 0.001$) (Table 3). Application of potassium @ 0 kg ha^{-1} recorded highest number of days to harvesting (177.08 days) and lowest number of days to harvesting was recorded with potassium application @75 kg ha^{-1} (170.16 days). The number of days to harvesting was reduced with higher potassium application and it was delayed in potassium unfertilized plots. Reduction in the number of days to harvesting with increasing levels of potassium can be attributed to its role in promotion of early growth and development through enhanced carbohydrate metabolism, translocation and utilization in synthesis of new cells as deficiency of K in plants have been found with delayed maturity in plants (Mengel 1997).

Table 1 Effect of different levels of potassium and varieties on plant height of onions at Krishnapur, Chitwan, Nepal (2019/20)

Treatments	Plant height (cm)		
	30 DAT	60 DAT	90 DAT
Levels of potassium (Factor A)			
0 kg K ha^{-1}	19.34^{b}	43.84^{b}	54.35^{b}
25 kg K ha^{-1}	20.09^{ab}	47.52^{a}	56.57^{b}
50 kg K ha^{-1}	21.18^{a}	49.84^{a}	61.26^{a}
75 kg K ha^{-1}	21.27^{a}	50.60^{a}	64.45^{a}
SEM (±)	0.46	1.51	2.27
$LSD_{0.05}$	1.12**	2.99***	3.62**
Onion varieties (Factor B)			
Red Creole	19.32^{c}	45.93^{b}	57.23^{b}
Nasik -53	20.26^{bc}	46.92^{ab}	56.40^{b}
Dibya Gavran-11	21.72^{a}	49.93^{a}	63.47^{a}
Fursungi	20.58^{b}	49.02^{ab}	59.52^{b}
SEM (±)	0.49	0.92	1.58
$LSD_{0.05}$	1.12**	2.99*	3.62**
Interaction effect			
SEM (±)	0.31	0.88	1.32
$LSD_{0.05}$	2.25^{ns}	5.99^{ns}	7.25^{ns}
Grand mean	20.47	47.95	59.15
CV %	6.59	7.49	7.35

In column figures with same small letter (s) do not differ significantly by DMRT at 0.05 level. ns = non-significant; *, ** and *** Significant at 0.05, 0.01 and <0.001 levels respectively. SEM- Standard error of mean, LSD = Least significant difference, CV = Coefficient of variance and DAT= days after transplanting

Table 2 Effect of different levels of potassium and varieties on number of leaves of onions at Krishnapur, Chitwan, Nepal (2019/20)

Treatments	Number of leaves		
	30 DAT	60 DAT	90 DAT
Levels of potassium (Factor A)			
0 kg K ha^{-1}	3.40	5.51	7.11^{c}
25 kg K ha^{-1}	3.37	5.54	7.37^{bc}
50 kg K ha^{-1}	3.21	5.60	7.57^{b}
75 kg K ha^{-1}	3.41	5.65	8.01^{a}
SEM (±)	0.04	0.02	0.19
$LSD_{0.05}$	0.23^{ns}	0.22^{ns}	0.39***
Onion varieties (Factor B)			
Red Creole	3.37	5.65	7.47
Nasik -53	3.36	5.64	7.38
Dibya Gavran-11	3.38	5.49	7.45
Fursungi	3.28	5.51	7.66
SEM (±)	0.02	0.04	0.04
$LSD_{0.05}$	0.23^{ns}	0.22^{ns}	0.39^{ns}
Interaction effect			
SEM (±)	0.03	0.03	0.09
$LSD_{0.05}$	0.46^{ns}	0.44^{ns}	0.79^{ns}
Grand mean	3.35	5.57	7.41
CV %	11.74	7.45	4.32

In column figures with same small letter (s) do not differ significantly by DMRT at 0.05 level. ns = non-significant; *, ** and *** Significant at 0.05, 0.01 and <0.001 levels respectively. SEM- Standard error of mean, LSD = Least significant difference, CV = Coefficient of variance and DAT = days after transplanting.

Similar results were reported by different researchers however, the results are different to Uikey et al. (2015) as they reported higher number of days to harvesting with increasing K levels in onions.

