RESEARCH PAPER:

Effect of indole – 3- acetic acid on cluster bean [*Cyamopsis tetragonoloba* (L.) Taub.]

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SUMMARY

Experiment was carried out to study the effect of IAA on seedling growth, vegetative and yield parameters of cluster bean [*Cyamopsis tetragonoloba* (L.) Taub.]. On the 7th day, the characters like root length, shoot length and number of lateral roots increased rapidly in all the concentrations used. The root length increased very significantly at 50 ppm. A significant increase was seen in shoot length at 10 ppm and 20 ppm and very significant increase at 30 ppm, 40 ppm and 50 ppm. The number of lateral roots increased significantly at 30 ppm, 40 ppm and 50 ppm. On the 40th day, IAA treatment stimulated the length of epicotyl, length of hypocotyl, root length, number of leaves, internodal length, petiole length and number of lateral roots. Pod circumference increased significantly at 20 ppm and very significantly at 30 ppm, 40 ppm and 50 ppm. A significant increase of pod length was noted at 40 ppm and a very significant increase at 50 ppm. The pod weight increased very significantly at 40 ppm and 50 ppm. Number of seed/pod increased significantly at 20 ppm and very significantly at 30 ppm, 40 ppm and 50 ppm. The increase in weight of seeds/pod was directly proportional to the concentration used.

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Key Words :
Cluster bean, *Cyamopsis tetragonoloba,* Indole – 3 – acetic acid, Vegetative parameters, Yield parameters

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Cluster bean [*Cyamopsis tetragonolobus* (L.) Taub.] is one of the important pulse crops consumed by human being and is now being considered as an important legume in India. It is an annual, erect, self -pollinated pulse crop. It is also cultivated for hay, silage and green manure. Raw mature seeds contain 23 per cent protein, 1.7 per cent fat, 6 per cent carbohydrate and traces of vitamins and minerals.

The productivity of this crop in India is surprisingly poor, compared to other countries. Hence, there is an urgent need to increase the levels of cluster bean to ensure adequate supply of proteins in basic diet and also better return to the farmers. Therefore, in the present study, an attempt had been made to understand the effect of indole-3-acetic acid in cluster bean.

Protein nutrition is one of the most crucial problems in India. Majority of Indians are vegetarian and pulses form an important constituent in the diet. Due to their nutritional value comparative to meat, pulses make an important component of vegetarian diet. Pulses also carry bacterial colonies in root nodules, enacting to utilize and fix atmospheric nitrogen. Since all plant parts are rich in protein, they also form excellent organic manure.

Growth and development of the plant body are controlled by two sets of internal factors namely, nutritional and hormonal. The growth substance includes both synthetic chemicals which do not occur in plants and those that are synthesized by the plant itself. Therefore, in the present study, an attempt was made to understand the effect of IAA.

EXPERIMENTAL METHODOLOGY

Seeds of cluster bean *[Cyamopsis tetragonolobus* (L.) Taub.], purchased from the seed centre, Agriculture University, Coimbatore were used for the investigations. Seeds of cluster bean were sown in experimental plots of Avinashilingam Deemed University. Three sets of experiments were conducted.

Experiment I:

For evaluating the rate of seedling growth, the seeds were germinated in germination

towels. For all the experiments, the seeds were surface sterilized in 0.1 per cent mercuric chloride for 1 to 2 minutes and rinsed thrice in distilled water.

Experiment II:

For studying the various morphometric characters during the mid-vegetative period of growth, the seeds were sown in pots and the characters were statistically analyzed.

Experiment III:

The seeds were sown in statistically designed randomized compact blocks in the research field in Avinashilingam Deemed University and the investigation on pods and seeds were carried out.

Effect of indole-3-acetic acid on seedling responses in *Cyamopsis tetragonoloba* (L.) Taub. was observed. To study the effect of different concentrations (10 ppm, 20 ppm, 30 ppm, 40 ppm and 50 ppm) of IAA on seedling responses, seed were soaked in 50ml of respective solutions for 24 hours. A control was also maintained. The seeds were allowed to germinate in the germination towels for 7days. Periodically they were moistened with distilled water. On the 7th day, root length, shoot length and number of lateral roots were recorded.

