Plant Archives Vol. 26, No. 2, 2026 pp. 1394-1400 e-ISSN:2581-6063 (online), ISSN:0972-5210

Plant Archives

Journal homepage: http://www.plantarchives.org

DOI Url : https://doi.org/10.51470/PLANTARCHIVES.2026.v26.no.2.190

MORPHO-PHYSIOLOGY AND YIELD OF BRINJAL (*Solanum melongena* L.) AS INFLUENCED BY FOLIAR APPLICATION OF HOMOBRASSINOLIDE

Victor Manigra Narzary[1], Kaushik Das[1*], Soibam Helena Devi[1], Sudeshna Baruah[2], Marami Dutta[3], Bikash Hazarika[2], Kasturi Saikia[1], Barbee Baruah[1] and Tapan Senchowa[1]

[1]Department of Plant Physiology, Assam Agricultural University, Jorhat, Assam, India.

[2]Department of Horticulture, Assam Agricultural University, Jorhat, Assam, India.

[3]Department of Soil Science, Assam Agricultural University, Jorhat, Assam, India.

*Corresponding author E-mail : kaushik.das@aau.ac.in

(Date of Receiving-09-07-2026; Date of Revision-04-09-2026; Date of Acceptance-11-09-2026)

ABSTRACT

Brassinosteroids are crucial phytohormones that modulate critical developmental and physiological pathways, offering a strategic approach to enhancing agricultural productivity. A field experiment was conducted at the Experimental Farm, Department of Horticulture, Assam Agricultural University, Jorhat, to evaluate the effect of exogenous homobrassinolide (HBL) foliar spray on the growth and physiology of brinjal (*Solanum melongena* L. cv. Abu). Twelve treatments comprising five HBL concentrations (0.25, 0.50, 0.75, 1.00 and 1.25 ppm) applied either as a single spray (20 days after transplanting, DAT) or a double spray (20 and 40 DAT), together with two corresponding water-sprayed controls, were laid out in a Randomized Block Design with four replications. The double application of 0.75 ppm HBL consistently outperformed all other treatments, significantly enhancing plant architecture and growth metrics, including a 142.65% increase in plant height, 92.73% increase in leaf number, and 90.52% expansion in leaf area (at 70 DAT). Furthermore, root system development was substantially improved, characterized by a 79.04% increase in root volume and an 87.32% increase in root length (at 70 DAT). Physiological indices were also optimized; double application of 0.75 ppm HBL enhanced total leaf chlorophyll content to 81.72% (at 50 DAT), relative leaf water content (RLWC) to 92.26% (at 50 DAT) and significantly boosted leaf NPK content and increased fruit yield. The results establish double foliar application of 0.75 ppm HBL as an effective, economically viable agronomic intervention for enhancing brinjal productivity under the agro-climatic conditions of upper Brahmaputra valley, Assam.

Key words : Brassinosteroids, Brinjal, Growth metrics, Homobrassinolide, Yield

Introduction

Brinjal (*Solanum melongena* L.) is among the most widely cultivated Solanaceous vegetables of tropical and subtropical regions and is valued for its low caloric density and favourable mineral composition (Khosravifar *et al.*, 2025; Kamaleshwaran *et al.*, 2026). India cultivates brinjal over 749.50 thousand hectares with an annual production of 12,873.80 thousand metric tonnes and an average productivity of 17.20 t ha^{-1} (Horticultural Statistics at a Glance, Government of India, 2020–2025). Ministry of Agriculture and Farmers Welfare, New Delhi). Assam ranks eighth among Indian states, contributing about 2.5% of national output, with Nagaon, Barpeta and Kamrup as the principal production centres (Horticultural Statistics at a Glance, Government of India (2020–2025). Ministry of Agriculture and Farmers Welfare, New Delhi). Despite this importance, commercial cultivation is frequently constrained by limited physiological performance, poor plant vigour, erratic reproductive development and non-uniform fruit maturity (Wakachure *et al.*, 2020), creating scope for physiological interventions such as plant growth regulators (PGRs) to complement conventional agronomic and breeding approaches.

Brassinosteroids (BRs), recognised as the sixth class of phytohormones, regulate cell division and elongation, vascular differentiation, photosynthesis and reproductive

physiology, and confer tolerance to diverse abiotic and biotic stresses (Hu *et al*., 2021; Lu *et al*., 2025). Exogenous BR application has been reported to enhance canopy development, leaf area, chlorophyll content and assimilate partitioning, and thereby to increase yield in a wide range of crops (Che *et al*., 2024). Homobrassinolide (HBL), a major bioactive brassinosteroid analogue, has improved growth and yield in crops such as tomato (Sridhara *et al*., 2021), celery (Liu *et al*., 2022) and lettuce (Prajwalitha *et al*., 2026); however, systematic field-level evidence on its effect on the morpho-physiology and yield of brinjal, particularly under the agro-climatic conditions of Northeast India, remains scanty. Standardising an effective concentration and spray schedule of HBL for this region is therefore an immediate research need. The present field investigation was undertaken to evaluate the dose- and frequency-dependent effects of foliar-applied homobrassinolide on the vegetative growth, root architecture and physiological attributes of brinjal, and to identify the most effective and economically viable treatment for the target agro-ecology.

