**Response of NPK Fertilizer Application Rates on Onion (*Allium cepa* L.) Yield**

**Abstract**

Onion is an important crop in Punjabi, but its’ productivity is very mainly due to poor soil fertility. The objective to increase onion productivity, an experiment was conducted at the experimental farm of the Department of Horticulture, GKU, Talwandi Sabo (Punjab) during the Rabi season of 2022-2023. The experiment was designed using a Randomized Block Design (RBD) with eighteen treatment combinations and three replications, with three levels of nitrogen (20, 40, and 60 N kg/acre), three levels of phosphorus (15, 20, and 30 P kg/acre), and two levels of potassium (20 and 30 K kg/acre). The observations were recorded plant height at 85th day, 100th day and at harvest stage (cm), number of green leaves per plant at 85th day, 100th day and at harvest stage, leaf length at harvest stage (cm), equatorial diameter (cm), polar diameter (cm), Bulb survival percentage (%), Marketable yield per plot (kg) and total yield per hectare (tons). The height of plant 48.89 cm at 85th day and 49.93 cm at 100th day, the number of leaves par plant 15.56 at 85th day and at 100th day number of leaves per plant 16.67 was maximum with T18 (60: 30: 30 NPK kg/acre). The plant height 61.21 cm at harvest stage and number of leaves 17.56 at harvest stage, maximum leaf length at harvest stage 49.34 (cm), equatorial diameter 8.34 (cm), polar diameter 6.88 (cm), Bulb survival percentage 95.01%, Marketable yield per plot 4.50kg and total yield per hectare 12.76 tons was recorded by T10 (40: 20: 30 NPK Kg/acre) treatment. Therefore, application of 40: 20: 30 Kg/acre NPK gave the highest yield 12.76 tons and recommend for onion producer.

**Key words:** Nitrogen, Phosphorus, Potassium, Allium

**1. INTRODUCTION**

As a member of the Alliaceae family, onions (*Allium cepa* L.) have diploid chromosome number 2n = 6. The region of Palestine and Afghanistan is where it originated in Western Asia. (Malik YS 1999) The family Alliaceae, which includes allium crops and their cousins, is recognized as separate. An estimated 750 species make up the genus Allium, with the most significant culinary Allium crops being garlic, leeks, Japanese bunching onions, and onions (Ranbinowitch HD, 2002). Numerous factors influence the production of onions, but the most significant ones are uneven fertilizer application, improper fertilizer rates, improper soil fertility management techniques, and growers' lack of knowledge about soil fertility management (Gebretsadik and Dechassa 2016; Negasi et al. 2017). In order to absorb the soil's immobile nutrients, onions, a crop with shallow roots, need to be fertilized properly (Brewster, 1994). Onions need nitrogen to grow larger bulbs and produce more, thus it's crucial for the best possible production. Plant height, the number of green leaves per plant, the fresh weight of the bulb, and the onion bulb output all rise noticeably with increasing nitrogen application rates [13,14]. In 2007 and 2009, Nasreen and Al-Fraihat, 2009). In order to achieve the economic target yield of the onion crop, Vairavan et al. (2021) examined the soil and discovered that applying 100% NPK ha-1 as TNAU-WSF was the best rate. The addition of potassium (50 kg ha-1), phosphorus (160 kg ha-1), and nitrogen (40 kg ha-1) did enhance bulb onion yield, according to Dilzar et al. (2023). We also got the maximum bulb onion yield (18.36 Mg ha-1) since it was the optimal combination of NPK fertilizers.

**2. MATERIAL AND METHODS**

The present investigation entitled “Response of NPK on onion (*Allium cepa* L.) yield.” was carried out at the experimental farm of the Department of Horticulture of Guru Kashi University, Talwandi Sabo (Bathinda) during rabi 2022-2023. The experiment was laid out in a Randomized Block Design with three replications. There were eighteen treatments having combinations of different levels of NPK fertilizer (Nitrogen: 20 (N1), 40 (N2) and 60 (N3) kg/acre, Phosphorous: 15 (P1), 20 (P2) and 30 (P3) kg/acre and Potassium: 20 (K1) and 30 (K2) kg/acre. The Punjab Naroya variety was sown with spacing 15 x 7.5 cm. The observations recorded during research are height of the plant (cm), number of green leaves per plant (No), leaf length (cm), equatorial diameter (cm), polar diameter of bulb (cm), bulb survival percentage (%), marketable yield per plot (kg) and total yield per hectare (tons). All data from the experimental field were analyzed separately for experiment for characters and yield with the help of OPSTAT (Statistical Software Package for Agricultural Research Workers) (Sheoran *et al*., 1998). The critical difference at 5% level of implication was calculated to equate the mean different treatments.

