# RESPONSE OF NITROGEN ON THE GROWTH AND PRODUCTIVITY OF OKRA GENOTYPES

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**ABSTRACT:** *Nitrogen is the most essential element for plants. However, excessive use of the nitrogen in crop cultivation decreases the nitrogen use efficiency of plants and mediates severe environmental pollution. Hence its optimum use needs to be analyzed critically. The pot experiment was conducted during 2014-15 to evaluate the response of nitrogen on the growth and productivity of okra genotypes. The trial was carried out at the experimental area of the Horticulture garden Sindh Agriculture University, Tandojam in a three replicated completely randomized design (CRD). The growth and yield performance of five okra genotypes (Sabzpari, Bemisal, Ambika, Arka Anamika and Resham) was assessed to four nitrogen levels, including a control (0, 50, 150 and 250 kg ha$^{-1}$). The results demonstrated that all the growth and yield attributesof okra were significantly (P<0.05) affected by various N levels and genotypes. However, best results were obtained when plants received highest N level of 250 kg ha$^{-1}$. The plants fertilized with higher level of N (250 kg ha$^{-1}$) showed maximum plant height (95.633 cm), branches plant$^{-1}$ (5.04), days to flower initiation (47.54), numbers of pod plant$^{1}$ (17.09), weight of single pod (13.193 g) pod length (10.54 cm), and weight of pods plant$^{-1}$ (225.55 g). The crop received 0 kg N ha$^{-1}$ showed poor performance and produced minimum values for all the growth and yield parameters. Plants received 0 kg N ha$^{-1}$ showed 67.43 cm plant height, 3.37 branches plant$^{-1}$, 37.98 days to flower initiation, 45.46 days to fruit development, 13.12 numbers of pods plant$^{1}$, 8.21 pod length cm, 11.373 weight of single pod, 148.34 weight of pods plant$^{-1}$. Among the genotypes, Sabzpari revealed better performance and comparatively produced higher values as compared to other genotypes for most of the investigated traits. Sabz pari produced 93.04 cm plant height, 4.6333 number of branches, 45.26 days to flower initiation, 17.09 pods plant$^{-1}$, 12.842 g single pod weight, 10.13 cm pod length, 221.16 g pods weight plant$^{-1}$. The results of a current study illustrated that although higher N level of 250 kg ha$^{-1}$ produced larger values for most of the investigated traits, however, statistically the difference between 250 kg ha$^{-1}$ and 150 kg ha$^{-1}$ was not significant (P>0.05). Hence, for achieving economically higher okra yield, the crop may be fertilized with N level of 150 Kg ha$^{-1}$.*

**Key words**: Okra, Nitrogen, Growth, Productivity, Genotypes

## INTRODUCTION

Okra is one of the important delicious vegetable crops of family Malvaceae. Okra is presently cultivated across the world [1]. Okra is a main vegetable crop of Pakistan and is equally liked by rural and urban people [2]. The plain areas of the country, especially (Sindh and Punjab) are major producers of okra [3]. Available reports reveal that in Pakistan, okra was grown on an area of 13919 hectares during 2011-12 with a production of about 102577 tons [4].

Okra has considerable calories and is a rich source of several minerals, including phosphorus, iodine, calcium, potassium, magnesium, iron, sulfur, copper and sodium [5]. In addition, it also provides various food components, including proteins, vitamins, carbohydrates, fat, fiber thiamine, nicotonic acid, riboflavin and oxalic acid [6]. The immature green pods of okra are used as a vegetable. Okra has considerable medicinal value and is able to reabsorb water and can remove excess cholesterol from the body and certain toxins. Okra prevents from constipation and gas troubles. It is a rich source of bacteria (probiotics) that supply vitamin B complex [6]. Okra reduces cholesterol level which may result in lowering the risk of heart diseases.

Okra is grown in the tropical and subtropical regions worldwide [7]. However, it also grows in temperate regions during the summer season. It requires warm season for satisfactory growth and pod development [2]. The average temperature between 21$^{o}$C to 30$^{o}$C is ideal for better growth and pod yield of okra [8 & 9].