Materials and Methods

Experimental site and agro-climate

The field trial was conducted from November 2025 to April 2026 at the Experimental Farm of the Department of Horticulture, Assam Agricultural University, Jorhat, located in the upper Brahmaputra valley agro-climatic zone (26°45′ N, 94°12′ E; 96.60 m above mean sea level). The site experiences a subtropical climate with warm, humid summers and mild, dry winters; the driest period spans December to April, and the soil is a well-drained sandy loam of alluvial origin (pH 4.55; organic carbon 0.56%; available N, P and K of 262.25, 28.85 and 219.15 kg ha^{-1}, respectively).

Experimental design and treatments

The trial was laid out in a Randomized Block Design (RBD) with 12 treatments and four replications, using brinjal cv. 'Abu' raised at a spacing of 60 cm × 60 cm on plots of 1.8 m × 1.8 m (total experimental area 265 m^2). Land preparation, basal fertilization (FYM 20 t ha^{-1}; N:P_2O_5 :K_2O 50:50:50 kg ha^{-1}), irrigation and weeding followed standard regional recommendations. Homobrassinolide was applied as a foliar spray at five concentrations (0.25, 0.50, 0.75, 1.00 and 1.25 ppm), either as a single application at 20 days after transplanting (DAT; T_1–T_5) or as a double application at 20 and 40 DAT (T_6–T_{10}), with two corresponding water-sprayed controls (T_{11}, single-spray control; T_{12}, double-spray control).

Table 1 : Treatment details of the field experiment.

Notation	Treatment
T_1	0.25 ppm HBL at 20 DAT
T_2	0.50 ppm HBL at 20 DAT
T_3	0.75 ppm HBL at 20 DAT
T_4	1.00 ppm HBL at 20 DAT
T_5	1.25 ppm HBL at 20 DAT
T_6	0.25 ppm HBL at 20 + 40 DAT
T_7	0.50 ppm HBL at 20 + 40 DAT
T_8	0.75 ppm HBL at 20 + 40 DAT
T_9	1.00 ppm HBL at 20 + 40 DAT
T_{10}	1.25 ppm HBL at 20 + 40 DAT
T_{11}	Control 1 – water spray at 20 DAT
T_{12}	Control 2 – water spray at 20 + 40 DAT

Observations recorded

Plant height and leaf number were recorded at 2-week intervals from 30 DAT to final harvest. Shoot and root fresh and dry weights, root volume (water-displacement method), longest root length, leaf area (LI-COR LI-2200 leaf area meter), total chlorophyll content (DMSO extraction method), relative leaf water content (RLWC) and leaf N, P and K content were recorded at 30, 50 and 70 DAT. Matured fruits were harvested and recorded data are presented here as q ha^{-1}.

Statistical analysis

Data were analysed by two-way analysis of variance (ANOVA) appropriate to the RBD, and treatment means were compared using the standard error of difference (SEd) and critical difference (CD) at P = 0.05. Pearson's product-moment correlation coefficients were computed to examine relationships among growth and physiological attributes.

Results and Discussion

Effect of homobrassinolide vegetative growth

Treatment effects on plant height and leaf number were non-significant at 30 DAT but became highly significant from 50 DAT onward as shown in Table 2. At 70 DAT, T_8 (0.75 ppm, double spray) recorded the greatest plant height (100.22 cm, 142.65% over control) and leaf number (53.00 leaves $plant^{-1}$, 92.73% over control), followed by T_9 (1.00 ppm, double spray). Shoot and root fresh and dry weights showed a similar pattern: T_8 produced the highest shoot fresh weight (195.43 g $plant^{-1}$, 206.89% increase), root fresh weight (13.02 g $plant^{-1}$, 98.70% increase), shoot dry weight (62.53 g $plant^{-1}$, 199.04% increase) and root dry weight (8.22 g $plant^{-1}$, 156.07% increase), all at 70 DAT as shown in Tables 3 and 4.

Table 2 : Effect of homobrassinolide on plant height (cm) and leaf number (plant^{-1}) of brinjal at 30, 50 and 70 DAT (values in parentheses indicate % increase over the corresponding control).

