**Physiological evaluation of small onion for increasing yield through growth regulators and nutrient mixture**

**Abstract :**

The production and demand for onion are relatively high. India has occupied the second position with 5.5 lakh hectares of area under onion cultivation with 77 lakh tonnes of production next to China in the world. Tamil Nadu is the major small onion producer for nearly 70 percent of total area in India. This work aimed to studying the effect of plant growth regulators and nutrient mixtures on growth, physiology and biochemical changes and yield of small onion. A field experiment has been taken at Horticultural College and Research Institute for women, Trichy during Oct 2023 to study the influence of plant growth regulators and nutrient mixture on maximizing the growth and yield of onion. The treatment includes control, foliar spray of Brassinolide 1.0ppm, Salicylic acid 100ppm, GA3 100ppm, NAA 100 ppm and combination of K2SO4 (1 %) + CuSO4 (0.5 %) + ZnSO4 (0.5 %) by using RBD with four replication. Two foliar sprays of growth regulators and nutrient mixture has been given on 25 and 45 DAP. The growth characters Viz., Plant height (31.93 cm) and No. of leaves (20) were highest in Brassinolide 1ppm treated plants at 60 Days After Planting. The root length was significantly varied among the treatments. Among the treatments Salicylic acid 100 ppm recorded the maximum root length of (10.06 cm). The quality attributes of the bulbs includes total Soluble solids (12.18%), Pyruvic acid content (2.57 µmolg-1) were increased by the foliar spray of Brassinolide 1ppm. Among the treatments highest bulb yield was recorded by Brassinolide 1ppm the yield increase was 12 % compared to control followed by Salicylic acid 100ppm recorded the highest yield.

**Introduction:**

Plant growth regulators are considered as a new generation of agrochemicals. When added in small amounts, modify the growth of the plants usually by stimulation or modifying one part of natural growth regulatory system, thereby increasing the crop yield ([Desh and Kumar, 2016](https://arccjournals.com/journal/indian-journal-of-agricultural-research/A-5858#desh_2016)). PGR are the growth regulating substances produced naturally by plants that participate in control of plant growth [(Santner and Estelle, 2009)](https://arccjournals.com/journal/indian-journal-of-agricultural-research/A-5858#santner_2009). PGRs are key factors in vegetative growth, flowering, fruit setting and seed production in plants including onion crop. The production and demand for onion are relatively high. India has occupied the second position with 5.5 lakh hectares of area under onion cultivation with 77 lakh tonnes of production next to China in the world. This work aimed to studying the effect of plant growth regulators and nutrient mixtures on growth, physiology and biochemical changes and yield of small onion.

**Materials and Methods:**

The field trial has been taken at Vazhiyur, Perambalur District for the period 2022-2023. Foliar sprays of growth regulators and nutrient mixture has been given on 30th and 45th DAP. The treatment includes T1: Control, T2: foliar spray of Brassinolide (1.0 ppm), T3:Salicylic acid - 100 ppm, T4: Gibberellic acid – 100 ppm, T5: NAA – 100 ppm, T6 : K2SO4 (1 %) + CuSO4 (0.5 %) + ZnSO4 (0.5 %) by using RBD with four replication. Confirmation trial was conducted at Horticultural College and Research Institute for Women, Trichy during 2023 -2024. The aggregatum onion, Perambalur local variety was used and bulb as planting materialusing Randomized Block Design with four replication.

**Result and Discussion :**

Plant height was measured from the ground level to the tip of the growing point. Among the treatment T2 (Brassinolide - 1.0 ppm) recorded highest plant height of 34.50 cm at 40 DAP. Among the treatments nutrient mixture recorded plant height of 34.37 cm which is on par with BR (1ppm) compared with control. Foliar spray of Salicylic acid 100 ppm recorded higher root length of (4.3 cm) and highest SPAD value was recorded by treatment T2 (Brassinolide - 1.0 ppm) 47.7 which was followed by T3 (salicylic acid 100 ppm) recorded SPAD value of 44.0 compared to control. (Table 1). Similar results have been reported that foliar spray of PGR increased plant height, leaves per plant by [Tiwari et al. (2003);](https://arccjournals.com/journal/indian-journal-of-agricultural-research/A-5858#tiwari_2003) [Dwivedi et al. (2019)](https://arccjournals.com/journal/indian-journal-of-agricultural-research/A-5858#dwivedi_2019). These results are also in close conformity with those of [Susheela et al. (2005)](https://arccjournals.com/journal/indian-journal-of-agricultural-research/A-5858#susheela_2005); [Islam et al.  (2007)](https://arccjournals.com/journal/indian-journal-of-agricultural-research/A-5858#islam_(2007); [Bose et al. (2009)](https://arccjournals.com/journal/indian-journal-of-agricultural-research/A-5858#bose_2009); [Shashi Kumar and Shashidhar, (2016](https://arccjournals.com/journal/indian-journal-of-agricultural-research/A-5858#shashi_2016)).