Nitrogen plays a significant role for healthy growth and development of plants [10]. Nitrogen encourages the plant vegetative growth, enhances the green color of leaves, and enhances photosynthetic activity; while its deficiency causes poor growth that eventually causes low yield of crops [11]. It is the essential component of proteins, chlorophyll, amino acid [12]. It has been widely noted that application of N at low or excessive levels adversely affected the growth and productivity of plants [13]. Moreover, excessive use of N in Agriculture decreases the nitrogen use efficiency of crop plants and increases the total input cost [14]. Hence its optimum use in crop cultivation is perquisite for sustainability of Agriculture.

Nitrogen plays a fundamental role for successful cultivation of okra [15]. Several lines of evidence revealed the significance of N for satisfactory growth and pod development of okra [16,17;18 & 19]. [20] assessed the growth and yield performance of okra and found that N added in the soil at the rate of 150 kg ha$^{-1}$ showed maximum pods plant$^{-1}$. Similarly, [16] also reported that N application at 150 kg ha-1 significantly enhanced the growth and development of the okra. [21] also found the positive and significant influence of N on all the growth and yield related traits of Okra.

The yield of okra in Pakistan is inconsistent and yet lesser than the potential yields of different varieties. One of the main constraints to the low yield of okra is the improper and inadequate application of N fertilizers [15 & 16]. The judicious use of N is a prerequisite for sustainability of okra cultivation. Developing okra genotypes that perform well and producing an acceptable yield under low N condition is a sustainable and promising approach in reducing the heavy input of N fertilizers in okra cultivation and enhancing the sufficient profit margins. Several lines of evidence indicated that wide genetic variation existed among various genotypes of okra for growth and yield related traits under various N conditions [15 & 16]. This may be attributed to significant differences in N uptake and utilization among various genotypes of okra.

Keeping in view the significance and different response of okra genotypes to N for various growth and yield contributing traits, the current study was performed to assess and determine the optimum level of N for better growth and productivity of okra genotypes.

## MATERIALS AND METHODS

The pot experiment was conducted at the experimental area of the Horticulture garden, Sindh Agriculture University, Tandojam during 2014-15 in a three replicated completely randomized design (CRD). Four N levels, viz; 0, 50, 150 and 250 kg ha$^{-1}$ were used to investigate the growth and yield performance of five okra genotypes (Sabzpari, Bemisal, Ambika, Arka Anamika and Resham). For this study, the soil was collected from the Latif Farm of Sindh Agriculture University, Tandojam. In order to ensure uniformity, soil was properly-dried, and big clods were crushed. After that, soil was passed through a sieve with a 2 mm mesh to remove any coarse soil. Plastic pots having a capacity of 15 kilograms of soil in each pot with enough perforation (hole) at the bottom for drainage were used for current research. Five seeds were sown in each pot. When the plants came in third leaf stage, only one healthy plant was left in each pot. The Source of N was urea and was applied in three split doses. One third of N was applied at the time sowing and remaining N was applied at the time of flowering and fruit development. At the time of sowing, recommended dose of phosphorus and potassium (60 and 50 kg ha$^{-1}$) was also added to the soil. All the required cultural practices, including, irrigation, weeding and hoeing were performed throughout the growth period of the crop. The data were collected on the plant characters, including plant height (cm), number of branches plant$^{-1}$, days to flower initiation, number of pods plant-1, weight of single pod (g), pod length (cm), weight of pods plant$^{-1}$ (g)

**Statistical analysis**

The collected data was statistically analyzed for analysis of variance (ANOVA). The LSD test was performed to compare the superiority of the treatments using Statistics- 8.1 computer software [22].