Treatment	Plant height			Leaf number		
	30 DAT	50 DAT	70 DAT	30 DAT	50 DAT	70 DAT
T_1	17.02 (0.43)	39.69 (48.09)	49.44 (22.42)	15.50 (3.33)	28.50 (29.55)	33.50 (28.85)
T_2	17.05 (0.59)	41.19 (53.68)	51.06 (26.44)	16.00 (6.67)	30.50 (38.64)	35.50 (36.54)
T_3	18.02 (6.33)	48.51 (81.02)	60.32 (49.37)	17.00 (13.33)	32.50 (47.73)	44.75 (72.12)
T_4	17.15 (1.18)	44.53 (66.14)	55.40 (37.20)	16.25 (8.33)	30.50 (38.64)	36.25 (39.42)
T_5	16.99 (0.22)	34.89 (30.18)	43.70 (8.23)	15.50 (3.33)	26.00 (18.18)	30.25 (16.35)
T_6	17.05 (0.41)	63.71 (128.44)	84.36 (104.26)	15.75 (3.28)	29.00 (31.82)	36.50 (32.73)
T_7	17.04 (0.34)	67.44 (141.80)	89.50 (116.71)	16.25 (6.56)	32.00 (45.45)	40.50 (47.27)
T_8	18.05 (6.32)	74.61 (167.52)	100.22 (142.65)	17.25 (11.48)	36.50 (65.91)	53.00 (92.73)
T_9	17.28 (1.74)	69.28 (148.39)	92.42 (123.78)	16.75 (9.84)	34.50 (56.82)	44.50 (61.82)
T_{10}	16.99 (0.04)	56.79 (103.61)	73.09 (76.96)	15.25 (0.00)	26.50 (20.45)	32.00 (16.36)
Control 1	16.95	26.80	40.38	15.00	22.00	26.00
Control 2	16.98	27.89	41.30	15.25	23.25	27.50
SEd(±)	-	2.056	1.752	-	2.012	2.483
CD	NS	4.183	3.564	NS	4.094	5.052

Table 3 : Effect of homobrassinolide on shoot and root fresh weight (g plant^{-1}) of brinjal at 30, 50 and 70 DAT (values in parentheses indicate % increase over the corresponding control).

Treatment	Shoot Fresh weight			Root Fresh weight		
	30 DAT	50 DAT	70 DAT	30 DAT	50 DAT	70 DAT
T_1	43.52 (0.03)	67.03 (44.36)	96.84 (55.94)	5.70 (21.22)	7.66 (41.33)	9.20 (54.06)
T_2	43.53 (0.07)	68.58 (47.70)	99.40 (60.06)	5.61 (19.41)	7.90 (45.80)	9.50 (59.05)
T_3	44.00 (1.15)	79.85 (71.98)	115.70 (86.31)	6.76 (43.88)	8.94 (64.94)	10.87 (82.12)
T_4	43.56 (0.13)	75.94 (63.55)	109.53 (76.37)	6.10 (29.73)	8.19 (51.06)	9.95 (66.67)
T_5	43.51 (0.03)	57.93 (24.76)	84.00 (35.27)	5.26 (11.91)	7.19 (32.70)	8.54 (43.05)
T_6	43.58 (0.29)	111.83 (136.27)	162.13 (154.59)	5.38 (19.35)	8.34 (43.30)	10.03 (53.13)
T_7	43.60 (0.34)	120.23 (154.01)	174.15 (173.48)	5.61 (24.45)	8.76 (50.47)	10.57 (61.41)
T_8	43.63 (0.41)	136.93 (189.30)	195.43 (206.89)	6.65 (47.45)	11.05 (89.82)	13.02 (98.70)
T_9	43.60 (0.35)	124.00 (161.99)	179.28 (181.52)	5.92 (31.21)	9.11 (56.57)	11.08 (69.16)
T_{10}	43.53 (0.18)	97.70 (106.42)	141.65 (122.44)	5.01 (11.14)	8.07 (38.70)	9.74 (48.74)
Control 1	43.50	46.43	62.10	4.70	5.42	5.97
Control 2	43.45	47.33	63.68	4.51	5.82	6.55
SEd(±)	-	2.301	2.203	-	1.554	1.823
CD	NS	4.683	4.483	NS	3.162	3.708

Root architecture

Root volume and the length of the longest root were unaffected by treatment at 30 DAT but diverged significantly thereafter as shown in Table 5. At 70 DAT, T_8 produced the highest root volume (24.35 cc plant^{-1}, 79.04% over control) and root length (21.28 cm, 87.32% over control), followed by T_9 (22.40 cc and 18.84 cm, respectively).

Leaf area, chlorophyll content and relative leaf water content

Leaf area expanded significantly with HBL treatment from 50 DAT onward, reaching a maximum of 679.28 cm^2 plant^{-1} under T_8 at 70 DAT (90.52% over control), compared with 592.53 cm^2 under T_9 (66.19% over control) as shown in Table 6. Total leaf chlorophyll content peaked at 50 DAT, with T_8 recording 3.85 mg g^{-1} fresh weight (81.72% over control) and T_3 (0.75 ppm single spray) recording 3.56 mg g^{-1} (71.86% over control) as shown in Table 7. Relative leaf water content was likewise highest under T_8 at 50 DAT (92.26%, a 22.14% increase over the control value of 75.54%), followed by T_9 (89.83%) as shown in Table 7.