**Table 1: Effect of plant growth regulators and nutrient mixture on growth of onion on 40 Days after planting**

|  |  |  |  |
| --- | --- | --- | --- |
| **Treatment** | **Plant height**  **(cm)** | **Root length(cm)** | **SPAD**  **value** |
| T1- Control | 25.50 | 2.5 | 22.5 |
| T2 – Brassinolide - 1.0 ppm | 34.37 | 3.4 | 47.7 |
| T3 – Salicylic acid - 100 ppm | 31.20 | 4.3 | 44.0 |
| T4 – Gibberellic acid - 100ppm | 29.80 | 3.5 | 34.1 |
| T5 – NAA - 100 ppm | 32.00 | 2.9 | 23.5 |
| T6 -K2So4 (1 %) + CuSo4 (0.5 %) + ZnSO4 (0.5 %) | 34.50 | 3.5 | 33.6 |
| Mean | 31.22 | 3.4 | 34.2 |
| SE(d) | 1.88 | 0.3 | 5.49 |
| CD (0.05) | 4.01 | 0.6 | 11.70 |

**Table 2: Effect of plant growth regulators and nutrient mixture on growth and physiological parameters of onion on 60 Days after planting**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Treatment** | **Stem height**  **(cm)** | **Soluble protein mg/g** | **Total chlorophyll mg/g** | **SPAD**  **value** |
| T1- Control | 36.0 | 23 | 1.023 | 42.9 |
| T2 – Brassinolide - 1.0 ppm | 42.5 | 42 | 1.713 | 61.7 |
| T3 – Salicylic acid - 100 ppm | 45.0 | 36 | 1.649 | 40.6 |
| T4 – Gibberellic acid - 100ppm | 38.0 | 11 | 1.031 | 41.0 |
| T5 – NAA - 100 ppm | 36.0 | 26 | 1.045 | 29.0 |
| T6 -K2So4 (1 %) + CuSo4 (0.5 %) + ZnSO4 (0.5 %) | 38.0 | 30 | 1.195 | 55.3 |
| Mean | **39.3** | **28** | **1.28** | **45.1** |
| SE(d) | **1.99** | **6** | **0.25** | **6.07** |
| CD (0.05) | **4.24** | **13** | **0.54** | **12.96** |

The Physiological parameters like soluble protein and total chlorophyll content were estimated at 60 Days after Planting. Among the treatments BR - 1.0 ppm (T2) spray recorded more soluble protein (42 ) and total chlorophyll content (1.713) compared to control.(Table 2)

**Table 3: Effect of plant growth regulators and nutrient mixture on yield and yield parameters of onion**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Treatment** | **TDMP**  **Kg/ha** | **Bulb fresh weight(g/plant)** | **Bulb yield tonnes ha-1** | **Bulb yield**  **tonnes ha-1**  **(Pooled )** |
| T1- Control | 49.3 | 18.00 | 8.44 | 9.42 |
| T2 – Brassinolide - 1.0 ppm | 61.2 | 29.00 | 9.58 | 10.72 |
| T3 – Salicylic acid - 100 ppm | 63.7 | 27.50 | 9.13 | 10.43 |
| T4 – Gibberellic acid - 100ppm | 54.0 | 22.50 | 8.70 | 9.98 |
| T5 – NAA - 100 ppm | 55.3 | 20.00 | 8.13 | 9.89 |
| T6 -K2So4 (1 %) + CuSo4 (0.5 %) + ZnSO4 (0.5 %) | 59.0 | 24.50 | 8.98 | 10.19 |
| Mean | 57.08 | 23.58 | 8.82 | 10.04 |
| SE(d) | 2.86 | 2.23 | 0.38 | 0.37 |
| CD (0.05) | 6.09 | 4.75 | 0.81 | 0.79 |