**3. Result and discussion**

Among the growth parameters, height of plant (cm) and number of leaves were significantly influenced by different levels of N, P, K. The height of plant 48.89 cm at 85th day and 49.93 cm at 100th day was maximum with T18 (60: 30: 30 NPK kg/acre) and plant height 61.21 cm at harvest stage by T10 (40: 20: 30 NPK Kg/acre) treatment. The number of leaves par plant 15.56 at 85th day with T18 (60: 30: 30 NPK kg/acre) and at 100th day number of leaves per plant 16.67 and 17.56 at harvest stage by T10 (40: 20: 30 NPK Kg/acre) treatment. Similarly, Singh and Mohanty (1998) also reported that number of leaves per plant were greatest with 160-80 NK kg ha-1. The maximum leaf length at harvest stage 49.34 (cm), equatorial diameter 8.34 (cm), polar diameter 6.88 (cm), Bulb survival percentage 95.01%, Marketable yield per plot 4.50kg and total yield per hectare 12.76 tons was recorded by T10 (40: 20: 30 NPK Kg/acre) treatment. Kaur and Singh (2022) reported that the dose of 200 kg/ha N and 100 kg/ha P increased the bulb weight 89.60 gm at maturity and marketable bulb yield 22.32 t ha-1. Combining optimum NPK fertilizer helps to get higher bulb yield. From the results of this investigation, it can be concluded that, NPK application at the rate of40: 20: 30 Kg/acre which helps to produce about 12.76 tons maximum total yield per hectare.

**Table 1: Effect of NPK fertilizers application rate on onion (*Allium cepa* L.) growth contributing characters**.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Plant height at 85th day | Plant height at 100th day | Plant height at harvest | Number of green leaves per plant at 85th day |
| Treatments |
| T1: N1 P1 K1 | 34.45 | 36.23 | 48.11 | 6.23 |
| T2: N1 P1 K2 | 35.47 | 37.46 | 49.71 | 6.57 |
| T3: N1 P2 K1 | 37.56 | 38.11 | 50.69 | 7.24 |
| T4: N1 P2 K2 | 38.22 | 39.89 | 52.01 | 7.67 |
| T5: N1 P3 K1 | 39.76 | 40.71 | 53.86 | 8.12 |
| T6: N1 P3 K2 | 40.23 | 41.68 | 54.11 | 8.67 |
| T7: N2 P1 K1 | 42.32 | 43.55 | 55.31 | 9.11 |
| T8: N2 P1 K2 | 43.23 | 44.97 | 54.89 | 9.76 |
| T9: N2 P2 K1 | 45.56 | 46.66 | 59.84 | 10.14 |
| T10: N2 P2 K2 | 48.78 | 49.74 | 61.21 | 15.11 |
| T11: N2 P3 K1 | 44.78 | 45.02 | 56.89 | 11.34 |
| T12: N2 P3 K2 | 43.67 | 44.63 | 57.67 | 11.66 |
| T13: N3 P1 K1 | 45.56 | 46.89 | 58.44 | 12.23 |
| T14: N3 P1 K2 | 46.78 | 47.72 | 59.86 | 12.47 |
| T15: N3 P2 K1 | 47.76 | 48.23 | 60.13 | 12.83 |
| T16: N3 P2 K2 | 47.89 | 48.99 | 61.11 | 15.06 |
| T17: N3 P3 K1 | 48.23 | 49.25 | 60.99 | 14.34 |
| T18: N3 P3 K2 | 48.89 | 49.93 | 60.32 | 15.56 |
| CD at 5% | 0.25 | 0.34 | 0.45 | 0.50 |