Table 4 : Effect of homobrassinolide on shoot and root dry weight (g plant^{-1}) of brinjal at 30, 50 and 70 DAT (values in parentheses indicate % increase over the corresponding control).

Treatment	Shoot Dry weight			Root Dry weight		
	30 DAT	50 DAT	70 DAT	30 DAT	50 DAT	70 DAT
T_1	6.48 (27.31)	20.43 (57.12)	30.17 (48.27)	2.04 (43.49)	3.42 (46.89)	4.11 (29.17)
T_2	6.76 (32.86)	21.17 (62.87)	30.82 (51.44)	2.09 (46.83)	3.53 (51.61)	4.25 (33.57)
T_3	7.07 (38.90)	24.54 (88.79)	35.80 (75.90)	2.39 (68.13)	4.03 (72.85)	4.90 (54.01)
T_4	7.30 (43.42)	23.27 (79.02)	33.94 (66.78)	2.19 (54.40)	3.89 (66.74)	4.69 (47.41)
T_5	6.07 (19.16)	17.89 (37.62)	26.42 (29.80)	1.92 (35.04)	3.15 (35.19)	3.81 (19.81)
T_6	6.45 (26.97)	34.03 (153.20)	51.81 (147.75)	1.94 (43.33)	4.70 (73.52)	6.05 (88.47)
T_7	6.92 (36.17)	36.53 (171.80)	55.68 (166.30)	2.02 (49.63)	5.01 (84.78)	6.55 (103.89)
T_8	7.08 (39.42)	40.74 (203.09)	62.53 (199.04)	2.37 (75.37)	6.07 (123.99)	8.22 (156.07)
T_9	7.02 (38.19)	37.23 (177.03)	57.74 (176.12)	2.14 (58.70)	5.41 (99.45)	7.18 (123.68)
T_{10}	6.02 (18.45)	29.53 (119.74)	45.51 (117.65)	1.78 (32.04)	4.44 (63.78)	5.78 (80.06)
Control 1	5.09	13.00	20.35	1.42	2.33	3.18
Control 2	5.08	13.44	20.91	1.35	2.71	3.21
SEd(±)	-	2.315	3.370	-	0.254	0.278
CD	NS	4.711	6.858	NS	0.517	0.556

Table 5 : Effect of homobrassinolide on root volume (cc plant^{-1}) and longest root length (cm) of brinjal at 30, 50 and 70 DAT (values in parentheses indicate % increase over the corresponding control).

Treatment	Root Volume			Root Length		
	30 DAT	50 DAT	70 DAT	30 DAT	50 DAT	70 DAT
T_1	5.94 (10.98)	12.78 (13.96)	15.20 (18.75)	10.02 (11.61)	12.84 (36.45)	15.16 (39.68)
T_2	6.10 (14.02)	13.06 (16.53)	15.90 (24.22)	10.14 (12.86)	13.25 (40.75)	15.65 (44.24)
T_3	6.93 (29.44)	15.38 (37.15)	18.60 (45.31)	10.40 (15.81)	15.12 (60.68)	18.12 (67.00)
T_4	6.18 (15.42)	13.68 (21.99)	16.40 (28.13)	10.17 (13.25)	13.97 (48.41)	16.67 (53.64)
T_5	5.59 (4.44)	12.19 (8.72)	14.50 (13.28)	10.01 (11.47)	12.08 (28.32)	14.21 (30.92)
T_6	5.71 (7.18)	16.05 (32.21)	19.70 (44.85)	10.02 (10.79)	14.09 (46.87)	16.59 (45.99)
T_7	6.64 (24.53)	16.69 (37.46)	20.80 (52.94)	10.23 (13.11)	15.17 (58.19)	17.97 (58.19)
T_8	7.13 (33.68)	20.25 (66.80)	24.35 (79.04)	10.50 (16.15)	18.13 (89.00)	21.28 (87.32)
T_9	7.05 (32.27)	18.18 (49.71)	22.40 (64.71)	10.43 (15.32)	15.66 (63.24)	18.84 (65.85)
T_{10}	5.66 (6.24)	14.73 (21.29)	17.60 (29.41)	10.00 (10.62)	13.39 (39.62)	16.11 (41.77)
Control 1	5.35	11.21	12.80	8.98	9.41	10.85
Control 2	5.33	12.14	13.60	9.04	9.59	11.36
SEd(±)	-	0.762	0.749	-	1.313	0.919
CD	NS	1.550	1.524	NS	2.673	1.870

Leaf nutrient (N, P and K) content

Leaf N, P and K content increased significantly with all HBL treatments at every growth stage. At 50 DAT, T_8 recorded the highest values – N: 4.68% (54.97% over control), P: 0.62% (75.71% over control) and K: 5.23% (63.36% over control) – followed by T_9. The pattern was consistent across 30 and 70 DAT, with double-spray treatments consistently exceeding their corresponding single-spray counterparts.