On the 40th day, the plants uprooted carefully from the pots were studied for the following characters - epicotyl length, hypocotyl length, root length, number of leaves/plant, internodal length, petiole length and number of lateral roots/plant.

The pods were collected from each concentration after maturation. 20 pods at random were collected and the following economically important traits were studied – Pod circumference, pod length, pod weight, number of seeds/pod and weight of seeds/pod.

EXPERIMENTAL FINDINGS AND DISCUSSION

The effect of indole-3-acetic acid on *Cyamopsis tetragonoloba* (L.) Taub. was assessed by studying the following morphological traits. Three sets of experiments were conducted. On the 7th day, the parameters like root length, shoot length and the number of lateral roots were recorded. On the 40th day, the parameters like length of epicotyl, length of hypocotyl, root length, number of leaves/plant, internodal length, petiole length and the number of the lateral roots/plant were analyzed. At the end of season, 20 matured pods were collected from each concentration and traits like pod circumference, pod length, pod weight, number of seeds/pod and weight of seeds/pod were noted. The results were presented in Tables 1-3.

Table 1 : Effect of indole-3-acetic acid on early seedling growth (7 days)

Characters	Control	10 ppm	20 ppm	30 ppm	40 ppm	50 ppm
Root length (cm)	9.33±0.38	9.61±0.49	9.97±0.30	9.94±0.4	10.01±0.26	11.16±0.30**
Shoot length (cm)	8.42±0.32	9.41±0.24*	9.02±0.32*	0.66±0.26**	9.69±0.35**	10.39±0.28**
Number of lateral roots	4.05±0.73	5.55±0.65	5.8±0.73	5.85±0.70*	5.65±0.59*	6.9±0.38*

* and ** indicate significance of values at p= 0.05 and 0.01, respectively

Table 2 : Effect of indole-3-acetic acid on vegetative parts (40 days)

Characters	Control	10 ppm	20 ppm	30 ppm	40 ppm	50 ppm
Length of epicotyl (cm).	4.43±0.13	4.84±0.18*	5.21±0.16**	5.35±0.09**	5.4±0.19**	6.16±0.17**
Length of hypocotyl (cm).	3.48±0.17	3.85±0.12	4.25±0.26*	4.31±0.08**	4.36±0.13**	4.55±0.11**
Root length (cm)	4.88±0.22	5.13±0.24	5.22±0.21	5.62±0.16**	5.34±0.17	5.49±0.14
Number of leaves	2.95±0.05	3.05±0.05	3.15±0.13	3.55±0.11**	3.6±0.11**	3.8±0.09**
Internodal length (cm)	1.05±0.08	1.03±0.06	1.23±0.07	1.32±0.04**	1.56±0.1**	1.6±0.07**
Petiole length (cm)	0.38±0.03	0.41±0.02	0.63±0.04**	0.84±0.03**	0.995±0.05**	1.21±0.04**
Number of lateral roots	3.95±0.29	4.3±0.23	5.15±0.4*	5.35±0.30**	5.4±0.22**	5.5±0.19**

* and ** indicate significance of values at p= 0.05 and 0.01, respectively

Table 3 : Effect of indole-3-acetic acid on pod and seed characters

Characters	Control	10 ppm	20 ppm	30 ppm	40 ppm	50 ppm
Pod circumference (cm)	1.98±0.06	2.12±76	2.18±0.05*	2.28±0.07**	2.3±0.05**	2.4±0.05**
Pod length (cm)	9.77±0.21	9.81±0.15	9.74±0.26	10.25±0.13	10.35±0.14*	10.98±0.18**
Pod weight (g)	1.94±0.09	2.00±0.11	2.00±0.09	2.07±0.08	2.3±0.09**	2.61±0.08**
Number of seeds/pod	4.35±0.18	4.4±0.15	4.75±0.18*	5.1±0.16**	5.95±0.18**	5.9±0.16**
Weight of seeds/pod (mg)	92±6.35	92.5±5.33	91±5.28	89.75±7.46	104.5±4.56	115±6.67*