## RESULTS AND DISCUSSION

### Plant height

The results showed that plant height was significantly ($P<0.05$) influenced by various levels of nitrogen (N) and genotypes; while the interaction of N levels × genotypes was non-significant ($P>0.05$). The maximum plant height (95.63 cm) was observed when plants received the highest level of N (250 kg ha$^{-1}$) followed by 94.47 cm when plants were treated with 150 kg ha$^{-1}$ (Table 1). The plants fertilized with N at 50 kg ha$^{-1}$ showed a plant height of 80.02 cm. The crop receiving N (0 kg ha$^{1}$) resulted in lowest plant height (80.02 cm). The results of genotypes revealed that Sabzpari showed maximum plant height (93.04 cm); while lowest plant height (77.16 cm) was noted in Resham. The maximum plant height at higher N level may be due to the improved cell division and more tissue formation that causing luxuriant vegetative growth of the plant that eventually enhanced the plant height. These results are in line with [23] who compared the growth and yield performance of okra genotypes under various N levels and reported that Sabzpari showed maximum plant height as compared to rest of genotypes.

**Number of branches plant$^{-1}$**

The various N levels and genotypes showed a significant response for branches plant$^{-1}$. The maximum branches plant$^{-1}$ (5.04) were recorded in plants that were treated with increasing level of N (250 kg ha$^{-1}$) followed by branches (4.95), when crop received N at 150 Kg ha$^{-1}$ (Table 2). The crop fertilized with N (50 kg ha$^{-1}$) produced branches 4.51 plant$^{-1}$. The crop fertilized with N (0 kg ha$^{-1}$) produced lowest branches (3.37). Among the genotypes, Sabz pari produced maximum number of branches (4.63), similarly 4.58 plant$^{-1}$ in Arka Anamika; while Bemisal and Resham resulted in average branches of 4.42 and 4.31 plant$^{-1}$, respectively. However, the minimum branches 4.31 plant$^{-1}$ was recorded in Ambika. This indicates that higher application of nitrogen was beneficial for the okra crop to produce maximum number of branches than those under deficit N condition. These results are strongly endorsed by [21] who also reported maximum branches at increasing N levels.

**Days to flower initiation**

The results illustrated that N levels and genotypes had a significant ($P<0.05$) effect on days to flower initiation. The maximum days to flower initiation (47.54) was observed in plants which were fertilized at higher N level (250 kg ha$^{-1}$) closely followed by 150 Kg ha$^{-1}$ where 45.63 days were recorded for flower initiation (Table-3). The N applied at 50 kg ha$^{-1}$ showed 41.72 days. The plants which were not treated with N showed less days (37.98) to flower initiation. For varieties, maximum days to flower initiation (48.59) were recorded in Ambika; while Sabzpari, Bemisal and Arka Anamika resulted in average days to flower initiation 45.26, 45.59 and 39.16, respectively. However, the minimum days to flower initiation (38.06) were recorded in Resham. Among interactions, the interaction effect of (250 kg ha$^{-1}$ × Ambika) showed maximum days to flower initiation (52.81); while the interaction of (0 N level kg ha$^{-1}$ × Resham) resulted in lowest days to flower initiation (33.13). The highly diverse response of the genotypes for the flowering time might have been associated with genetic variation because all the recommended cultural practices were performed uniformly in all the pots. These results are in line with [23] who reported that early flowering in some genotypes may be associated with the genetic makeup of the cultivars. In the current study, higher level of N delayed flowering. This might be due to application of N in excessive quantity that caused the excess vegetative growth and discouraged the reproductive growth of plants.