Fruit Yield (q ha^{-1})

HBL application demonstrated a marked influence on yield of the brinjal crop. The best yield was obtained from T_8 (double application at 0.75 ppm); 126.97% higher than the control yield of 163.14 q ha^{-1} and T_9 (double application at 1.00 ppm) 94.90% higher than the control yield of 163.14 q ha^{-1}.

Across all measured attributes, double foliar application of 0.75 ppm HBL (T_8) consistently outperformed both higher and lower concentrations as well as the single-spray schedule, indicating a biphasic, hormetic dose-response typical of brassinosteroid action, in which supra-optimal concentrations disrupt hormonal

Table 6 : Effect of homobrassinolide on leaf area (cm^2 $plant^{-1}$) of brinjal at 30, 50 and 70 DAT (values in parentheses indicate % increase over the corresponding control).

Treatment	30 DAT	50 DAT	70 DAT
T_1	185.59 (1.92)	317.28 (19.41)	406.25 (14.40)
T_2	185.74 (2.00)	344.33 (29.59)	436.23 (22.84)
T_3	191.90 (5.38)	386.78 (45.57)	506.83 (42.72)
T_4	187.08 (2.73)	359.98 (35.48)	461.25 (29.89)
T_5	183.31 (0.67)	292.48 (10.08)	382.43 (7.69)
T_6	185.49 (1.74)	345.33 (29.68)	470.48 (31.96)
T_7	185.86 (1.95)	384.25 (44.30)	545.28 (52.94)
T_8	191.78 (5.19)	464.58 (74.46)	679.28 (90.52)
T_9	186.49 (2.29)	441.75 (65.89)	592.53 (66.19)
T_{10}	183.48 (0.64)	302.93 (13.76)	412.70 (15.75)
Control 1	182.10	265.70	355.11
Control 2	182.31	266.29	356.54
SEd(±)	-	13.681	14.593
CD	NS	27.835	29.690

and coriander (Xu *et al*., 2023), reflects the established role of brassinosteroids in promoting cell division and cell elongation. The pronounced improvement in root volume and root length under HBL treatment parallels findings in citrus (Alkanani *et al*., 2024) and rice (Zhu *et al*., 2026), and is functionally significant: an expanded root system would be expected to enhance water and nutrient acquisition, providing a physiological basis for the concurrent increases in relative leaf water content (Khosravifar *et al*., 2025) and leaf N, P and K content (Bera *et al*., 2020) recorded in the present study.

The substantial rise in total leaf chlorophyll content under HBL treatment corroborates earlier reports in *Zanthoxylum schinifolium* (Liang *et al*., 2024) and tobacco (Zhang *et al*., 2021) and is consistent with the demonstrated role of brassinosteroids in enhancing Rubisco activation, expression of photosynthesis-related genes and CO_2 assimilation in *Cucumis sativus* (Xia *et al*., 2009; Yu *et al*., 2003). Because brinjal itself has previously shown BR-mediated protection of the

Table 7 : Effect of homobrassinolide on total leaf chlorophyll content (mg g^{-1} fresh weight) and relative leaf water content (%) of brinjal at 30, 50 and 70 DAT (values in parentheses indicate % increase over the corresponding control).

Treatment	Leaf Chlorophyll			RLWC		
	30 DAT	50 DAT	70 DAT	30 DAT	50 DAT	70 DAT
T_1	2.24 (32.40)	2.72 (31.52)	2.49 (31.61)	73.00 (0.97)	79.18 (6.19)	76.61 (7.39)
T_2	2.50 (48.08)	3.03 (46.14)	2.78 (46.83)	73.23 (1.28)	80.74 (8.29)	78.06 (9.42)
T_3	2.98 (76.18)	3.56 (71.86)	3.25 (71.96)	73.58 (1.76)	85.05 (14.07)	81.10 (13.68)
T_4	2.74 (61.83)	3.25 (56.88)	2.99 (58.07)	73.38 (1.49)	82.83 (11.09)	80.21 (12.44)
T_5	2.09 (23.52)	2.49 (20.17)	2.28 (20.37)	72.70 (0.55)	77.24 (3.59)	74.35 (4.22)
T_6	2.26 (34.38)	2.92 (37.74)	2.62 (35.75)	73.08 (1.28)	85.83 (13.62)	80.99 (11.17)
T_7	2.54 (50.89)	3.26 (53.77)	2.95 (52.72)	73.33 (1.63)	89.10 (17.95)	83.63 (14.79)
T_8	3.02 (79.76)	3.85 (81.72)	3.47 (79.79)	73.68 (2.11)	92.26 (22.14)	88.63 (21.65)
T_9	2.76 (64.29)	3.48 (64.15)	3.15 (63.21)	73.48 (1.84)	89.83 (18.91)	84.89 (16.52)
T_{10}	2.11 (25.45)	2.67 (26.06)	2.42 (25.39)	72.99 (1.16)	82.65 (9.41)	79.49 (9.11)
Control 1	1.69	2.07	1.89	72.30	74.56	71.34
Control 2	1.68	2.12	1.93	72.15	75.54	72.85
SEd(±)	0.019	0.025	0.023	1.313	3.330	3.261
CD	0.039	0.050	0.048	2.672	6.775	6.635

