



## Effect of Plant Growth regulators on Morphological, Physiological and Biochemical parameters of Soybean (*Glycine max* L. Merrill)

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### Abstract:

Plant growth and developmental processes are very much regulated by certain chemical substances called Growth regulators. Growth regulators are known to improve the physiological efficiency including photosynthetic ability and can enhance the effective partitioning of assimilates from source and sink in the field crops. The present study was conceptualized and executed with the prime objective of study the effect of chlormequat chloride, NAA, Mepiquat chloride and Brassinosteroids on morphological, physiological and biochemical parameters of soybean. The field trial was conducted following randomized block design with nine treatments replicated thrice. The basic material for the present investigation consisted of soybean cv. Js-335 and two growth promoting (NAA and Brassinosteroid) and growth retarding substances (chlormequat chloride and mepiquat chloride). These growth regulators were sprayed at flower initiation stage. The Morphophysiological parameters, namely, Plant height, number of branches, number of trifoliates per plant, dry matter accumulation in leaf, stem and reproductive parts, LAI, CGR and RGR was observed to increase significantly with the application of NAA (20 ppm) and brassinosteroid (25 ppm). However, it decreased with the application of chlormequat chloride and mepiquat chloride. The Biochemical parameters, namely, chlorophyll content was observed to increase significantly with application of NAA (20 ppm), brassinosteroid (25 ppm), mepiquat chloride 5%, AS (5%) and chlormequat chloride 50%SL at different concentrations compared to control and water spray but whereas fluorescence emission and photosynthetic rate were noticed to be non-significant. A significant increase in the seed protein content was also noticed with the application of NAA (20 ppm), brassinosteroid (25 ppm), mepiquat chloride 5% AS (5%) and chlormequat chloride at different concentrations, compared to control and water spray. In conclusion, the study revealed the

superiority of NAA (20 ppm) treatment for majority of the morphological, physiological and biochemical parameters at different growth stages, compared to other growth regulator and control treatments studied in the present investigation for rabi soybean.

**Key words:** Growth regulators, randomized block design, soybean cv. Js-335, Morphophysiological parameters, Biochemical parameters.

### Introduction:

Soybean (*Glycine max*. L. Merrill) is a highly nutritive and energy rich dual purpose rainy season monocarpic legume crop with biologically effective proteins (43 %), edible oil (20 %), vitamins, minerals, salts and essential amino acids. Because of its versatility, soybean is popularly known as “Miracle Bean” and is being exploited in many agro-based industries with innumerable ways. India occupies an area of 8.89 m ha with a production of 10.96 mt and productivity of 1235 kg ha<sup>-1</sup>. (Centre for Monitoring Indian Economy, 2012). The evaluation of morpho-physiological and biochemical traits of crops namely, Plant height, number of branches, number of leaves per plant, dry matter accumulation in leaf, stem and reproductive parts, LAI, CGR and RGR, fluorescence, photosynthetic rate, chlorophyll content, germination, flowering, pod and seed development in addition to senescence either by reducing (growth retardant) or enhancing plant growth (growth promoters) indicates crop growth patterns which are reflected in final yield and thus, influences crop productivity. Plant growth regulators have been reported to be an effective tool for increasing crop yields due to their important role in various physiological and biochemical processes in plant, leading to rapid change in phenotype of the plant within the season to achieve desirable results. The use of growth regulators has been gaining more importance in the recent years for improvement of crop yield potential and quality of produce. In this context, there is an urgent need to identify suitable growth regulators for improving yield potential by

changing the various above mentioned parameters in soybean.