Table 3 Effect of different levels of potassium and varieties on days to harvesting of onions at Krishnapur, Chitwan, Nepal (2019/2020)

Treatments	Days to harvesting (days)
Levels of K (Factor A)	
0 kg K ha^{-1}	177.08[a]
25 kg K ha^{-1}	175.91[a]
50 kg K ha^{-1}	172.91[b]
75 kg K ha^{-1}	170.16[c]
SEM (±)	1.55
$LSD_{0.05}$	1.23***
Onion varieties (Factor B)	
Red Creole	177.75[a]
Nasik -53	172.58[b]
Dibya Gavran	176.91[a]
Fursungi	168.83[c]
SEM (±)	2.06
$LSD_{0.05}$	1.23***
Interaction effect	
SEM (±)	1.19
$LSD_{0.05}$	2.46**
Grand mean	174.02
CV %	1.55 %

In column figures with same small letter (s) do not differ significantly by DMRT at 0.05 level. ns = non-significant; * and ** Significant at 0.05 and 0.01. SEM- Standard error of mean, LSD = Least significant difference, CV = Coefficient of variance

Table 4 Interaction effect of different levels of potassium and varieties on days to harvesting of onion at Krishnapur, Chitwan, Nepal (2019/20)

Treatments	Days to harvesting (days)
Levels of K * Varieties	
0 kg K ha^{-1} * Red Creole	181[a]
0 kg K ha^{-1} * Nasik-53	173.66[def]
0 kg K ha^{-1} * Dibya Gavran	180[ab]
0 kg K ha^{-1} * Fursungi	173.66[def]
25 kg K ha^{-1} * Red Creole	179.66[ab]
25 kg K ha^{-1} * Nasik-53	173.66[def]
25 kg K ha^{-1} * Dibya Gavran	178[bc]
25 kg K ha^{-1} * Fursungi	172.33[f]
50 kg K ha^{-1} * Red Creole	176[cde]
50 kg K ha^{-1} * Nasik-53	173.33[ef]
50 kg K ha^{-1} * Dibya Gavran	176.33[cd]
50 kg K ha^{-1} * Fursungi	166[h]
75 kg K ha^{-1} * Red Creole	174.33[def]
75 kg K ha^{-1} * Nasik-53	169.66[g]
75 kg K ha^{-1*} Dibya Gavran	173.33[ef]
75 kg K ha^{-1} * Fursungi	163.33 [i]
SEM (±)	1.19
$LSD_{0.05}$	2.46**
Grand mean	174.02
CV%	1.55%

In column figures with same small letter (s) do not differ significantly by DMRT at 0.05 level. ns = non-significant; *, ** and *** Significant at 0.05, 0.01 and <0.001 levels respectively. SEM- Standard error of mean, LSD = Least significant difference, CV = Coefficient of variance.

Among varieties, highest number of days to harvesting (177.75 days) was recorded with Red Creole and lowest number days to harvesting (168.83 days) with Fursungi. The interaction effect was found to be significant with least days to harvesting observed in combination of 75 kg K ha^{-1} and Fursungi (162.33 days) followed by combination of 50 kg K ha^{-1} and Fursungi (166 days) and highest number of harvesting days with combination of 0 kg K ha^{-1} * Red Creole (181 days) ($p \leq 0.01$) (Table 4).

3.2. Effect of potassium and varieties on yield and yield attributing parameters

3.2.1. Bulb length and bulb diameter

Both the bulb length and diameter of the bulbs were significantly affected by the different levels of potassium and varieties ($p \leq 0.01$); however, their interaction effect was found to be insignificant (Table 5). Potassium application @75 kg ha^{-1} recorded the maximum bulb length (3.77 cm) and the maximum bulb diameter (4.21 cm) while K application @ 0 kg ha^{-1} recorded minimum bulb length (3.29 cm) and minimum bulb diameter (3.80 cm). Maximum length and diameter of the bulbs at higher levels of potassium may be because of higher availability of K and its influence on the photosynthates and channeling of food materials into the bulbs boosting the synthesis of carbohydrates and protein. Naher et al. (2017) reported increase in length and diameter of the bulbs with increase in K levels from control to 180 kg K ha^{-1}. Similar results of increased bulb diameter with increasing K levels were reported by Uikey et al. (2015) in onion and Jiku et al. (2020) in ginger. Similarly, among the varieties, Fursungi recorded the maximum bulb length (3.79 cm) and minimum bulb length (4.19 cm) was recorded with Dibya Gavran-11 (Table 5).

