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# Growth and yield performance of cauliflower as influenced by NPK fertilization combinations under Western plain zones of Uttar Pradesh

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## ABSTRACT

**The present investigation was carried out during 2016-2017 to delineate the best performing combinational doses of NPK on two cauliflower varieties (Pusa Snowball K-1 and Pusa Himjyoti). Four different combinations of NPK kg ha$^{-1}$, *viz.* T0 = 0:0:0, T1 = 80:30:60, T2 = 120:60:80 and T3 = 150:70:100 NPK with three replications using two-way factorial analysis. Results revealed that NPK application of 120:60:80 kg ha$^{-1}$ was found to be performing better for yield contributing characters of cauliflower var. Pusa Snowball K-1 with maximum plant weight (1.50 kg/ plant), net curd weight (659 g/ plant), curd diameter (13.33 cm), curd height (10.12 cm), stalk length (3.25 cm) and curd yield per plot (14.29 kg/plot), whereas, treatment T3, when applied on Pusa Snowball K-1 resulted in better growth in terms of plant height (37.16 cm), plant spread (47.23 cm) and number of leaves (14.93). The study also revealed that ascorbic acid as well as β-carotene contents in curds showed a decreasing trend with increasing level of NPK inputs irrespective of variety. Under Western plain zones of Uttar Pradesh better performance of Pusa Snowball K-1 with NPK application of 120:60:80 kg ha$^{-1}$ could be suitable combination for cauliflower cultivation.**

**Key Words:** Cauliflower, curd quality, growth, Pusa Himjyoti, Pusa Snowball K-1, yield.

## INTRODUCTION

Cauliflower being a heavy feeder of nutrients requires balanced and sufficient supply of nutrients for better growth and higher yield. Hence, cauliflower production needs efficient nutrient management for achieving maximum yield. Among various factors responsible for low production of cauliflower, nutrition is of prime importance. Among the major nutrients, nitrogen is the main limiting nutrient in cauliflower along with other micro-nutrients (Ali *et al*., 1). An adequate supply of nitrogen is associated with vigorous vegetative growth. Phosphorus (P) is important not only for floral initiation but also influence the plant growth. It is an essential constituent of many vital compounds. An adequate supply of phosphorus tends to counter the deleterious effects of an excess of N. It hastens maturity, improves fruit quality, favours root growth and may increase disease resistance in plants. Potassium plays an important role in the water economy of plants and reduces the tendency to wilt. It also hardens supporting tissues and thereby reduces lodging. It may reduce susceptibility to disease and it improves the quality of fruits and other storage organs like swollen roots and tubers. A balanced N to K ratio is particularly important in plant nutrition, as K tends to reduce the adverse effects of excessive N. Balanced dose of nitrogenous, phosphatic and potassic fertilizers is required to increase crop productivity without any adverse effect on environment. The present investigation was conducted at ICAR-IIFSR during 2016-17 to find out the ideal level of nutrients on growth, yield and quality of cauliflower var. Pusa Himjyoti and Pusa Snowball K-1.

## MATERIALS AND METHODS

The present investigation was carried out on cauliflower (*Brassica oleracea* L. var. *botrytis*) following two-way factorial analysis with four different combinations of NPK, two cultivars Pusa Snowball K-1 and Pusa Himjyoti with three replications for each treatment at Siwaya Farm of ICAR-IIFSR, Modipuram, Meerut during 2016-17. The experiment comprised of four combinations of NPK, *viz.*, control T0 (0:0:0), T1 (80:30:60 kg ha$^{-1}$), T2 (120:60:80 kg ha$^{-1}$) and T3 (150:70:100 kg ha$^{-1}$). The soil of the experimental plot was sandy loam with pH 7.57, organic carbon 0.55%, available N content 118.54 kg ha$^{-1}$, available $P_2O_5$ content 11.83 kg ha$^{-1}$ and available $K_2O$ 154.61 kg ha$^{-1}$. Five-week-old seedlings of cauliflower var. Pusa Snowball K-1 and Pusa Himjyoti were transplanted at a spacing of 60 cm x 60 cm there by accommodating 24 plants in a plot size of 10 m$^2$ (5 m × 2 m). Half dose of nitrogen, full dose of phosphorus and potash were applied in experimental plots and thoroughly mixed in soil before transplanting. Remaining half dose of nitrogen was applied one month after transplanting. All the crop