#### Materials and Methods:

The investigation was conducted on 'cv JS- 335' soybean genotype during rabi with nine treatments replicated thrice involving exogenous application of PGRs (NAA (20 ppm), brassinosteroid (25 ppm), mepiquat chloride 5% AS (5%) and chlormequat chloride at different concentrations) and a control (*i.e.*, no spray) in a randomized block design in the College Farm, College of Agriculture, Rajendranagar, Hyderabad. Foliar application of PGRs was made at flower initiation stage. Plant based observations *viz.*, namely, Plant height, number of branches, number of trifoliates per plant, dry matter accumulation in leaf, stem and reproductive parts (60 and 75 days upto harvest), LAI, CGR and RGR were recorded on five randomly selected and tagged plants at 15 days intervals from 15 DAE (days after emergence) till up to 75 DAE and at the time of harvest. The leaf area ( $\text{cm}^2$ ) was measured using LI-3100 Leaf Area Meter (LICOR-Lincoln, Nebraska, USA) leaf area index (LAI), Crop growth rate ( $\text{g m}^{-2} \text{d}^{-1}$ ), Relative growth rate ( $\text{g g}^{-1} \text{d}^{-1}$ ) were estimated. Afterwards, these leaf samples were subsequently dried hot-air oven at  $60^{\circ}$ - $70^{\circ}$  C. The dried samples were then weighed to record data on dry matter production. The values were expressed as  $\text{g m}^{-2}$ . Biochemical characters like chlorophyll content was measured using SPAD-502 (Soil Plant Analytical Development) meter, Leaf fluorescence was measured using fluorescence induction monitor (FIM-1500), Measurement of seed protein content was estimated by powdered the dried seed material. Thereafter the nitrogen percentage in the seed was estimated by taking 0.1 g of powdered seed sample following the kjeldal procedure as given in <sup>(1)</sup>. Protein percentage was then estimated by multiplying the nitrogen percentage with the factor, 6.25. Then Nitrogen harvest index (%) was measured. Finally the data were analysed statistically following the method of I.CAR <sup>(2)</sup>.

#### Results and discussion:

##### Morphological traits:

The data on plant height at different growth stages (Table 1) indicated that plant height increased with crop age. The growth promoters, especially NAA and brassinosteroid increased plant height, compared to water spray, control and the growth retardants studied in the present investigation. A comparison of the

growth promoter treatments further indicated that NAA at 20 ppm resulted in maximum plant height, compared to other treatments studied in the present investigation. The increased plant height may be due to the stimulating action of auxin which softens the cell wall by increasing its plasticity or may be the oxidative decarboxylation of synthetic auxins which could not be catalyzed by the enzyme peroxidase. Similar results have also been reported earlier <sup>(3)</sup> in blackgram due to application of NAA. The application of brassinosteroid (25ppm), another growth promoter studied in the present investigation had also resulted in increased plant height, on par with NAA (20ppm) and significantly greater, compared to control and water spray. Similar results in increase in plant height was observed <sup>(4)</sup> due to application of brassinosteroid and attributed it to increased photosynthetic rate in soybean. The growth retardants studied in the present investigation, namely, chlormequat chloride and mepiquat chloride recorded a decrease in plant height, compared to water spray, control and the growth promoters. A similar reduction in the plant height of soybean crop with the application of chlormequat chloride (40ppm) at 35 DAE, compared to NAA and GA was reported by <sup>(5)</sup>. The mechanism of reduction in plant height appears to be due to reduction in cell division and its expansion.

The number of branches per plant is an important morphological character, directly related to yield in soybean. In the present investigation, number of branches per plant increased gradually upto 75 days (table 1). Further, the different growth regulator treatments studied differed significantly at 45, 60, 75 DAE and harvest and maximum number of branches per plant were recorded in NAA (20 ppm), followed by chlormequat chloride 50% SL (162.5 a.i/ha). Similar results were reported by <sup>(6)</sup> in soybean. Application of mepiquat chloride 5%AS (5%) and brassinosteroid (25ppm) had also recorded significantly higher number of branches per plant, compared to control in the present study. Similar results were reported earlier in black gram <sup>(6)</sup> and green gram <sup>(7)</sup>. In general, leaf is considered as an important functional unit of plant which contributes to the formation of yield. The number of trifoliolate leaves increased gradually from 15D AS to 60 DAE, and thereafter declined (table 1) due to senescence. Significant influence of the growth regulator treatments was noticed at 30, 45, 60, 75 DAE and harvest. All treatments, with the exception of

