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Morpho-physiological characters and yield of groundnut (*Arachis hypogaea* L.) affected by different levels of plant growth regulators

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ABSTRACT

The present investigation intitled “Effects of plant growth regulators on morpho-physiological, yield and yield parameters of groundnut (*Arachis hypogaea* L.)” was carried out during Kharif 2025-26 at oilseed research unit Dr, P.D.K.V, akola in randomized block design (RBD) with three replications and ten treatments viz., T_1 (PBZ @ 50 ppm), T_2 (PBZ @ 100 ppm), T_3 (PBZ @ 150 ppm), T_4 (SA @ 100 ppm), T_5 (SA @ 125 ppm), T_6 (SA @ 150 ppm), T_7 (MH @ 750 ppm), T_8 (MH @ 1000 ppm), T_9 (MH @ 1250 ppm) and T_{10} (control) were tested for morphological characters and reveled that the appropriate regulation of vegetative growth through PGR application can favour the partitioning of assimilates towards reproductive development and thereby improve yield and seed quality in groundnut. Under the conditions of the present investigation, foliar application of maleic hydrazide at 1250 ppm emerged as the most promising treatment, followed by paclobutrazol at 150 ppm.

Keywords: Groundnut, Maleic hydrazide, Paclobutrazol, Salicylic acid, Plant growth regulators

1. Introduction

Groundnut (*Arachis hypogaea* L.) commonly known as peanut, goobernut, earhnut, monkey nut and mung-phooli, is an important oilseed and food crop cultivated in many parts of the world. It ranks among the major food crops globally and is considered the second most important oilseed crop in India. Groundnut originated in South America, and species of the genus *Arachis* are naturally distributed across a wide geographical range extending from southern Uruguay to Northeastern Brazil. It belongs to the family Fabaceae and is a self-pollinated legume crop. Cultivated groundnut is an autotetraploid species with a chromosome number of $2n = 4x = 40$. Based on differences in plant growth and branching pattern cultivated groundnut is broadly classified into two subspecies. The two subspecies of cultivated groundnut are further divided into two botanical varieties. *A. hypogaea subsp. fastigiata* includes var. *fastigiata*, commonly referred to as the valencia type and var. *vulgaris* known as the spanish type. Similarly, *A. hypogaea subsp. hypogaea* comprises var. *hypogaea* commonly known as the Virginia type and var. *hirsuta*. Plant growth regulators (PGRs) are naturally occurring or synthetic organic compounds that influence various physiological processes in plants when applied in small quantities. They play an important role in regulating plant growth and development and are widely used to improve flowering, fruit development, fruit size, ripening and root growth. The use of PGRs as seed treatments or foliar applications has been reported to improve the growth, yield and quality of several vegetable crops. The response of plants to PGR application is influenced by environmental factors such as light, temperature, moisture and nutrient availability. Moreover, the effectiveness of PGRs depends on factors such as the type and concentration of the regulator, method of application and time of treatment.

2. Material and methodology

The present investigation intitled “Effects of plant growth regulators on morpho-physiological, yield and yield parameters of groundnut (*Arachis hypogaea* L.) cv. PDKVG 335 was carried out during Kharif 2025-26 at oilseed research unit Dr, P.D.K.V, Akola in randomized block design (RBD) with three replications and ten treatments viz., T_1 (PBZ @ 50 ppm), T_2 (PBZ @ 100 ppm), T_3 (PBZ @ 150 ppm), T_4 (SA @ 100 ppm), T_5 (SA @ 125 ppm), T_6 (SA @ 150 ppm), T_7 (MH @ 750 ppm), T_8 (MH @ 1000 ppm), T_9 (MH @ 1250 ppm) and T_{10} (control). The sowing was done on 20 June 2025 by dibbling method having plot size 5 m x 1.5 m with a spacing of 30 cm x 10 cm. Thereafter, all intercultural operations were done as and when required.

The observations were measured by five randomly selected and tagged plants. Plant height was measured from the base of the plant to the growing tip and expressed in centimeter. The leaf area was measured on automatic leaf area meter. The specific leaf weight was computed from the data of leaf dry weight (mg) and

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leaf area (cm^2) at 80 DAS and at harvest. The SPAD meter is an instrument that used to measure the chlorophyll content and total dry matter of plant was determined to assess the dry matter accumulation. For this the plant was uprooted from field and these plants were sun dried and then oven dried at 70°C to record a constant weight. The number of pods from five sample plants were counted and then average number of pods per plant were worked out after harvest. Pods from each plant were threshed by hand, cleaned and weighed separately. From this mean yield of seed per plant were worked out and recorded in grams.