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management practices were adopted during cropping season. Observations on growth, yield and quality of cauliflower were recorded as per the standard procedures. Before and after harvest of the crop, soil samples from the depth of 0-15 cm were collected from each plot. Samples were dried, grinded, mixed thoroughly and used for determination of available NPK nutrient contents using standard methods, *viz*. nitrogen by alkaline potassium permanganate method (Subbiah and Asija, 13), phosphorus by Olsen's method (Olsen *et al*., 8) and potassium by ammonium acetate method using flame photometer (Hanway and Haidal, 4). The results obtained were subjected to two-way factorial (Factor 1: 4 levels of NPK: Factor 2: 2 varieties) analysis using SPSS software (ver. 16.0). Means of different treatments and their interactions were compared using Duncan multiple range test (DMRT) at 5% level of significance (Steel and Torrie, 12).

## RESULTS AND DISCUSSION

The results presented in Table 1 depicts the effect of different treatments on growth characteristics and yield attributes of two cauliflower varieties. Plant height of at 30 DAT (days after transplanting) and plant spread at 30 and 45 DAT were significantly influenced by NPK fertilization. The maximum plant height of 23.43 cm at 30 DAT and 33.81 cm at 45 DAT has been recorded for treatment T3, whereas the minimum plant height of 18.40 and 29.33 cm were recorded for control (T0), respectively at 30 and 45 DAT. Among the two varieties, Pusa Snowball recorded better growth attributes than Pusa Himjyoti. Significantly higher values of plant height and plant spread at 30 and 45 DAT were recorded in Pusa Snowball K-1 as compared to Pusa Himjyoti. Pusa Pusa Snowball K-1 registered plant height of 24.67 cm at 30 DAT and 34.71 cm at 45 DAT. Combined effect of different NPK levels and variety on plant height at 30 and 45 DAT revealed significant interaction effect. Pusa Snowball K-1 with the application of T2 @120:60:80 recorded the maximum plant height (25.71 cm) at 30 DAT and T3 @150:70:100 recorded the maximum plant height of 37.16 cm at 45 DAT (Table 1). This might be due to the higher availability of nutrients, which promoted more vegetative growth in the plants receiving higher doses of NPK. Similar findings have been recorded by Verma and Yadav (15) in cauliflower and Choudhary and Choudhary (2) on cabbage; and Mahmud *et al*. (7) on broccoli.

The results also revealed the significant effect of NPK level on plant spread. The maximum plant spread of 27.79 cm at 30 DAT and 42.22 cm at 45 DAT has been recorded for treatment T3. Comparison of both the varieties in terms of plant spread at 30 and 45 DAT suggested significant higher values for Pusa Snowball K-1 over Pusa Himjyoti had significant difference for plant spread at 30 and 45 DAT (31.24 cm at 30 DAT and 45.06 cm at 45 DAT). Significant interaction effect of variety and NPK level was observed for plant spread. The results revealed the significant effect of NPK level on number of leaves at 30 and 45 DAT and plant stand (%) at harvest (Table 1). The highest number of leaves (11.57) has been recorded for treatment T3 at 30 DAT and 14.13 at 45 DAT. Pusa Snowball K-1 recorded higher values for number of leaves (12.65 at 30 and 13.89 at 45 DAT) as compared to Pusa Himjyoti (8.63 at 30 and 12.27 at 45 DAT). Significant interaction effect of variety and NPK level was observed in number of leaves, where higher number of leaves (13.96 at 30 DAT and 14.93 at 45 DAT were recorded for treatment T3, which were at par with T2. Similar results were also recorded for plant stand with highest value (92.13%) for treatment T2 and lowest (86.34%) for control (Table 1). This could be attributed to enhanced vegetative growth and subsequent higher yield. The results are in line with the findings of Kodithuwakku and Kirthisinghe (5) and Prasad *et al*. (9).