**Number of pods plant$^{-1}$**

The various N levels and genotypes revealed a significant difference (P<0.05) for number of pods plant$^{-1}$. However, interaction between nitrogen levels x varieties was not significant (P>0.05). The results showed that maximum pod numbers plant$^{-1}$ (17.09 plant-$^{1}$) were recorded at increasing N levels (250 Kg ha$^{-1}$) followed by 16.96 when the crop was fertilized with N at 150 kg ha$^{-1}$ (Table-4). However, statistically the difference between 250 kg ha$^{-1}$ and 150 kg ha$^{-1}$ was not significant (P>0.05). Pod number decreased to 15.01, when the crop was treated with N at 50 kg ha$^{-1}$. The minimum pods plant$^{-1}$ (13.13) were recorded in plants, received 0 kg N ha$^{-1}$ (Table-4). Among genotypes, Sabzpari produced maximum pods (17.09) followed by 16.71 in Resham; while Ambika and Arka Anamika produced pods plant$^{-1}$ 15.19 and 14.51, respectively. However, the minimum pods 14.22 were observed in a variety Bemisal. Among interactions, the interaction effect of (250 kg ha$^{-1}$ × Sabzpari) resulted in greatest pods 18.70 plant$^{-1}$; while the interaction of (0 × Bemisal) resulted in lowest pods (11.81) plant$^{-1}$. This indicates that highest level of nitrogen was beneficial for the okra crop that produces more pods than those under deficit nitrogen conditions. More pods under higher N level might have associated with the presence of essential nutrient (N) in the soil due to its application in a large quantity that enhance plant height and greater branches that eventually enhanced pod number plant$^{-1}$. The minimum pods plant$^{-1}$ might be due to the absence of essential nutrients, especially N in the soil that ultimately reduced the pod number plant$^{-1}$. These results are in agreement with the findings of [24] who described that pod number in the individual plant was significantly enhanced at the higher N level. Similar findings were also described by [19] who reported that pod numbers were significantly influenced by N levels.

**Weight of single pod (g)**

The results presented in (Table 5) reveals that highest level of nitrogen 250 kg ha$^{-1}$ significantly produced higher values for weight of single pod (13.193 g) than rest of N levels. The N added in the soil at 150 kg ha$^{-1}$ showed (13.067 g) single fruit weight. The single fruit decreased to 12.227 (g) when the N level was reduced to 50 kg ha-$^{1}$. The plants received 0 kg N ha$^{-1}$ showed the lowest single fruit weight 11.373 (g). For genotypes, Bemisal produced maximum weight of single fruit (13.183 g); while Ambika, Sabzpari and Arka Anamika showed the weight of single fruit 12.875 g, 12.842 g and 11.792 g, respectively. However, the minimum weight of single fruit 11.633 g was recorded in Resham. Among interactions, the interaction between (250 kg ha$^{-1}$ × Bemisal) showed the maximum weight of single fruit 14.17 (g) while the interaction of 0 × Resham resulted in the lowest weight of single fruit (10.17 g). The maximum single fruit weight at the highest level of N might be associated with the presence of N in large quantity in the soil, which eventually enhanced the total weight of single pod. Positively, [25] reported the positive and significant influence of N on weight of single pod at increasing N level. Similarly, [26] also also reported the maximum weight of single pod at higher N level of 125 kg ha$^{-1}$.

**Length of pod (cm)**

The results presented in (Table-6) showed that various N levels and genotypes had a significant influence on pod length, however the interaction between N levels and genotypes revealed a non- significant difference (P<0.05). The longer pods (10.55 cm) were observed in pots which were fertilized with higher N level of 250 kg ha$^{-1}$, closely followed by 10.29 cm when the crop received N at 150 kg ha$^{-1}$ (Table 6). However, statistically the difference between 250 kg ha$^{-1}$ and 150 kg ha$^{-1}$ was non-significant. The length of the pod was further reduced to 8.69 cm at 50 kg ha$^{-1}$. The minimum pod length (8.22 cm) was observed in control, where N was not applied (Table 7). Among genotypes, Sabzpari produced the longest pods (10.13 cm); while Bemisal, Ambika and Arka Anamika resulted in average length of pods 9.46 cm, 9.40 cm and 9.31 cm, respectively. The pods with minimum length 8.88 cm was noted in Resham. Among interactions, the interaction effect of (150 kg ha$^{-1}$ × Sabzpari) showed the greatest pod length 11.49 cm; while the interaction of (0 × Resham) resulted in lowest length of pods (7.73 cm). Pod length is an important parameter that positively affects total yield. It relies not only on genotypes but also their response to diverse environmental conditions [15]. In the current study, the longest pods at higher N level may be related to the application of N in large quantity that enhanced the fertility of soil, resultantly longer pods were produced. These findings are consistent with the results of [27] who also found the maximum pod length at higher N level.