balance and diminish the growth response (Chen *et al*., 2024). Comparable concentration optima have been reported for brassinosteroid action on vegetative growth in other Solanaceous and non-Solanaceous crops (Chen *et al*., 2024; Liang *et al*., 2024).

The marked increase in plant height, leaf number and biomass accumulation observed under T_8 is consistent with reports of BR-induced stimulation of vegetative growth in rice (Chen *et al*., 2024), *Zanthoxylum schinifolium* (Liang *et al*., 2024), celery (Liu *et al*., 2022) photosynthetic apparatus under salinity and chilling stress (Wu *et al*., 2012 and Wu *et al*., 2015), the present results extend this photoprotective and photosynthesis-promoting role of BR to unstressed field conditions, where it translated directly into greater biomass accumulation. Furthermore, observations on maturation of crop as influenced by BRs are similar to some previous research findings. For example, Zahedipour-Sheshglani *et al*. (2020) reported that low concentration of BR considerably resulted in rapid maturation.

Table 8 : Effect of homobrassinolide on leaf nitrogen, phosphorus and potassium content (%) of brinjal at 30, 50 and 70 DAT (values in parentheses indicate % increase over the corresponding control).

Treatment	N (%)			P (%)			K (%)		
	30 DAT	50 DAT	70 DAT	30 DAT	50 DAT	70 DAT	30 DAT	50 DAT	70 DAT
T1	3.66 (24.05)	3.59 (19.90)	3.24 (20.00)	0.41 (26.56)	0.45 (40.63)	0.37 (37.04)	3.67 (13.47)	3.95 (24.61)	3.63 (26.57)
T2	3.94 (35.78)	3.86 (28.93)	3.50 (29.54)	0.44 (37.50)	0.48 (50.00)	0.40 (48.15)	3.94 (21.90)	4.20 (32.49)	3.91 (36.24)
T3	4.34 (49.74)	4.20 (40.47)	3.83 (41.85)	0.49(53.13)	0.53 (65.63)	0.45 (66.67)	4.35 (34.52)	4.63 (45.90)	4.32 (50.52)
T4	4.14 (42.67)	4.04 (35.12)	3.66 (35.56)	0.47 (46.88)	0.51 (59.38)	0.43 (59.26)	4.14 (28.10)	4.38 (38.17)	4.11 (43.03)
T5	3.49 (20.34)	3.36 (12.37)	3.01 (11.48)	0.38 (11.76)	0.42 (31.25)	0.34 (25.93)	3.49 (7.97)	3.70 (16.72)	3.40 (18.29)
T6	3.60 (23.71)	4.28 (41.56)	3.91 (44.28)	0.51 (50.00)	0.55 (57.14)	0.47 (67.86)	3.82 (19.00)	4.75 (48.44)	4.46 (53.71)
T7	4.01 (37.89)	4.42 (46.36)	4.05 (49.45)	0.54 (57.35)	0.58 (64.29)	0.50 (76.79)	4.12 (28.35)	4.92 (53.83)	4.67 (61.03)
T8	4.37 (50.09)	4.68 (54.97)	4.26 (57.29)	0.58 (69.12)	0.62 (75.71)	0.54 (91.07)	4.53 (41.04)	5.23 (63.36)	4.99 (71.90)
T9	4.26 (46.48)	4.49 (48.51)	4.13 (52.40)	0.56(63.24)	0.60 (70.00)	0.52 (83.93)	4.26 (32.79)	5.02 (56.95)	4.77 (64.48)
T10	3.47 (19.24)	3.52 (16.56)	3.18 (17.16)	0.40 (25.00)	0.43 (22.86)	0.36 (28.57)	3.59 (11.92)	4.01 (25.23)	3.55 (22.41)
Control 1	2.90	2.99	2.70	0.31	0.33	0.30	3.24	3.17	2.87
Control 2	2.91	3.02	2.71	0.33	0.35	0.32	2.99	3.20	2.90
SEd(±)	0.05	0.019	0.017	0.008	0.002	0.014	0.046	0.019	0.009
CD	0.118	0.039	0.035	0.017	0.005	0.013	0.093	0.039	0.019