Main and interaction effect of variety as well as different levels of NPK on yield performance of cauliflower was studied. There was significant main and interaction effect of NPK level as well as variety on gross plant weight, net curd weight, curd diameter, curd height, stalk length and curd yield in the present study (Table 2). Treatment T2 recorded maximum gross plant weight (1.41 kg) and net curd weight (497.45 g). Among the two varieties, Pusa Snowball K-1 was better than Pusa Himjyoti and recorded higher gross plant weight (1.37 kg) and net curd weight (553.45 g). Maximum gross plant weight (1.50 kg) and net curd weight (659.00 g) was recorded for Pusa Snowball K-1 with treatment T2. The results revealed that yield attributes of both cauliflower varieties up to NPK supplementation at 120:60:80. However, further increase in NPK levels had negative impact. These results are also in close conformity with the findings of Mahmud *et al*. (6), El-All and Shabrawy (3) and Singh *et al*. (11) on brocooli. The result indicated that the treatment receiving high dose of nitrogen fertilizer resulted in higher vegetative growth, while at optimum doses of nitrogen, phosphorous and potash resulted in reproductive growth in terms of higher curd yield, curd weight, curd diameter, curd height and stalk length.

**Table 1.** Effect of different NPK combinations on growth attributes of cauliflower.

| Treatment# | Plant height | | Plant spread | | No. of leaves | | Plant stand (%) |
|---|---|---|---|---|---|---|---|
| | 30 DAT | 45 DAT | 30 DAT | 45 DAT | 30 DAT | 45 DAT | |
| NPK level | | | | | | | |
| T0 (control) | 18.40$^{a}$ | 29.33$^{a}$ | 23.93$^{a}$ | 38.23$^{a}$ | 9.95$^{a}$ | 12.52$^{a}$ | 86.34$^{a}$ |
| T1 | 21.06$^{b}$ | 30.76$^{b}$ | 25.95$^{b}$ | 39.21$^{a}$ | 10.48$^{b}$ | 12.65$^{a}$ | 88.89$^{b}$ |
| T2 | 23.16$^{c}$ | 32.90$^{c}$ | 27.44$^{c}$ | 41.27$^{c}$ | 10.55$^{b}$ | 13.03$^{b}$ | 92.13$^{c}$ |
| T3 | 23.43$^{c}$ | 33.81$^{c}$ | 27.79$^{c}$ | 42.22$^{c}$ | 11.57$^{c}$ | 14.13$^{c}$ | 87.35$^{a}$ |
| SEM± | 0.17 | 0.32 | 0.26 | 0.36 | 0.11 | 0.11 | 0.35 |
| Variety | | | | | | | |
| V1 (Pusa Snowball) K-1 | 24.67$^{b}$ | 34.71$^{b}$ | 31.24$^{b}$ | 45.06$^{b}$ | 12.65$^{b}$ | 13.89$^{b}$ | 89.39$^{b}$ |
| V2 (Pusa Himjyoti) | 18.35$^{a}$ | 28.69$^{a}$ | 21.32$^{a}$ | 35.40$^{a}$ | 8.63$^{a}$ | 12.27$^{a}$ | 87.96$^{a}$ |
| SEM± | 0.12 | 0.23 | 0.18 | 0.25 | 0.04 | 0.08 | 0.25 |
| NPK level × variety | | | | | | | |
| V1T0 | 23.33$^{e}$ | 32.53$^{d}$ | 29.06 | 42.23 | 11.77$^{d}$ | 13.52 | 87.04 |
| V1T1 | 24.26$^{f}$ | 32.71$^{d}$ | 30.70 | 43.94 | 12.42$^{e}$ | 13.35 | 89.82 |
| V1T2 | 25.71$^{g}$ | 36.43$^{e}$ | 32.49 | 46.82 | 12.44$^{e}$ | 13.74 | 93.06 |
| V1T3 | 25.39$^{g}$ | 37.16$^{e}$ | 32.71 | 47.23 | 13.96$^{f}$ | 14.93 | 87.67 |
| V2T0 | 13.46$^{a}$ | 26.12$^{a}$ | 18.81 | 34.22 | 8.13$^{a}$ | 11.52 | 85.65 |
| V2T1 | 17.86$^{b}$ | 28.80$^{b}$ | 21.20 | 35.48 | 8.55$^{ab}$ | 11.94 | 87.96 |
| V2T2 | 20.61$^{c}$ | 29.37$^{bc}$ | 22.38 | 35.71 | 8.66$^{b}$ | 12.31 | 91.21 |
| V2T3 | 21.46$^{d}$ | 30.46$^{c}$ | 22.87 | 37.21 | 9.19$^{c}$ | 13.32 | 87.04 |
| SEM± | 0.24 | 0.46 | 0.36 | 0.50 | 0.15 | 0.16 | 0.49 |
| ANOVA, P>F | | | | | | | |
| NPK Level | ** | ** | ** | ** | ** | ** | ** |
| Variety | ** | ** | ** | ** | ** | ** | ** |
| NPK level × Variety | ** | * | NS | NS | ** | NS | NS |