**Table 2: Effect of NPK on onion (*Allium cepa* L.) growth and yield contributing characters**.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Number of green leaves per plant at 100th day | Number of green leaves per plant at harvest | Leaf length at harvest stage (cm) | Equatorial diameter (cm) |
| Treatments |
| T1: N1 P1 K1 | 9.23 | 10.11 | 27 | 3.32 |
| T2: N1 P1 K2 | 9.57 | 10.56 | 27.45 | 3.68 |
| T3: N1 P2 K1 | 10.24 | 11.12 | 28.35 | 3.89 |
| T4: N1 P2 K2 | 10.67 | 11.78 | 28.79 | 4.14 |
| T5: N1 P3 K1 | 11.12 | 12.23 | 31.37 | 4.34 |
| T6: N1 P3 K2 | 11.67 | 12.79 | 34.47 | 5.34 |
| T7: N2 P1 K1 | 12.11 | 13.24 | 36.58 | 5.76 |
| T8: N2 P1 K2 | 12.76 | 13.79 | 39.56 | 6.11 |
| T9: N2 P2 K1 | 14.14 | 15.13 | 42.89 | 6.23 |
| T10: N2 P2 K2 | 16.67 | 17.56 | 49.34 | 8.34 |
| T11: N2 P3 K1 | 14.34 | 15.22 | 44.24 | 6.34 |
| T12: N2 P3 K2 | 14.66 | 15.79 | 44.78 | 6.67 |
| T13: N3 P1 K1 | 15.23 | 16.11 | 45.78 | 6.89 |
| T14: N3 P1 K2 | 15.47 | 16.45 | 45.89 | 7.12 |
| T15: N3 P2 K1 | 15.83 | 16.89 | 46.45 | 7.34 |
| T16: N3 P2 K2 | 16.21 | 17.11 | 47.11 | 7.56 |
| T17: N3 P3 K1 | 16.34 | 17.23 | 47.68 | 7.89 |
| T18: N3 P3 K2 | 16.56 | 17.51 | 48.56 | 8.13 |
| CD at 5% | 0.18 | 0.25 | 1.12 | 0.23 |

**Table 3: Effect of NPK on onion (*Allium cepa* L.) yield contributing characters**.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Polar diameter (cm) | Bulb survival percentage (%) | Marketable yield per plot (kg) | Total yield per hectare (tonnes) |
| Treatments |
| T1: N1 P1 K1 | 3.89 | 72.67 | 1.40 | 6.88 |
| T2: N1 P1 K2 | 3.98 | 74.24 | 1.67 | 7.01 |
| T3: N1 P2 K1 | 4.12 | 76.34 | 2.23 | 7.61 |
| T4: N1 P2 K2 | 4.34 | 78.36 | 2.45 | 7.67 |
| T5: N1 P3 K1 | 4.43 | 81.38 | 2.67 | 8.12 |
| T6: N1 P3 K2 | 5.48 | 84.24 | 3.01 | 8.34 |
| T7: N2 P1 K1 | 5.40 | 86.56 | 3.12 | 9.23 |
| T8: N2 P1 K2 | 5.75 | 90.35 | 3.59 | 10.61 |
| T9: N2 P2 K | 5.70 | 91.99 | 3.67 | 10.76 |
| T10: N2 P2 K2 | 6.88 | 95.01 | 4.50 | 12.76 |
| T11: N2 P3 K1 | 5.54 | 81.67 | 3.45 | 10.45 |
| T12: N2 P3 K2 | 5.53 | 80.12 | 3.56 | 10.57 |
| T13: N3 P1 K1 | 5.43 | 78.34 | 3.83 | 10.70 |
| T14: N3 P1 K2 | 5.34 | 77.45 | 3.87 | 10.97 |
| T15: N3 P2 K1 | 6.13 | 84.34 | 3.91 | 11.00 |
| T16: N3 P2 K2 | 6.76 | 94.46 | 4.12 | 12.27 |
| T17: N3 P3 K | 6.45 | 90.12 | 4.02 | 11.23 |
| T18: N3 P3 K2 | 6.56 | 89.13 | 3.97 | 11.23 |
| CD at 5% | 0.26 | 2.24 | 0.45 | 0.75 |

**Conclusion**

Numerous factors influence the production of onions, but the most significant ones are uneven fertilizer application, improper fertilizer rates, improper soil fertility management techniques, and growers' lack of knowledge about soil fertility management.

**4. Availability of data and material**

All relevant data and material are presented in the Research Review Paper.

**5. Funding**

Not Applicable.

**6. Consent for publication**

Not applicable.

**7. Ethics approval and consent to participate**

Not applicable

**8. Conflicts of Interest**

The authors declare no conflicts of interest.

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