Significant increase in yield and yield parameters was observed. Among the treatments T2 – Brassinolide - 1.0 ppm spray recorded highest bulb yield of 9.58 t/ ha compared with control (8.44) followed by treatment T3 recorded grain yield of 9.13 t/ ha. Pooled analysis of onion bulb yield for the two years observed that foliar spray of BR - 1.0 ppm spray recorded higher bulb yield of 10.72 t/ ha compared to control (9.42 t/ ha).the yield increase was 12 %. Followed by foliar spray of salicylic acid 100 ppm (T3) recorded onion bulb yield of 10.43 t/ha.(Table 3). Among the ameliorants tested in field experiment, foliar application of Brassinolide 1.00 ppm was applied at 30th and 40 DAP resulted in significant improvement in yield and quality components *viz*., bulb fresh weight, bulb diameter, bulb yield per hectare, TDMP and TSS followed by Salicylic acid 100 ppm compared to control. This results are in agreement with [(Singh et al., 1995;](https://arccjournals.com/journal/indian-journal-of-agricultural-research/A-5858#singh_1995) [Hye et al., 2002;](https://arccjournals.com/journal/indian-journal-of-agricultural-research/A-5858#hye_2002)  [Devi et al., 2018).](https://arccjournals.com/journal/indian-journal-of-agricultural-research/A-5858#devi_2018)

**Conclusion :**

The present study was carried out to study the effect of plant growth regulators and nutrient mixture on onion for increasing yield. The experiment was conducted at farmers field in perambalur and Horticultural College and Research Institute for Women.

Plant growth regulators and nutrient mixtures were given as foliar spray on 30 th and 45th Days after planting. Various biometric observation was taken after every spray to assess the growth, physiology and biochemical changes in small onion and demining the best Plant growth Regulators and nutrient mixtures to be sprayed to enhance growth and yield on onion.

Among the treatments highest bulb yield was recorded by foliar spray of Brassinolide 1ppm at 30 and 45th days after planting. The yield increase was 12 % compared to control followed by Salicylic acid 100ppm recorded the highest yield.

**Reference :**

Desh, R.C. and Kumar, S. (2016). Plant growth regulators in onion- A review. Indian Journal of Arid Horticulture. 11(1-2): 15-21.

Santner and Estelle, M. (2009). Recent advances and emerging trends in plant hormone signaling. Nature. 459: 1071-1078.

Tiwari, R.S., Agarwal, A. and Sengar, S.C. (2003). Effect of bioregulators on growth bulb yield, quality and storability of onion cv. Pusa Red. Indian Journal of Plant Physiology. 8(4): 411-413.

Dwivedi, B., Diwan, G. and Asati, K.P. (2019). Effect of plant growth regulators and their methods of application on growth of Kharif onion (*Allium cepa* L.) cv agrifound dark red. International Journal of Current Microbiology and Applied Sciences. 8(09): 1597-1610.

Susheela, T., Ravisankar, C., Rao, B.V. (2005). Effect of growth regulator and methods of application on growth and yield of onion cv. N- 53. Journal of Research ANGRAU. 33(4): 110-113.

Islam, M.S., Islam, M.O., Alam, M.N., Ali, M.K., Rahman, M.A. (2007). Effect of Plant growth regulator on growth, yield and yield components of onion. Asian Journal of Plant Sciences. 6(5): 849-853.

Bose, U.S., Bisen, A., Sharma, R.K., Dongre, R. (2009). Effect of micro nutrients along with growth regulator on growth and yield of onion. International Journal of Applied Agricultural Research. 4(3): 267-271.

Shashi Kumar, H.M. and Shashidhar, T.R. (2016). Effect of foliar application of growth regulator and bio stimulants on growth and yield of onion var. Bhima Shakti. Journal of Farm Science. 29(1): 50-52.

Singh, S., Singh, K., Singh, S.P., Singh, S. (1995). Effect of hormones on growth and yield characters of seed crop of *Kharif* onion. Indian Journal of Plant Physiology. 38(3): 193-196.

Hye, M.A., Haque, M.S., Karim, M.A. (2002). Influence of growth regulators and their time of application on yield of onion. Pakistan Journal of Biological Sciences. 5(10): 1021-1023.

Devi, J., Singh, R., Walia, I. (2018). Effect of foliar application of GA3 and NAA on onion- A review, Plant Achieves. 18(2): 1209-1214.