3. Result and Discussion

Effects of foliar application of different concentrations of plant growth regulators on the morphological characteristics of groundnut plants. The observations include plant height (cm), leaf area (cm^2), specific leaf weight (mg cm^{-2}), specific leaf area ($\text{cm}^2 \text{g}^{-1}$) total dry matter production, chlorophyll content index, number of pods plant^{-1} and yield plant^{-1} are presented in table 1. These parameters were evaluated to understand the influence of PGR treatments on the morpho-physiological and yield performance of the crop.

3.1 Plant height

Plant height showed significant differences among the treatments. The mean plant height values differ from 32.80 to 37.91 cm. The shortest plants were observed under treatment T₉ (1250 ppm MH) (32.80), followed by T₃ (150 ppm PBZ) (33.04) and T₈ (1000 ppm MH) (33.49) compared to the untreated control (T₁₀) (37.91). The remaining treatments exhibited intermediate plant heights. In comparison with the control, noticeable reductions in plant height were also observed with treatment T₂ (100 ppm PBZ) (34.20), T₇ (750 ppm MH) (34.85) and T₆ (150 ppm SA) (35.15) while the other treatments produced comparatively moderate effects. The results obtained in the present investigation are supported by the findings of Kulkarni *et al.*,

(1995) [1], Porwal *et al.*, (2002) [2], Ravi *et al.*, (2024) [3] and Lenka *et al.*, (2024) [4].

3.2 Leaf area

Leaf area ranged from 1252.98 to 1617.20 $\text{cm}^2 \text{plant}^{-1}$. The lowest leaf area was recorded with T₉ (1250 ppm MH) (1252.98) over all the treatments however, treatment T₂ (100 ppm PBZ) (1395.10), T₃ (150 ppm PBZ) (1328.79), T₇ (750 ppm MH) (1416.36) and T₈ (1000 ppm MH) (1331.86) at par with it. The maximum leaf area was recorded under T₁₀ (Control) (1617.20). The findings of the present study are consistent with the results reported by Craft *et al.* (1994) [5], Phulekar *et al.*, (1998) [6], El-shennaway *et al.*, (2004) [7] and Muneeba *et al.* (2022) [8].

3.3 Specific leaf weight

The maximum specific leaf weight was recorded in T₉ (1250 ppm MH) (7.41) followed by T₃ (150 ppm PBZ) (7.35) and T₈ (1000 ppm MH) (7.20). The minimum value was recorded in the control (T₁₀) (5.08). The specific leaf weight under T₉ was approximately 45.87% higher than the control. This result finding are close agreement with the finding of Craft and Sutton (1994) [5], Phulekar *et al.* (1998) [6], Shukla *et al.* (2000) [9].

3.4 Specific leaf area

The specific leaf area was calculated and it showed considerable variation among the treatments. The leaf area ranged from 131.89 to 170.23. The lowest specific leaf area was recorded with T₉ (1250 ppm MH) (131.89) over all the treatments however, treatment T₂ (100 ppm PBZ) (146.85), T₃ (150 ppm PBZ) (139.87), T₇ (750 ppm MH) (149.09) and T₈ (1000 ppm MH) (140.20) at par with it. The maximum specific leaf area was recorded under T₁₀ (Control) (170.23). This result finding are in close agreement with the finding of Phulekar *et al.* (1998) [6], Shukla *et al.* (2000) [9].

Table 1. Morpho-physiological and yield characters influenced by different plant growth regulators