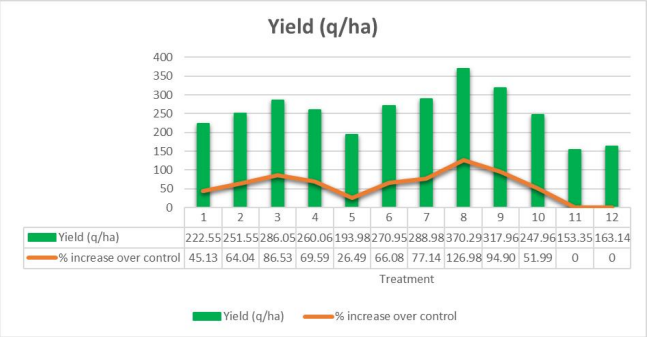

Fig. 1 : Yield in quintal per hectare along with percent increase.

Taken together, the present findings support a coordinated physiological model in which HBL-induced enhancement of root growth improves water and nutrient uptake; this, together with elevated chlorophyll content and photosynthetic efficiency, sustains greater vegetative biomass accumulation and increased fruit yield.

Foliar application of homobrassinolide significantly improved the vegetative growth, root architecture, physiological status and nutrient uptake of brinjal, with the response following a clear hormetic dose pattern. A double foliar spray of 0.75 ppm HBL at 20 and 40 days after transplanting was identified as the most effective and economically viable schedule among all treatments evaluated. These findings recommend the double application of 0.75 ppm HBL as a practical agro-physiological intervention for enhancing brinjal productivity under the agro-climatic conditions of Assam and provide a basis for further multi-location and multi-season validation as well as molecular investigation of the underlying BR-signalling pathways.

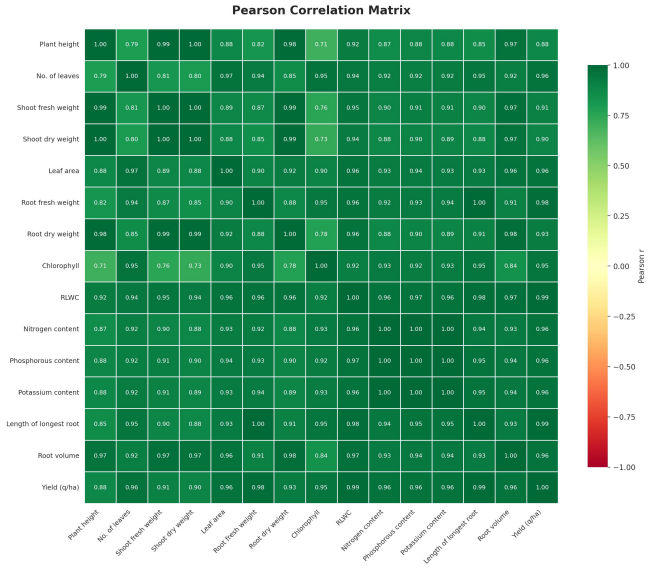

Fig. 2 : Pearson correlation Matrix.

Acknowledgement

The authors thank the Department of Plant Physiology and the Experimental Farm staff of the Department of Horticulture, Assam Agricultural University, Jorhat, for facilities and field assistance. This work forms part of M.Sc. research of the first author.

References

Alkanani, I.K.A. and Al-Tamimi A.H.M. (2024). Response of orange saplings to spraying with brassinolide and adding organic fertilizer in some of vegetative and root growth characteristics. *J. Kerbala Agricult. Sci.*, **3(11)**.

Bera, A.K., Maity U. and Mazumdar D. (2020). Effect of foliar application of brassinolide and salicylic acid on NPK content in leaf and nutritive values of seed in green gram

(Vigna radiata L. Wilczek). *Legume Res*., **31(3)**, 169–173.

Chen, X., Hu X., Jiang J. and Wang X. (2024). Functions and mechanisms of brassinosteroids in regulating crop agronomic traits. *Plant Cell Physiol.*, **65(10)**, 1568–1580.

Horticultural Statistics at a Glance, Government of India (2020–2025). Ministry of Agriculture and Farmers Welfare, New Delhi.

Hu, D., Wei L. and Liao W. (2021). Brassinosteroids in plants: crosstalk with small molecule compounds. *Biomolecules*, **11(12)**, 1–17.

Kamaleshwaran, R. and Elayaraja D. (2026). Biofortification of brinjal with zinc and iron through fortified organics optimized NPK and bioactive compounds and their effects on the growth yield and quality of brinjal and on soil properties in coastal saline soil. *Plant Sci. Today*, **13(1)**, 1–9.