chlormequat chloride 50% SL (375 a.i/ha) at 60 and 75DAE, increased the number of trifoliates significantly, compared to control. The positive influence of chlormequat chloride and NAA<sup>(8)</sup>; and mepiquat chloride and brassinosteroid<sup>(9)</sup> on number of trifoliates per plant were also reported earlier. Among the growth regulators, NAA (20 ppm) was more effective followed by brassinosteroid (25ppm). Poor partitioning of photo assimilates to the growing reproductive parts is one of the major constraints in pulses. This can be overcome by applying synthetic plant growth regulators. The dry matter production in leaves increased upto 60 DAE and declined (table 2) thereafter till harvest in all the growth regulator treatments including control. Among the treatments, the leaf dry weight was significantly higher with the application of NAA (20 ppm), brassinosteroid (25ppm), mepiquat chloride 5%AS (5%) and chlormequat chloride 50% SL (137.5 a.i/ha and 162.5 a.i/ha), compared to control and water spray, due to the beneficial effect of these growth regulators on leaf development. Similar results with foliar application of 50 ppm NAA at flowering in soybean and pigeon pea were obtained by<sup>(10)</sup>. The data recorded (table 2) on dry matter production in stem revealed gradual increase upto 75 DAE. Among different growth regulator treatments NAA (20ppm) exhibited maximum stem dry matter followed by brassinosteroid (25ppm), chlormequat chloride 50% SL (137.5 a.i/ha) over control and other treatments studied. Similar results in increase in stem dry matter was observed by<sup>(11)</sup> in greengram with the application of NAA @ 40 ppm. Dry matter production, particularly in reproductive parts is an important yield contributing character. There was a gradual increase in dry matter production of pods (table 2) from 60 DAE to harvest stage, and the highest dry matter was observed at harvest stage. Further, among the growth regulators treatments, NAA (20ppm) followed by brassinosteroid (25 ppm) and chlormequat chloride 50% SL (162.5 a.i/ha) had recorded maximum dry matter in pods, compared to control and other treatments studied. Similar increase in dry matter of reproductive parts with the application of NAA @ 20ppm in soybean<sup>(12)</sup>; and chlormequat chloride in soybean<sup>(13)</sup> were reported earlier.

#### Physiological traits:

Leaf area index is considered to be one of the photosynthetic determinants in crop plants and in the

present study, it increased gradually (table 3) from 30 to 75 DAE and decreased thereafter due to senescence and ageing of leaves. Application of growth promoters, namely, NAA (20 ppm) and brassinosteroid (20ppm) had resulted in higher LAI, compared to the growth retardants, mepiquat chloride and chlormequat chloride, in addition to water spray and control, at 30, 45, 60 and 75 DAE, probably due to their positive effect on cell division and cell elongation leading to enhanced leaf growth. Further, the application of growth retardants, namely, mepiquat chloride 5%AS (5%) and chlormequat chloride 50%SL at different concentrations had also resulted in higher LAI, compared to control, in the present investigation. The positive influence of mepiquat chloride and chlormequat chloride<sup>(14, 15)</sup> has also been reported earlier. The average daily increment in biomass production, namely, CGR is an important useful tool for estimating production efficiency, enabling comparison between the treatments. The observations recorded (table 3) on CGR in the present study revealed that most of the CGR values were maximum at 45-60 DAE. There was a gradual increase in CGR values from 15-30 DAS to 45-60 DAE, and thereafter it declined. Application of NAA (20ppm), followed by brassinosteroid (25 ppm) had recorded high CGR over control and other treatments studied. RGR, an efficiency index, declined with the advancement of crop growth from 15-30 DAE to 75DAE-harvest, due to a decline in crop growth rate (CGR) and more particularly, in the rate of dry matter production. Maximum RGR values (table 3) were attained at 15-30 DAE. The application of NAA (20 ppm) had resulted in significantly high RGR at 30-45, 60-75 and 75-harvest growth stages. Further, Mepiquat chloride 5% AS at 75-harvest and chlormequat chloride 50%SL applied at 137.5 a.i/ha at 30-45DAE; and at 162.5 and 187.5 a.i/ha at 75-harvest had also recorded high RGR, compared to control. The findings are in conformity with the reports of<sup>(16)</sup> in soybean.

#### Biochemical parameters:

Apart from morphological and physiological characters, growth regulators also known to influence different biochemical parameters. The influence of different growth promoting and growth retarding substances, in rabi soybean, in comparison to control and water spray on various biochemical parameters,

namely, chlorophyll content, fluorescence emission and photosynthetic rate is discussed hereunder:

The application of NAA (20 ppm), brassinosteroid (25 ppm), mepiquat chloride 5%AS (5%) and chlormequat chloride 50%SL at different concentrations had all resulted in significantly higher chlorophyll content, compared to control and water spray(table 4). The high chlorophyll content noticed with the application of NAA was attributed to the protection of chlorophyll molecule from photo oxidation and increased chlorophyll synthesis. Further, <sup>(17)</sup> explained that application of mepiquat chloride to groundnut crop resulted in high chlorophyll content due to delayed chlorophyll degradation. <sup>(18)</sup> in soybean also reported the positive influence of brassinosteroid application on chlorophyll content, similar to findings of the present investigation. Similarly, increased chlorophyll content with the application of chlormequat chloride was reported earlier by <sup>(19)</sup>. The fluorescence emission values (table 4), namely, Fm, Fo, Fv and

Fv/Vm and photosynthetic rate at flowering did not record any significant difference for the different growth regulator treatments studied in the present investigation. In the present study, a significant increase in the seed protein content (table 4) was noticed with the application of NAA (20 ppm), brassinosteroid (25 ppm), mepiquat chloride 5%AS (5%) and chlormequat chloride at different concentrations, compared to control and water spray indicating that, the applied growth regulators had marked effect on Biosynthetic pathways related to protein synthesis. Similar enhancement in seed protein content with the application of NAA, brassinosteroid , mepiquat chloride and chlormequat chloride were also reported earlier. The data pertaining to Nitrogen harvest index is presented in (Table 4). It was noticed to range from 16.26 (Control) to 17.78 (chlormequat chloride 50% SL applied at 187.5 a.i/ha). A perusal of these results however, revealed the existence of non-significant differences between the treatments

**Table 1: Effect of different growth regulators on plant height (cm), no. of branches/plant and no. of trifoliates/plant in rabi soybean**

Treatments	Plant height (cm)						No. of branches						No. of trifoliates					
	Days after emergence					At harvest	Days after emergence					At harvest	Days after emergence					At harvest
	15	30	45	60	75		15	30	45	60	75		15	30	45	60	75	
T1 Chlormequat chloride 50 % SL (137.5g a.i/ha)	10.14	14.46	20.15	25.95	26.07	26.16	2.99	3.65	4.05	4.41	4.94	4.94	3.9	11.16	19.59	22.19	20.42	18.6
T2 Chlormequat chloride 50 % SL (162.5g a.i/ha)	9.64	14.37	20.08	24.06	24.52	24.65	2.96	4.57	4.91	5.02	5.39	5.39	3.99	10.54	19.44	21.61	20.57	13.08
T3 Chlormequat chloride 50 % SL (187.5g a.i/ha)	8.76	11.87	17.21	19.83	20.43	20.46	2.99	4.09	4.86	4.97	5.28	5.28	4.11	11.68	19.34	22.08	20.84	14.77
T4 Chlormequat chloride 50 % SL (375g a.i/ha)	8.39	9.27	14.92	19.15	20.04	20.08	2.96	3.38	3.84	4.17	4.18	4.18	3.82	9.73	19.15	19.71	18.37	16.07
T5 Alpha naphthyl acetic acid (NAA) 20 ppm	11.41	23.46	28.54	31.79	32.25	32.28	2.99	4.03	5.07	5.19	5.51	5.51	5.02	14.12	23.47	30.62	27.27	22.95
T6 Mepiquat chloride 5 % AS (5 %)	8.48	12.01	16.14	20.72	22.07	22.09	2.99	4.19	4.57	4.75	5.06	5.06	4.14	12.02	19.64	22.33	22.34	16.66
T7 Brassinosteroid (25 ppm)	10.87	14.69	27.69	30.88	31.03	31.12	2.86	3.72	4.02	4.19	4.24	4.24	4.7	13.3	21.16	23.43	22.69	20.19
T8 Water	10.39	13.73	21.32	28.07	28.79	28.82	2.86	3.62	3.77	4.08	4.16	4.16	3.33	9.28	18.34	19.54	19.23	12.02
T9 Control	10.22	14.72	20.44	26.53	26.99	27.06	2.83	3.28	3.42	3.76	3.9	3.9	3.2	8.13	16.75	18.9	17.27	10.92
Mean	9.81	14.29	20.72	25.22	25.8	25.86	2.94	3.84	4.28	4.5	4.74	4.74	4.02	11.11	19.65	22.27	21	16.14
Sed	0.21	1.16	0.5	0.86	0.74	0.77	0.04	0.09	0.11	0.15	0.12	0.12	0.03	0.37	0.41	0.93	1.38	0.38
CD (0.05)	NS	NS	1.07	1.84	1.58	1.65	NS	NS	0.22	0.31	0.24	0.24	NS	0.78	0.87	1.96	2.93	NS