3.2.2. Individual bulb weight

The highest individual bulb weight (49.37 g) was recorded at 75 kg K ha^{-1} followed by 50 kg K ha^{-1} (46.70 g) and the lowest individual bulb weight at 0 kg K ha^{-1} (41.53 g) (Table 5). Higher individual weight of bulbs at higher levels of potassium may be attributed to increased length and diameter of the bulbs as potassium affects the synthesis and translocation of carbohydrates from leaves to the bulbs. The carbohydrates produced during the process of photosynthesis are transported to the storage organs via phloem and this process of transport occurs at the expense of adenosine triphosphate (ATP) (Prajapati 2012). If there is low availability of potassium, the production of ATP is reduced resulting lesser accumulation of carbohydrates in storage organs like bulbs and this may be the reason for lower individual bulb weight with control. Similar results of increase in individual weight of the bulbs with increasing K levels was reported by Haque et al. (2018) and Kumara et al. (2018) in onions. Similarly, Fursungi gave the highest individual bulb weight (49.44 g) and the lowest bulb weight (41.28 g) was found with Red Creole.

The interaction effect was found to be significant with highest individual bulb weight recorded with combination of 75 kg K ha^{-1} and Fursungi (56.30 g) and least with 0 kg K ha^{-1} and Red Creole (36.70 g) ($p \leq 0.05$) (Table 6).

3.2.3. Marketable yield per hectare

Marketable yield was significantly affected by both potassium levels and varieties ($p \leq 0.001$). The highest marketable yield per hectare (24.14 mt ha^{-1}) was recorded with 75 kg K ha^{-1} followed by 50 kg K ha^{-1}(22.71 mt ha^{-1}) (Table 5). Application of 0 kg K ha^{-1} recorded lowest marketable yield (19.27 mt ha^{-1}) at par with 25 kg K ha^{-1}(19.80 mt ha^{-1}). Marketable yield per hectare was increased by 17.85% and 25.27% with 50 kg K ha^{-1} and 75 kg K ha^{-1} respectively, as compared to control (Table 5). This increased marketable yield may because of the favorable effects of K on root growth and development, synthesis of carbohydrates, stomatal regulation and translocation and accumulation of photosynthates from leaves to the bulbs (Bekele 2018). Potassium had positive effects on vegetative as well as yield attributing characters of plants and ultimately resulted higher yield of bulbs. Larger plant height, a greater number of leaves, larger diameter of the bulbs and higher individual bulb weight was observed with increase in potassium application which ultimately led to higher marketable yield. Aftab et al. (2017) reported similar findings of 50% higher marketable yield of bulb for 120 kg K ha^{-1} application compared to the control. Similar results of increase in marketable yield with increase in K levels were reported by Deepa et al. (2017) in onion and Islam et al. (2020) in tomato.

Among varieties, Fursungi recorded highest marketable yield per hectare (24.23 mt ha^{-1}) and lowest marketable yield per hectare (17.73 mt ha^{-1}) was recorded with Red Creole. The marketable yield of Dibya Gavran-11 (22.33 mt ha^{-1}) didn't vary significantly with N-53 (21.63 mt ha^{-1}). The interaction effect was found to be non-significant (Table 6). This difference in yield may be the result of interaction between the genetic makeup of the varieties and the environment (Baliyan 2014). Gautam et al. (2009) reported similar results of lower bulb yield of Red Creole in an experiment that included N-53 and other two varieties. Higher yield from Fursungi can be attributed to larger plant height, larger bulb diameter, larger individual weight of the bulbs as obtained from the variety compared to the other three varieties. Similar results of difference in marketable yield among five different onion varieties was reported by Kindeya et al. (2020) and Baliyan (2014).