Treatments	Morpho-physiological and yield characters							
	Plant height (cm)	Leaf Area (cm^2)	Specific leaf weight (mg cm^{-2})	Specific leaf area ($\text{cm}^2 \text{g}^{-1}$)	Chlorophyll content index	Total dry matter production (g)	Number of pods plant^{-1}	Yield plant^{-1} (g)
T ₁ (50 ppm PBZ)	36.02	1542.63	6.36	162.38	38.80	33.69	20.67	14.18
T ₂ (100 ppm PBZ)	34.20	1395.10	7.05	146.85	42.25	36.19	23.30	16.07
T ₃ (150 ppm PBZ)	33.04	1328.79	7.35	139.87	41.81	37.29	25.27	17.20
T ₄ (100 ppm SA)	35.50	1508.35	6.43	158.77	39.13	34.20	21.20	14.51
T ₅ (125 ppm SA)	36.19	1584.19	6.29	166.76	37.67	33.42	18.60	13.60
T ₆ (150 ppm SA)	35.15	1496.05	6.66	157.48	40.40	34.79	21.88	15.11
T ₇ (750 ppm MH)	34.85	1416.36	6.87	149.09	43.84	35.41	22.70	15.40
T ₈ (1000 ppm MH)	33.49	1331.86	7.20	140.20	42.00	36.75	24.17	16.48
T ₉ (1250 ppm MH)	32.80	1252.98	7.41	131.89	41.10	39.09	26.13	18.15
T ₁₀ (Control)	37.91	1617.20	5.08	170.23	32.91	31.19	14.96	11.82
GM	34.92	1447.35	6.67	152.3	40.35	35.20	21.89	15.25
SE (m) ±	1.01	70.36	0.44	11.59	2.00	1.44	1.29	0.96
CD at 5 %	3.01	209.06	1.30	34.44	5.95	4.27	3.85	2.89

3.5 Chlorophyll content index

The chlorophyll content index varied significantly among the different treatments. The highest chlorophyll content index was recorded in T₇ (750 ppm MH) (43.84), followed by T₂ (100 ppm PBZ) (42.25) and T₈ (1000 ppm MH) (42.00). In comparison, the lowest chlorophyll content index was observed in the control (T₁₀) (32.91). The treatment T₇ recorded an increase of approximately 33.23 per cent over the control.

3.6 Total dry matter production

The higher total dry matter production of 39.09 g plant^{-1} was recorded in the treatment T₉ (1250 ppm MH) which was followed by treatment T₃ (150 ppm PBZ) (37.29), T₈ (1000 ppm MH) (36.75) and T₂ (36.19) whereas the control recorded the lowest total dry matter production of 31.19 g plant^{-1} . The greater dry matter accumulation indicates enhanced photosynthetic activity throughout the crop growing period improved nutrient uptake and more efficient utilization of assimilates, ultimately contributing to better pod yield. This result finding is in close agreement with the finding of Reddy *et al.* (2009) [10],

Thein *et al.* (2012) ^[11], Goswami *et al.* (2022) ^[12] and Ravi *et al.* (2024) ^[3].

3.7 Number of pod plant⁻¹

Yield contributing characters such as number of pods plant⁻¹ was found significantly different among all the treatments. The highest number of pods plant⁻¹ was observed in the treatment T₉ (1250 ppm MH) (26.13) than rest of treatments however, treatment T₂ (23.30), T₃ (25.27), T₇ (22.70) and T₈ (24.17) remained at par with it T₉. The lowest number of pods plant⁻¹ were produced in the treatment T₁₀ control (14.96). The experimental findings correspond with those of Rahman *et al.* (2004) ^[13], Sharma *et al.* (2005) ^[14] and Lenka *et al.* (2024) ^[4].

3.8 Yield plant⁻¹

Data regarding yield plant⁻¹ showed significant variation among all treatments and are recorded in the table 2. The highest yield was shown by treatment T₉ (1250 ppm MH) (18.15) over the all treatments however, treatment T₂ (16.07), T₃ (17.20), T₇ (15.40) and T₈ (16.48) remained statistically similar with it. The lowest number of pods plant⁻¹ were produced in the treatment T₁₀ control (11.82). The result of this experiment are consistent with those of Thein *et al.* (2012) ^[11], Mishra *et al.* (2021) ^[15], Ghadiali *et al.* (2023) ^[16], Dasanal *et al.* (2024) ^[17] and Srikant *et al.* (2024) ^[18].

Conclusion

Based on the findings of the present investigation, the effect of different plant growth regulators on the morpho-physiological and yield characters of groundnut influenced by different growth regulators.

- 1) Morphological characters viz., plant height, leaf area, specific leaf area and specific leaf weight and Physiological characters viz., dry matter production and chlorophyll content index was observed to be superior with MH @ 1250 ppm and PBZ @ 150 ppm.
- 2) Similarly, important yield-contributing characters including number of pods plant⁻¹ and pod yield plant⁻¹ were significantly improved with the application of MH @ 1250 ppm and PBZ @ 150 ppm.
- 3) Overall, the results indicate that MH @ 1250 ppm was the most promising treatment for improving the growth and yield performance of groundnut under the conditions of the present study. However, since the experiment was conducted for only one season, further trials across different seasons and locations are recommended to validate and confirm these findings

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