**Weight of pods plant$^{-1}$**

The results showed that weight of pods plant$^{-1}$ was significantly (P<0.05) influenced by various N levels and genotypes. However, the interaction between N levels x genotypes was not significant (P>0.05). The maximum pods weight plant$^{-1}$ (225.55 g) was observed at higher N level (250 Kg ha$^{-1}$) closely followed by 222.16 g at 150 kg N ha$^{-1}$ (Table 7). The pod weight further reduced to 183.00 g plant$^{-1}$ under deficit N conditions (50 kg ha$^{-1}$). The lowest pod weight 148.34 g was recorded when plants received N at 0 kg ha$^{-1}$. Among genotypes, Sabzpari produced maximum weight of pods (221.16 g); while Bemisal, Ambika and Arka Anamika showed 196.67 g, 195.88 g and 188.64 g, respectively. The lowest pods weight 171.46 was noted in Arka Anamika. Among interactions, the interaction effect of (150 kg ha$^{-1}$ × Sabzpari) resulted in maximum weight of pods 258.96 g; while the interaction (0 × Bemisal) resulted in lowest weight of pods 140.00 plant$^{-1}$. This indicates that nitrogen at high quantity was beneficial for the okra crop to produce highest weight of pods than those under deficit N conditions. The highest pod weight might have been associated with the increase in length and weight of single pod that ultimately enhanced the weight of pods plant$^{-1}$. This indicates that application of N in large quantity proved better that increased the pod weight plant$^{-1}$. These findings are further confirmed by [17], who also found maximum fruit weight at increasing N level. Moreover, [18] also described that growth and yield characters of okra showed a significant response to various N levels.

**Table: 1 Plant height (cm) of okra genotypes as influenced by various nitrogen levels**

| Nitrogen levels | Genotypes | | | | | Mean |
|---|---|---|---|---|---|---|
| | Sabzpari | Bemisal | Ambika | Arka Anamika | Resham | |
| N1 (0) | 77.13 | 68.66 | 61.17 | 66.47 | 63.73 | 67.43 C |
| N2 (50 kg $ha^{-1}$) | 88.33 | 75.47 | 74.10 | 76.83 | 85.37 | 80.020 B |
| N3 (150 kg $ha^{-1}$) | 103.73 | 88.50 | 86.50 | 95.83 | 97.80 | 94.473 A |
| N4 (250 kg $ha^{-1}$) | 102.97 | 91.20 | 86.90 | 96.87 | 100.23 | 95.633 A |
| Mean | 93.04 A | 86.78 B | 84.00 C | 80.95 D | 77.16 E | - |

| | **Nitrogen levels** | **Genotypes** | **Nitrogen levels x Genotypes** |
|---|---|---|---|
| S.E | 0.7278 | 0.8137 | 1.6273 |
| LSD 0.05 | 1.4733 | 1.6472 | 3.2943** |
| LSD 0.01 | 1.9733 | 2.2063 | 4.4125** |
| CV(%) | 2.36 | | |

**Table: 2 Number of branches of okra genotypes as influenced by various nitrogen levels**

| Nitrogen levels | Genotypes | | | | | Mean |
|---|---|---|---|---|---|---|
| | Sabzpari | Bemisal | Ambika | Arka Anamika | Resham | |
| N1 (0) | 3.50 | 3.33 | 3.27 | 3.56 | 3.20 | 3.3727 C |
| N2 (50 kg $ha^{-1}$) | 4.70 | 4.40 | 4.37 | 4.70 | 4.40 | 4.5133 B |
| N3 (150 kg $ha^{-1}$) | 5.13 | 4.93 | 4.77 | 5.00 | 4.93 | 4.9533 A |
| N4 (250 kg $ha^{-1}$) | 5.20 | 5.03 | 4.87 | 5.07 | 5.03 | 5.0400 A |
| Mean | 4.6333 A | 4.4250 B | 4.3167 B | 4.5825 A | 4.3917 B | - |