Table 5 Effect of different levels of potassium and varieties on yield and yield attributing parameters of onion at Krishnapur, Chitwan, Nepal (2019/20)

Treatments	Bulb length (cm)	Bulb diameter (cm)	Individual bulb weight (g)	Marketable yield per hectare (mt ha^{-1})
Levels of potassium (Factor A)				
0 kg K ha^{-1}	3.29^{b}	3.80^{c}	41.53^{d}	19.27^{c}
25 kg K ha^{-1}	3.36^{b}	3.94^{bc}	43.37^{c}	19.80^{c}
50 kg K ha^{-1}	3.58^{ab}	4.07^{ab}	46.70^{b}	22.71^{b}
75 kg K ha^{-1}	3.77^{a}	4.21^{a}	49.37^{a}	24.14^{a}
SEM (±)	0.12	0.09	1.74	1.16
$LSD_{0.05}$	0.29**	0.21**	1.72***	1.26***
Onion varieties (Factor B)				
Red Creole	3.42^{bc}	3.49^{c}	41.28^{c}	17.73^{c}
Nasik -53	3.61^{ab}	3.98^{b}	44.50^{b}	21.63^{b}
Dibya Gavran-11	3.19^{c}	4.43^{a}	45.75^{b}	22.33^{b}
Fursungi	3.79^{a}	4.12^{b}	49.44^{a}	24.23^{a}
SEM (±)	0.10	0.12	1.68	1.36
$LSD_{0.05}$	0.29**	0.21***	1.72***	1.26***
Interaction effect				
SEM (±)	0.08	0.07	1.14	0.82
$LSD_{0.05}$	0.59^{ns}	0.43^{ns}	3.44*	2.51^{ns}
Grand mean	3.5	4.0	45.24	21.48
CV %	6.48	6.45	4.87	7.78

In column figures with same small letter (s) do not differ significantly by DMRT at 0.05 level. ns = non-significant; *, ** and *** Significant at 0.05, 0.01 and <0.001 levels respectively. SEM- Standard error of mean, LSD = Least significant difference, CV = Coefficient of variance.

Table 6 Interaction effect of different levels of potassium and varieties on yield and yield attributing parameters of onion at Krishnapur, Chitwan, Nepal (2019/20)

Treatments	Bulb length (cm)	Bulb diameter (cm)	Individual bulb weight (g)	Marketable yield (mt ha^{-1})
Levels of potassium * Varieties				
0 kg K ha^{-1} * Red Creole	3.23	3.42	36.70^{h}	16.34
0 kg K ha^{-1} * Nasik-53	3.59	3.77	41.73^{fg}	19.42
0 kg K ha^{-1} * Dibya Gavran-11	2.86	4.06	44.33^{efg}	20.83
0 kg K ha^{-1} * Fursungi	3.50	4.95	43.36^{fg}	20.46
25 kg K ha^{-1} * Red Creole	3.24	3.46	40.56^{g}	17.13
25 kg K ha^{-1} * Nasik-53	3.64	3.82	42.30^{fg}	19.63
25 kg K ha^{-1} * Dibya Gavran-11	2.91	4.31	42.80^{fg}	19.79
25 kg K ha^{-1} * Fursungi	3.64	4.19	47.83^{bcde}	22.66
50 kg K ha^{-1} * Red Creole	3.32	3.41	43.00^{fg}	18.24
50 kg K ha^{-1} * Nasik-53	3.56	4.13	45.16^{cdef}	23.06
50 kg K ha^{-1} * Dibya Gavran-11	3.51	4.61	48.40^{bcd}	23.47
50 kg K ha^{-1} * Fursungi	3.95	4.12	50.26^{b}	26.06
75 kg K ha^{-1} * Red Creole	3.88	3.68	44.86^{def}	19.19
75 kg K ha^{-1} * Nasik-53	3.66	4.19	48.83^{bc}	24.42
75 kg K ha^{-1*} Dibya Gavran-11	3.49	4.75	47.50^{bcde}	25.23
75 kg K ha^{-1} * Fursungi	4.06	4.22	56.30^{a}	27.73
SEM (±)	0.08	0.07	1.14	0.82
$LSD_{0.05}$	0.59^{ns}	0.43^{ns}	3.44*	2.51^{ns}
Grand mean	3.5	4.0	45.24	21.48
CV %	6.48	6.45	4.57	7.78

In column figures with same small letter (s) do not differ significantly by DMRT at 0.05 level. ns = non-significant; *, ** and *** Significant at 0.05, 0.01 and <0.001 levels respectively. SEM- Standard error of mean, LSD = Least significant difference, CV = Coefficient of variance.