**Table 2: Effect of different growth regulators on leaf dry weight ( $g\ m^{-2}$ ), stem dry weight ( $g\ m^{-2}$ ) and reproductive parts ( $g\ m^{-2}$ ) in rabi soybean**

		Leaf dry weight						Stem dry weight					Reproductive parts			
		Days after emergence					At harvest	Days after emergence					At harvest	Days after emergence		At harvest
		15	30	45	60	75		15	30	45	60	75		60	75	
T <sub>1</sub>	Chlormequat chloride 50 % SL (137.5 a.i/ha)	4.03	20.63	116.21	144.23	112.06	67.26	2.38	16.30	105.23	141.53	178.11	130.45	259.28	320.20	422.02
T <sub>2</sub>	Chlormequat chloride 50 % SL (162.5 a.i/ha)	4.10	23.06	111.40	140.08	101.54	97.07	2.99	17.50	103.07	138.66	172.83	127.80	289.42	363.16	427.77
T <sub>3</sub>	Chlormequat chloride 50 % SL (187.5 a.i/ha)	4.64	24.60	98.40	132.54	80.96	37.03	3.76	20.13	93.22	135.29	155.28	122.99	218.21	310.23	415.54
T <sub>4</sub>	Chlormequat chloride 50 % SL 375 (a.i/ha)	4.21	23.53	90.60	117.28	51.69	29.34	3.31	20.01	70.16	120.54	132.30	97.33	201.11	305.18	366.44
T <sub>5</sub>	Alpha naphthyl acetic acid (NAA) 20 ppm	4.07	23.24	125.50	165.47	143.10	127.38	2.71	17.17	109.41	153.48	185.10	169.98	300.11	427.74	488.30
T <sub>6</sub>	Mepiquat chloride 5 % AS (5 %)	4.13	23.34	115.41	143.37	121.79	107.21	3.05	16.71	94.26	136.52	167.70	124.93	288.64	340.15	425.16
T <sub>7</sub>	Brassinosteroid (25 ppm)	3.73	20.29	124.30	163.60	142.36	107.27	2.70	16.45	108.06	149.27	182.97	157.65	290.94	345.19	435.20
T <sub>8</sub>	Water	3.58	21.54	84.63	106.67	62.42	58.12	2.30	16.02	78.71	134.54	139.35	108.34	158.11	237.31	276.14
T <sub>9</sub>	Control	3.48	19.24	77.30	101.94	57.47	47.81	2.20	14.51	73.97	126.17	131.30	101.59	155.27	233.25	274.55
	Mean	4.00	22.16	104.86	135.02	97.04	75.39	2.82	17.20	92.90	137.33	160.55	126.78	240.12	320.27	392.35
	Sed	1.72	0.96	1.02	1.62	2.15	1.46	0.48	0.69	1.51	2.41	2.12	1.09	2.15	3.60	4.33
	C.D (0.05)	NS	NS	2.18	3.46	4.57	3.12	NS	NS	3.22	5.13	4.52	3.03	4.59	7.67	9.23

**Table 3: Effect of different growth regulators on leaf area index, crop growth rate (CGR) ( $g\ m^{-2}\ d^{-1}$ ), relative growth rate (RGR) ( $g\ g^{-1}\ d^{-1}$ ) in rabi soybean**