| | Nitrogen levels | Genotypes | Nitrogen levels x Genotypes |
|---|---|---|---|
| S.E | 0.0555 | 0.0620 | 0.1240 |
| LSD 0.05 | 0.1123** | 0.1255 | non significant |
| LSD 0.01 | 0.1504** | 0.1681 | non significant |
| CV (%) | 3.40 | | |

**Table: 3 Days to flower initiation of okra genotypes as influenced by various nitrogen levels**

| Nitrogen levels | Genotypes | | | | | Mean |
|---|---|---|---|---|---|---|
| | Sabzpari | Bemisal | Ambika | Arka Anamika | Resham | |
| N1 (0) | 38.38 | 40.33 | 43.57 | 34.50 | 33.13 | 37.98 D |
| N2 (50 kg $ha^{-1}$) | 43.77 | 42.23 | 47.17 | 37.85 | 37.60 | 41.72 C |
| N3 (150 kg $ha^{-1}$) | 48.57 | 46.43 | 50.83 | 41.82 | 40.52 | 45.63 B |
| N4 (250 kg $ha^{-1}$) | 50.33 | 51.12 | 52.81 | 42.47 | 40.98 | 47.54 A |
| Mean | 45.26 B | 45.03 B | 48.59 A | 39.16 C | 38.06 D | - |

| | Nitrogen Levels | Genotypes | Nitrogen levels x Genotypes |
|---|---|---|---|
| S.E | 0.4421 | 0.4942 | 0.9885 |
| LSD 0.05 | 0.8949** | 1.0005** | 2.0010* |
| LSD 0.0 | 1.1987** | 1.3401** | non significant |
| CV (%) | 2.80 | | |

**Table: 4 Number of pods $plant^{-1}$ of okra genotypes as influenced by various nitrogen levels.**

| Nitrogen levels | Genotypes | | | | | Mean |
|---|---|---|---|---|---|---|
| | Sabzpari | Bemisal | Ambika | Arka Anamika | Resham | |
| N1 (0) | 14.60 | 11.81 | 12.72 | 12.12 | 14.40 | 13.13 C |
| N2 (50 kg $ha^{-1}$) | 16.58 | 13.72 | 14.62 | 14.05 | 16.04 | 15.01 B |
| N3 (150 kg $ha^{-1}$) | 18.49 | 15.56 | 16.78 | 15.85 | 18.12 | 16.96 A |
| N4 (250 kg $ha^{-1}$) | 18.70 | 15.80 | 16.67 | 16.02 | 18.27 | 17.09 A |
| Mean | 17.09 A | 14.22 C | 15.19 B | 14.51 C | 16.71 A | - |

| | Nitrogen Levels | Genotypes | Nitrogen levels x Genotypes |
|---|---|---|---|
| S.E | 0.2056 | 0.2298 | 0.4596 |
| LSD 0.05 | 0.4161** | 0.4652P** | non significant |
| LSD 0.01 | 0.5574** | 0.6232** | non significant |
| CV (%) | 3.62 | | |

**Table: 5 Weight of single pod (g) of okra genotypes as influenced by various nitrogen levels**

| Nitrogen levels | Genotypes | | | | | Mean |
|---|---|---|---|---|---|---|
| | Sabzpari | Bemisal | Ambika | Arka Anamika | Resham | |
| N1 (0) | 11.00 | 11.97 | 11.97 | 11.77 | 10.17 | 11.373 B |
| N2 (50 kg $ha^{-1}$) | 12.80 | 12.57 | 13.47 | 11.07 | 11.23 | 12.227 AB |
| N3 (150 kg $ha^{-1}$) | 13.73 | 14.03 | 12.97 | 12.07 | 12.53 | 13.067 A |
| N4 (250 kg $ha^{-1}$) | 13.83 | 14.17 | 13.10 | 12.27 | 12.60 | 13.193 A |
| Mean | 12.842 AB | 13.183 A | 12.875 AB | 11.792 B | 11.633 B | - |