4. Conclusion

Among the different levels, application of potassium @75 kg ha^{-1} was found better for growth and yield of onion. Fursungi performed better in terms of yield compared to other three varieties. The yield performance of two varieties N-53 and Dibya Gavran-11 were similar and also better than that of the variety Red Creole. These conclusions are derived from the experiment carried out in a single season and further confirmation on 75 kg K ha^{-1} being the optimum level and Fursungi being the appropriate variety suited to the area is needed before the recommendation. Similarly, trails with higher levels of potassium should be conducted and their effect on onion growth and yield should be studied.

Conflict of Interests

The authors declare that there is no conflict of interests regarding the publication of this paper.

References

Aftab, S., Hamid, F. S., Farrukh, S., Waheed, A., Ahmed, N., Khan, N., Ali, S., Bashir, M., Mumtaz, S., Gul, H., Younis, M. 2017. Impact of Potassium on the growth and yield contributing attributes of onion (*Allium cepa* L.). Asian Research Journal of Agriculture, 7(3):1-4.

https://doi.org/10.9734/ARJA/2017/38322.

Amare, G. 2020. Review on mineral nutrition of onion (*Allium cepa* L.). *Open Biotechnology Journal* , 14(1):134-144.

https://doi.org/10.2174/1874070702014010134.

Baliyan, S.P. 2014. Evaluation of onion varieties for productivity performance in Botswana. World Journal of Agriculture Research, 2:129-135.

https://doi.org/10.12691/wjar-2-3-8

Barker, A. V., Maynard, D. N., Lach-man, W. H. 1967. Induction of tomato stem and leaf lesions, and potassium deficiency by excessive ammonium nutrition. Soil Science , 103:319-327. https://doi.org/10.1097/00010694-196705000-00003

Bekele, M. 2018. Effects of different levels of potassium fertilization on yield, quality and storage life of onion (*Allium cepa* L.) at Jimma, Southwestern Ethiopia. Journal of Food Science and Nutrition , 01(02):32-39.

https://doi.org/10.35841/food-science.1.2.32-39

Deepa, A.H., Wagh, A.P., Nagre, P.K., Kale, V.S., Walke, R.D. 2019. Effect of different doses and splits of potassium on growth and yield of onion. International Journal of Pure Applied Bioscience. 5(6): 887-894.

https://doi.org/10.18782/2320-7051.3053

FAOSTAT. 2024.World onion production. Food and Agriculture Organization of the United Nations. Available online: http://www.fao.org/faostat/en/#home (accessed on 24 September 2024)

Gautam, I., Khatri, B, Paudel, GP. 2009. Evaluation of different varieties of onion and their transplanting times for off-season production in mid hills of Nepal. Nepal Agriculture Research Journal , 7:21-26. https://doi.org/10.3126/narj.v7i0.1862

Hawkesford, M.,Horst, W.; Kichey, T., Lambers, H.; Schjoerring, J., Møller, I.S., White, P. 2012. Functions of Macronutrients. In: Marschner, P.(ed) Mineral Nutrition of Higher Plants, 3rd ed. Academic Press: San Diego, USA, pp. 135-189.

https://doi.org/10.1016/B978-0-12-384905-2.00006-6.

Islam, Md., Hossain, MM, Mia, M., Karim, A.J.M. Sirajul. 2020. Effect of potassium on yield, quality and shelf life of tomato. Bangladesh Journal of Agricultural Research. 44(4): 659-668. https://doi.org/10.3329/bjar.v44i4.45725

Jiku, M. A., Alimuzzaman, M, Singha, A., Rahaman, M. A., Ganapati, R. K., Alam, M. A., Sinha, S. R. 2020. Response and productivity of garlic (*Allium sativum* L.) by different levels of potassium fertilizer in farm soils. Bulletin of the National Research, 44(1):1-9. https://doi.org/10.1186/s42269-020-0267-7.

Khokhar, K. M. 2017. Environmental and genotypic effects on bulb development in onion – review. Journal of Horticultural Science and Biotechnology, 92(5):448-454.

https://doi.org/10.1080/14620316.2017.1314199.

Kindeya, Y., Chermet, S., Zibelo, H., Tuemay, A., Kassie, M., Abraha, A., Weldu, A. 2020. Performance evaluation and shelf life of onion varieties in Western Tigray, Ethiopia. Journal of Experimental Agriculture International, *42*(9):38-47. https://doi.org/10.9734/jeai/2020/v42i930585.