Khosravifar, F., Mohammadi M. and Eghlima G. (2025). Brassinosteroids improve drought resistance in Zinnia by regulating antioxidant activity and hormonal interactions with ABA and salicylic acid. *Plant Growth Regul.*, **105**, 2259–2273.

Kumar, D., Narolia R.K., Indurthi S., Meena T.K., Meena A.R., Kumar P., Gurjar J., Bhupender and Kaswan H. (2026). Heterotic potential, combining ability, and stability analysis for yield and quality attributes in eggplant (Solanum melongena). *Front. Plant Sci*., **17**, 1836360.

Liang, H., Yang Y., Li X., Hu L., Sun C., Liu X., Wei L. and Zhu J. (2024). Brassinolide promotes the growth of *Zanthoxylum schinifolium* by improving photosynthetic efficiency and antioxidant capacity. *Agronomy*, **14**, 2892.

Liu, Y.H., Sun M., Wang H., Liu J.X., Tan G.F., Yan J., Wang Y.H., Yan Z.M., Liu H., Tao J.P., Zhu W.M., Shu S. and Xiong A.S. (2022). 24-Epibrassinolide and 2,6-Dichlorobenzonitrile promoted celery petioles and hypocotyl elongation by altering cellulose accumulation and cell length. *Agronomy*, **12**, 1670.

Lu, Z., Ma C., Xie Y., Zeng Y., Peng J., Zhou D. and Wu J. (2025). Understanding the brassinosteroid-dependent environmental adaption in Brassicaceae plants. *Plants*, **14**, 1554.

Prajwalitha, Mishra S. and Sher A. (2026). Effect of brassinolide and plant spacing on morphological and yield attributes of lettuce. *Int. J. Plant Soil Sci*., **38(2)**, 71–78.

Sridhara, S., Ramesh N., Gopakkali P., Paramesh V., Tamam N., Abdelbacki A.M.M., Elansary H.O., El-Sabrout A.M. and Abdelmohsen S.A.M. (2021). Application of homobrassinolide enhances growth, yield and quality of tomato. *Saudi J. Biolog. Sci*., **28**, 4800–4806.

Wakchaure, G., Minhas P., Meena K., Kumar S. and Rane J. (2020). Effect of plant growth regulators and deficit irrigation on canopy traits, yield, water productivity and fruit quality of eggplant (*Solanum melongena* L.) grown in the water scarce environment. *J. Environ. Manage*., **262**, 110320.

Wu, X.X., Ding H.D., Zhu Z.W., Yang S.J. and Zha D.S. (2012). Effects of 24-epibrassinolide on photosynthesis of eggplant (*Solanum melongena* L.) seedlings under salt stress. *Afr. J. Biotechnol.*, **11(35)**, 8665–8671.

Wu, X.X., Ding H.D., Chen J.L., Zhu Z.W. and Zha D.S. (2015). Amelioration of oxidative damage in *Solanum melongena* seedlings by 24-epibrassinolide during chilling stress and recovery. *Biologia Plantarum*, **59(2)**, 350–356.

Xia, X.J., Huang L.F., Zhou Y.H., Mao W.H., Shi K., Wu J.X., Asami T., Chen Z. and Yu J.Q. (2009). Brassinosteroids promote photosynthesis and growth by enhancing activation of Rubisco and expression of photosynthetic genes in *Cucumis sativus*. *Planta*, **230**, 1185–1196.

Xu, Z., Huang S., Xie Y., Wang S., Jin N., Jin L., Tie J., Meng X., Li Z., Lyu J. and Yu J. (2023). Physiological responses of coriander (*Coriandrum sativum* L.) to exogenous 2,4-epibrassinolide at different concentrations. *BMC Plant Biol.*, **23**, 649.

Yu, J.Q., Huang L.F., Hu W.H., Zhou Y.H., Mao W.H., Ye S.F. and Nogues S. (2004). A role for brassinosteroids in the regulation of photosynthesis in *Cucumis sativus* L. *J. Exp. Bot.*, **55(399)**, 1135–1143.

Zhang, J., Zhang Y., Khan R., Wu X., Zhou L., Xu N., Du S. and Ma X. (2021) Exogenous application of brassinosteroids regulates tobacco leaf size and expansion via modulation of endogenous hormones content and gene expression. *Physiol. Mole. Biol. Plants*, **27(4)**, 847–860.

Zhu, K., Peng S., Xu Z., Shi K., Duanmu Q., Shen X., Xu Y., Zhang Y., Zhou T., Zhang W., Xu Y., Gu J., Zhang H., Wang Z., Zhang J. and Yang J. (2026). Brassinosteroid-mediated improvement of rice yield and phosphorus (P) use efficiency under P deficiency: A root–rhizosphere perspective. *Rice*, **19(1)**, 2–17.