| | Nitrogen Levels | Genotypes | Nitrogen levels x Genotypes |
|---|---|---|---|
| S.E | 0.5718 | 0.6393 | 1.2786 |

| | | | |
|---|---|---|---|
| LSD 0.05 | 1.1576** | non significant | non significant |
| LSD 0.01 | 1.5505** | non significant | non significant |
| CV(%) | 12.56 | | |

**Table: 6 Length of pod (cm) of okra genotypes as influenced by various nitrogen levels**

| Nitrogen levels | Genotypes | | | | | Mean |
|---|---|---|---|---|---|---|
| | Sabspari | Bemisal | Ambika | Arka Anamika | Resham | |
| N1 (0) | 8.37 | 8.47 | 8.72 | 7.79 | 7.73 | 8.22 B |
| N2 (50 kg ha$^{-1}$) | 9.25 | 8.72 | 9.29 | 7.80 | 8.37 | 8.69 B |
| N3 (150 kg ha$^{-1}$) | 11.49 | 10.23 | 9.44 | 9.85 | 10.45 | 10.29 A |
| N4 (250 kg ha$^{-1}$) | 11.43 | 10.40 | 10.17 | 10.07 | 10.67 | 10.55 A |
| Mean | 10.13 A | 9.46 AB | 9.40 B | 9.31 B | 8.88 B | - |

| | Nitrogen Levels | Genotypes | Nitrogen levels x Genotypes |
|---|---|---|---|
| S.E | 0.3067 | 0.3429 | 0.6859 |
| LSD 0.05 | 0.6209** | 0.6942* | non significant |
| LSD 0.01 | 0.8317** | non significant | non significant |
| CV(%) | 8.90 | | |

**Table: 7 Weight of pods plant$^{-1}$ of okra genotypes as influenced by various nitrogen levels**

| Nitrogen levels | Genotypes | | | | | Mean |
|---|---|---|---|---|---|---|
| | Sabspari | Bemisal | Ambika | Arka Anamika | Resham | |
| N1 (0) | 159.87 | 140.00 | 152.35 | 143.13 | 146.34 | 148.34 c |
| N2 (50 kg ha$^{-1}$) | 211.60 | 172.19 | 196.23 | 155.33 | 179.64 | 183.00 b |
| N3 (150 kg ha$^{-1}$) | 254.22 | 218.46 | 217.33 | 191.06 | 229.74 | 222.16 a |
| N4 (250 kg ha$^{-1}$) | 258.96 | 223.90 | 217.63 | 196.33 | 230.95 | 225.55 a |
| Mean | 221.16 a | 188.64 bc | 195.88 b | 171.46 c | 196.67 b | - |

| | Nitrogen Levels | Genotypes | Nitrogen levels x Genotypes |
|---|---|---|---|
| S.E | 8.1335 | 9.0935 | 18.187 |
| LSD 0.05 | 16.465** | 18.409** | non significant |
| LSD 0.01 | 22.054** | 24.658** | non significant |
| CV(%) | 11.44 | | |

## CONCLUSION AND RECOMMENDATIONS

It is concluded that growth and yield attributed traits of okra increased positively with increasing N levels. However, the highest N level of 250 Kg ha$^{1}$ did not prove beneficial, because statistically, the differences between 250 kg ha$^{-1}$ and 150 kg ha$^{-1}$ was not-significant (P>0.05). Among genotypes, Sabzpari produced significantly higher values for most of the traits as compared to other genotypes. Hence, for achieving economically higher okra yield, the crop may be fertilized with N level of 150 Kg ha$^{-1}$. Moreover, further study needs to be conducted in different locations and in different soils for the validation of optimum level of N for better productivity of okra.

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