Kumara, B.R., Mansur, C.P., Chander, G., Wani, S.P., Allolli, T.B., Jagadeesh, S.L., Mesta, R.K., Satish, D., Meti, S., G. Reddy, S. Effect of potassium levels, sources and time of. application on yield of onion (*Allium cepa* L.), International Journal of Current Microbiology and Applied Science. 6(2): 540-549. http://dx.doi.org/10.20546/ijcmas.2018.707.494

Luttjohann, B. 2017. Outstanding onions. *Permaculture News*. https://www.permaculturenews.org/2017/10/11/outstanding-onions/ (accessed on 20 August 2022)

M. K. Haque, M.K. Ali, M. A. Baki, M. Ehsanullah (2018). Effects of Nitrogen and Potassium on Bulb-to-Bulb Onion Production. Journal of Agricultural and Rural Research, 2(3): 38-46. http://aiipub.com/journals/effects-of-nitrogen-and-potassium-on-bulb-to-bulb-onion-production/

Manach, C., Williamson, G., Morand, S., Scalbert, C., Remesy, C. 2005. Bioavailability and bio efficacy of polyphenols in humans. I. Review of 97 bioavailability studies. American Journal of Clinical Nutrition, 81: 230-242.

https://doi.org/10.1093/ajcn/81.1.230S

Mandal, J., Acharya, P., Bera, R., Mohanta, S. 2020. Response of onion to NPK, S and micronutrients. International Journal of Current Microbiology and Applied Science, 9(6):1137-1144. https://doi.org/10.20546/ijcmas.2020.906.141

Manik, M. M. H., Razzaque, M. A., Haque, M. I., Joha, M. R. K., Syfullah, K., Khanam, A. A., Reza, M. S., & Afrose, S. N. (2024). Effect of Different Level of Potassium and Sulfur Fertilizers on Growth and Yield of Onion (Allium cepa L.). Asian Journal of Agriculture and Allied Sciences, 7(1), 33–40. https://journalagriculture.com/index.php/AJAAS/article/view/40

Margray, M.M. 2015. Effect of different levels of sulphur and potassium on growth, yield and quality of garlic (*Allium sativum* L.). PhD Thesis. Sher-e-Kashmir University of Agricultural Sciences & Technology of Kashmir, Srinagar, India.

Mengel, K. 1997. Impact of potassium on crop yield and quality with regard to economic and ecological aspects. In *Food security in the WANA region: The essential need for balanced fertilization*, Johnston, A.E., Ed; International Potash Institute: Basel, Switzerland,pp. 157–174.

Naher, Mst & Brahma, Sangita & Islam, Md & Sarker, M B & Hasan, Mm & Fahim, Abu. (2017). Productivity of summer onion to different sources and levels of potash. Bangladesh Agronomy Journal. 20 (1): 37-43.

http://dx.doi.org/10.3329/baj.v20i1.34881

Prajapati, K. 2012.The importance of potassium in plant growth – a review. Indian Journal of Plant Science, 1:177-186. Available at http://www.cibtech.org/jps.htm

Prasain, K. 2023. Traders look north as demand for onion rises: https://kathmandupost.com/money/2023/12/25/traders-look-north-as-demand-for-onion-rises.___(accessed on 30 September, 2024)

Shah, S., Muhammad, S., Alam, R., Rab, A., Mateen, A., Jan, I., Ali, A., Wahid, F. 2012. Comparative study of onion cultivars at Mardan, Khyber Pakhtunkhwa-Pakistan. Sarhad Journal of Agriculture, 28:399-402.

https://www.researchgate.net/publication/231350323_Comparative_study_of_onion_cultivars_at_Mardan_Khyber_Pakhtunkhwa-Pakistan

Tania, Chongtham & Chatterjee, R & Chattopadhyay, P & Phonglosa, Amit & Basanta, T & Haobijam, J. (2021). Role of potassium and nitrogen on growth, yield and quality of turmeric (*Curcuma longa L.*) cv. "Suranjana" under alluvial plains of West Bengal. International Journal of Current Microbiology and Applied Sciences. 10:7-12.

https://doi.org/10.20546/ijcmas.2021.1001.002

Uikey, D., Chittora, A., Birla, D., Thamba, KN. 2015. Effect of potassium and sulphur on growth, yield and quality of onion. Annals of Plant and Soil Research , 17(4):356-361.