Mean values (*P ≤ 0.05, **P ≤ 0.01, NS = Non significant); Data expressed as Mean of triplicate measurements (n = 3); #T0 = 0:0:0, T1 = 80:30:60, T2 = 120:60:80 and T3 = 150:70:100

The effect of NPK level on curd diameter, curd height and stalk length was reported to be significant. Application of treatment T2 resulted in maximum values of curd diameter (11.64 cm), curd height (8.54 cm) and stalk length (2.71 cm), whereas treatment T0 (control) resulted in the lowest value of curd diameter (10.06 cm), curd height (7.67 cm) and stalk length (2.11 cm). However, the interaction of levels of NPK and variety was recorded to be non-significant for these traits. The highest curd yield (10.92 kg/ plot) was recorded from treatment T2 followed by treatment T3 (9.43 kg/ plot). Among the interaction of NPK levels and variety highest curd yield was found from Pusa Snowball K-1 with treatment T2 and the lowest curd yield was found from Pusa Himjyoti with treatment T0 (control). Study of quality attributes of cauliflower in terms of ascorbic acid and β-carotene content were significantly influenced due to NPK levels as well as varietal difference (Table 3). The ascorbic acid as well as β-carotene content showed a decreasing trend irrespective of variety with increasing nitrogen level. Treatment T0 (control) had the highest ascorbic acid (57.24 mg/ 100 g) and β-carotene (0.30 µg/100 g) as compared to other treatment groups due to effect of NPK level alone. However, there was no significant interaction effect of NPK level and variety was noted. Study also suggested that there could be inverse relation between increasing NPK levels and ascorbic acid content. This might be due to the higher doses of NPK fertilizers, which reduced the dry matter content resulting in less ascorbic acid and β-carotene contents. These results are in conformity with the findings of Roni *et al*. (10) who have also recorded

**Table 2.** Effect of different NPK combinations on yield contributing characters of cauliflower.

| Treatment# | Gross plant wt. (kg) | Net curd wt. (g) | Curd dia. (cm) | Curd height (cm) | Stalk length (cm) | Curd yield/ plot (kg) |
|---|---|---|---|---|---|---|
| NPK level | | | | | | |
| T0 (control) | 1.21[a] | 390.56[a] | 10.06[a] | 7.67[a] | 2.11[a] | 7.69[a] |
| T1 | 1.27[b] | 419.95[b] | 10.36[a] | 7.92[b] | 2.22[a] | 8.65[b] |
| T2 | 1.41[d] | 497.45[d] | 11.64[b] | 8.54[d] | 2.71[b] | 10.92[d] |
| T3 | 1.33[c] | 455.77[c] | 10.39[a] | 8.14[c] | 2.23[a] | 9.43[c] |
| SEM ± | 0.01 | 2.61 | 0.13 | 0.06 | 0.05 | 0.11 |
| Variety | | | | | | |
| V1 (Pusa Snowball K-1) | 1.37[b] | 553.45[b] | 12.17[b] | 9.72[b] | 2.80[b] | 11.50[b] |
| V2 (Pusa Himjyoti) | 1.24[a] | 328.39[a] | 9.05[a] | 6.41[a] | 1.83[a] | 6.85[a] |
| SEM ± | 0.01 | 1.85 | 0.09 | 0.04 | 0.04 | 0.08 |
| NPK level × Variety | | | | | | |
| V1T0 | 1.26 | 455.90[c] | 11.47 | 9.32 | 2.58 | 8.96[c] |
| V1T1 | 1.32 | 516.10[d] | 12.01 | 9.61 | 2.78 | 10.67[d] |
| V1T2 | 1.50 | 659.00[f] | 13.33 | 10.12 | 3.25 | 14.29[f] |
| V1T3 | 1.41 | 582.80[e] | 11.88 | 9.84 | 2.60 | 12.06[e] |
| V2T0 | 1.16 | 325.13[ab] | 8.65 | 6.03 | 1.63 | 6.43[a] |
| V2T1 | 1.22 | 323.80[a] | 8.70 | 6.23 | 1.66 | 6.64[a] |
| V2T2 | 1.32 | 335.90[b] | 9.95 | 6.95 | 2.16 | 7.55[b] |
| V2T3 | 1.25 | 328.73[ab] | 8.90 | 6.45 | 1.85 | 6.80[a] |
| SEM ± | 0.02 | 3.69 | 0.18 | 0.08 | 0.07 | 0.15 |
| ANOVA, P>F | | | | | | |
| NPK Level | ** | ** | ** | ** | ** | ** |
| Variety | ** | ** | ** | ** | ** | ** |
| NPK level × Variety | NS | ** | NS | NS | NS | ** |