Treatments	LAI						CGR					RGR					
	Days after emergence					At harvest	Days after emergence					Days after emergence					
	15	30	45	60	75		15-30	30-45	45-60	60-75	75-Harvest	15-30	30-45	45-60	60-75	75-Harvest	
T <sub>1</sub>	Chlormequat chloride 50 % SL (137.5g a.i/ha)	0.14	0.75	2.4	4.52	3.43	2.34	2.03	12.3	21.57	4.36	0.62	0.1167	0.1194	0.06	0.0075	0.001
T <sub>2</sub>	Chlormequat chloride 50 % SL (162.5g a.i/ha)	0.13	0.73	2.23	4.32	3.07	2.23	2.23	11.59	23.58	4.62	1.01	0.1163	0.1111	0.0649	0.0077	0.0016
T <sub>3</sub>	Chlormequat chloride 50 % SL (187.5g a.i/ha)	0.16	0.72	2.13	4.26	3.05	2.15	2.42	9.79	19.63	4.03	1.94	0.1115	0.097	0.0621	0.0078	0.0035
T <sub>4</sub>	Chlormequat chloride 50 % SL (375g a.i/ha)	0.14	0.71	2.06	4.18	2.91	2.04	2.4	7.81	18.54	3.35	0.26	0.1171	0.0871	0.067	0.0072	0.0005
T <sub>5</sub>	Alpha naphthyl acetic acid (NAA) 20 ppm	0.14	0.81	2.96	4.77	3.81	2.87	2.24	12.97	25.61	9.13	1.98	0.119	0.1173	0.0646	0.0133	0.0026
T <sub>6</sub>	Mepiquat chloride 5 % AS (5 %)	0.14	0.74	2.36	4.43	3.22	2.28	2.19	11.31	23.92	4.07	1.84	0.1146	0.1104	0.0665	0.0068	0.0029
T <sub>7</sub>	Brassinosteroid (25 ppm)	0.15	0.76	2.63	4.71	3.73	2.79	2.02	13.04	24.76	4.45	1.97	0.1162	0.123	0.0637	0.007	0.0029
T <sub>8</sub>	Water	0.14	0.71	2.06	4.12	2.84	2.01	2.11	8.39	15.73	2.65	0.23	0.1236	0.098	0.0596	0.0063	0.0005
T <sub>9</sub>	Control	0.13	0.59	1.42	3.32	2.48	1.89	1.87	7.83	15.47	2.58	0.13	0.1188	0.1	0.062	0.0064	0.0003
	Mean	0.14	0.72	2.25	4.29	3.17	2.29	2.17	10.56	20.98	4.36	1.11	0.1171	0.107	0.0634	0.0078	0.0017
	Sed	0.08	0.03	0.17	0.1	0.16	0.29	0.49	0.32	0.59	0.59	0.02	0.0016	0.0064	0.0098	0.0007	0.0005
	C.D (0.05)	NS	0.06	0.37	0.21	0.35	NS	NS	0.68	1.26	1.27	0.04	0.0036	0.0136	NS	0.0015	0.001

**Table 4: Effect of different growth regulators on chlorophyll (SPAD-502), fluorescence, photosynthetic rate values, seed protein (%) and nitrogen harvest index in rabi soybean**

Treatments	SPAD-502 value	F <sub>o</sub>	F <sub>m</sub>	F <sub>v</sub>	F <sub>v</sub> /F <sub>m</sub>	Photosynthetic rate (µmol CO <sub>2</sub> m <sup>-2</sup> )	Seed protein (%)	Nitrogen Harvest Index
T1 Chloromequat chloride 50 % SL (137.5g a.i/ha)	32.74	59.67	173	115.91	0.67	17.5	41.8	17.06
T2 Chloromequat chloride 50 % SL (162.5g a.i/ha)	32.6	61	179.3	116.54	0.65	16.44	42.17	17.31
T3 Chloromequat chloride 50 % SL (187.5g a.i/ha)	32.53	62	184.3	123.48	0.67	16.98	42.63	17.78
T4 Chloromequat chloride 50 % SL (375g a.i/ha)	31.3	62.67	182.3	122.14	0.67	16.36	41.2	16.49
T5 Alpha naphthyl acetic acid (NAA) 20 ppm	33.74	65.33	188	125.96	0.67	15.52	42.47	17.66
T6 Mepiuvat chloride 5% AS (5%)	32.6	62.67	184.3	121.63	0.66	16	41.7	17.05
T7 Brassinosteroid (25 ppm)	33.03	65.67	188	124.08	0.66	16.36	42	17.29
T8 Water	30.26	63.67	179.67	120.37	0.67	15.82	40.43	16.44
T9 Control	30.16	61.67	177.67	117.26	0.66	15.88	40.2	16.26
Mean	32.11	62.71	181.84	120.82	0.66	16.32	41.62	16.73
Sed	0.3	1.78	6.91	4.52	0.29	1.64	0.14	1.26
C.D (0.05)	0.63	NS	NS	NS	NS	NS	0.31	NS

**Conclusion:**

The present study on Effect of Plant Growth regulators on Morphological, Physiological and Biochemical parameters of Soybean (*Glycine max* L. Merrill) revealed the superiority of NAA (20 ppm) and brassinosteroid (25ppm) for majority of the morphological, physiological, biochemical, parameters for rabi soybean, compared to control, water spray and the growth retardants studied.

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