Mean values (*P<0.05, **P<0.01, NS = Non-significant); Data expressed as mean of triplicate measurements (n = 3); #T0 = 0:0:0, T1 = 80:30:60, T2 = 120:60:80 and T3 = 150:70:100

reduction in ascorbic acid and β-carotene contents with higher doses of NPK in broccoli.

It is evident from the data presented in Table 4 that the application of different levels of NPK significantly influenced the N P and K content in soil. The maximum nitrogen content (112.69 kg $ha^{-1}$) in soil was recorded under T3 treatment, which was statistically at par with T2, whereas, minimum nitrogen content in soil (98.47 kg $ha^{-1}$) was recorded under control (T0). The maximum phosphorus content in soil (18.34 kg $ha^{-1}$) at harvest was recorded under 150:70:100 dose of NPK (T3), which was significantly superior to T1 and T2, whereas, the minimum phosphorus content in soil (14.14 kg $ha^{-1}$) was recorded under control (T0). Similar results were obtained for potassium content in soil. The maximum potassium content in soil (206.89 kg $ha^{-1}$) was recorded under 150:70:100 dose of NPK (T3). Results obtained are in line with the earlier findings (Merentola *et al*., 7; Tekasangla *et al*., 14) on cabbage. It can also be concluded from the present study that Pusa Snowball K-1 with NPK application of 120:60:80 could be suitable combination for cultivation in the regions for higher productivity and profitability.

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**Table 3.** Effect of different NPK combinations on ascorbic acid and β-carotene contents of cauliflower.

| Treatment[#] | Ascorbic acid (mg/100 g) | β-carotene (µg/100 g) |
|---|---|---|
| NPK level | | |
| T0 (control) | 57.24[d] | 0.30[d] |
| T1 | 54.65[c] | 0.27[c] |
| T2 | 52.11[b] | 0.24[b] |
| T3 | 49.93[a] | 0.22[a] |
| SEM ± | 0.29 | 0.01 |
| Variety | | |
| V1 (Pusa Snowball K-1) | 44.09[a] | 0.20[a] |
| V2 (Pusa Himjyoti) | 62.88[b] | 0.30[b] |
| SEM ± | 0.21 | 1.85 |
| NPK level × variety | | |
| V1T0 | 47.69 | 0.24 |
| V1T1 | 45.03 | 0.21 |
| V1T2 | 42.89 | 0.18 |
| V1T3 | 40.75 | 0.16 |
| V2T0 | 66.79 | 0.35 |
| V2T1 | 64.27 | 0.33 |
| V2T2 | 61.33 | 0.30 |
| V2T3 | 59.12 | 0.28 |
| SEM ± | 0.41 | 0.01 |
| ANOVA, P>F | | |
| NPK level | ** | ** |
| Variety | ** | ** |
| NPK level × variety | NS | NS |

Data expressed as Mean ± SE of triplicate measurements (n=3); Mean in the same column bearing different superscripts vary significantly (P<0.05); [#]T0 = 0:0:0, T1 = 80:30:60, T2 = 120:60:80 and T3 = 150:70:100

**Table 4.** Effect of different NPK fertilization on available N, $P_2O_5$ and $K_2O$ content in soil after harvest.

| Treatment[#] | Available N (before) | Available N (after harvest) | Available P (before) | Available P (after harvest) | Available $K_2O$ (before) | Available $K_2O$ (after harvest) |
|---|---|---|---|---|---|---|
| T0 (control) | 117.01 | 98.47[a] ± 2.61 | 11.04 | 14.14[a] ± 0.34 | 152.42 | 148.72[a] ± 7.93 |
| T1 | 118.54 | 99.72[a] ± 1.25 | 11.83 | 16.53[b] ± 0.07 | 154.61 | 169.21[a] ± 9.20 |
| T2 | 121.22 | 108.50[b] ± 1.92 | 12.08 | 16.84[b] ± 0.07 | 154.50 | 169.94[a] ± 8.86 |
| T3 | 124.5 | 112.69[b] ± 1.11 | 13.25 | 18.35[c] ± 0.09 | 156.91 | 206.89[b] ± 5.96 |
| P value | | 0.001 | | 0.000 | | 0.006 |

Data expressed as Mean ± SE of triplicate measurements (n=3); Mean in the same column bearing different superscripts vary significantly (P<0.05); [#]T0 = 0:0:0, T1 = 80:30:60, T2 = 120:60:80 and T3 = 150:70:100

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# Evaluation of *kharif* onion varieties and transplanting time for production under North-Western mid Himalayan region

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## ABSTRACT

**In order to boost onion production during *kharif*, it was considered imperative to test onion varieties for their performance and assess the effect of planting time on its production. Four onion varieties, *viz.* N-53, Nasik Red, Agrifound Dark Red (AFDR) and Agrifound Light Red (AFLR) were transplanted on five dates separated at ten day intervals starting from 15th July to 25th August at Research Farm of Krishi Vigyan Kendra, Chamba for two consecutive seasons (2014 & 2015). There was a significant effect of varieties, transplanting dates and their interaction on bulb diameter, bulb weight and yield. The maximum bulb diameter (5.52 cm) and highest bulb weight (58.65 g) among cultivars was noticed in cultivar Agrifound Dark Red. The yield of onion was significantly affected both by variety and transplanting time. The highest average yield (184.98 q/ha) was observed in variety FDR. The highest bulb yield among transplanting dates was recorded on fourth transplanting date $D_4$ (15th August). AFDR transplanted around second fortnight of August produced the highest bulb yield.**

**Key words:** Bulb yield, varieties, transplanting time, *kharif* onion.

## INTRODUCTION

Onion (*Allium cepa* L.) is the most important commercial vegetable crops on account of its value for local consumption and exportation commodity. In India, it occupies an area of 10,52,000 ha with a total production of 1,68,13,000 MT and an average yield of 16.0 MT/ha (NHB, 8). The *rabi* season crop of onion is harvested in April-May, while *kharif* onion and late *kharif* crop of onion is available in the market in October to December and January to February, respectively. The major portion of *rabi* season crop is stored throughout the country. This stored material is available for domestic markets as well as for export from May to October. There is critical gap in supply of onion from October to December in the country and as a result the prices shoot up. A good harvest in *kharif* season can bridge the gap between demand and supply of onion during this dearth period. *Kharif* onion plays an important role in the supply and price stabilization of onion in India. The *kharif* season onion provides the opportunities of export of *rabi* onion. Further, production of onion during *kharif* season offers a good alternative to the farmers for obtaining higher returns. Therefore, an experiment was conducted during 2014-15 to assess the effect of varieties and planting time on *kharif* onion production under subtropical conditions of Himachal Pradesh.

## MATERIALS AND METHODS

Four cultivars of onion, *viz.* N-53, Nasik Red, Agrifound Dark Red (AFDR) and Agrifound Light Red (AFLR) were transplanted on five dates separated by ten day interval starting from 15th July to 25th August at Research Farm of Krishi Vigyan Kendra (Dr YSPUH&F), Chamba, Himachal Pradesh, for two consecutive seasons (2014 & 2015). The experimental site was located at an altitude of 1,050 m above mean sea level with mean minimum and maximum temperature ranges between 12.31° to 25.3°C and average humidity remains around 63.91% (Fig. 1). The soils are well drained sandy loam with pH range of 5.8-6.5. The total rainfall during the growing seasons was 91.0 and 101 cm, respectively. The experiment was laid out in randomized block design with three replications for each treatment. Healthy seedlings were transplanted on raised beds at a spacing of 15 cm x 10 cm in plots of 3.0 x 3.0 $m^2$. All the observations pertaining to traits, *viz*. plant height (cm), neck thickness (cm), bulb diameter (cm), weight of bulb (g), days for harvesting, TSS and yield (q/ ha) were taken by randomly selecting 20 healthy plants from each plot. Recommended package of practices was adopted to raise the crop successfully. Data obtained during the two years were pooled and analyzed as per the standard procedure (Gomez and Gomez, 4).

## RESULTS AND DISCUSSION

Perusal of data pooled over two years (2014 and 2015) presented in Tables 1-7 revealed significant effect of varieties, planting time and their interaction

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