* and * * indicate significance of values at p= 0.05 and 0.01, respectively

Experiment I:

The results for experiment I are presented in Table I. The experiment was terminated on 7th day and the following parameters were recorded:

Root length:

The root length increased in all the concentrations when compared with the control (9.33 ± 0.38). A very significant increase was noted at 50 ppm (11.16 ± 0.30). The result is in agreement with the observation made by Muthukumar *el al.* (2005) in baby corn (*Zea mays* L.).

Shoot length:

An increase was noted in the shoot length due to IAA treatment. The increase was significant at 10 ppm (9.41 ± 0.24) and 20 ppm (9.02 ± 0.32). A very significant increase was noted at 30 ppm (9.66 ± 0.26), 40 ppm (9.69 ± 0.35) and 50 ppm (10.39 ± 0.28) than the control (8.42 ± 0.32). Like in the present study, an increase in shoot length was noted by Khalid Hussain *et al.* (2010) in scruf pea (*Psoralea corylifolia* L.)

Number of lateral root:

Regarding the number of lateral roots, an increase was noted on all the concentrations used and it was significant at 30 ppm (5.85 ± 0.7), 40 ppm (5.65 ± 0.59) and 50 ppm (6.9 ± 0.38) when compared with the control (4.05 ± 0.73).

Experiment II:

The results for experiment II are presented in Table 2. The experiment was terminated on 40th day and the following morphometric parameters were recorded:

Length of epicotyl:

Length of epicotyl increased in all the concentrations used. A very significant increase was noted at 20 ppm (5.21 ± 0.16), 30 ppm (5.35 ± 0.09), 40 ppm (5.4 ± 0.19) and 50 ppm (6.16 ± 0.17). A significant increase was noted at 10 ppm (4.84 ± 0.18) than the control (4.33 ± 0.13).

Length of hypocotyl:

Length of hypocotyl also increased in all the concentrations applied. It was significant at 20 ppm (4.25 ± 0.26) than the control (3.48 ± 0.17). It increased very significantly at 30 ppm (4.31 ± 0.08), 40 ppm (4.36 ± 0.13) and 50 ppm (4.55 ± 0.11).

Root length:

A significant increase in the root length was noted at 30 ppm (5.62 ± 0.16) than the control (4.88 ± 0.22).

Number of leaves:

The number of leaves increased in all the concentrations and it was very significant at 30 ppm (3.55 ± 0.11), 40 ppm (3.6 ± 0.11) and 50 ppm (3.8 ± 0.09) than the control (2.95 ± 0.05).

Internodal length:

Regarding the internodal length, a very significant increase was noted at 30 ppm (1.32 ± 0.04), 40 ppm (1.56 ± 0.1) and 50 ppm (1.05 ± 0.08). As in present study, increased in internodal length was noted by Meenakshi and Lingakumar (2011) in *Mentha arvevsis* L.

Petiole length:

A rapid increase was noted in petiole length of IAA treated plants. The increase was very significant at 20 ppm, 30 ppm, 40 ppm and 50 ppm (0.63 ± 0.04, 0.84 ± 0.03, 0.995 ± 0.05, 1.21 ± 0.04) than the control. The present study which is in agreement with earlier work done by Hassan *et al.* (2009) in wheat plant.

Number of lateral roots:

Lateral roots increased in number and it was significant at 20 ppm (5.15 ± 0.4) and very significant at 30 ppm (5.35 ± 0.3), 40 ppm (5.4 ± 0.22) and 50 ppm (5.5 ± 0.19) than the control (3.95 ± 0.29). This increase in number of leaves was noted by Zahir *et al.* (2007) in wheat (*Triticum aestivum* L.)

Experiment III:

The result for experiment III are presented in Table 3. The plants were allowed to grow in the field and 20 matured pods were collected from each concentration. The parameters like pod circumference (cm), pod length (cm), pod length (g), number of seeds/pod and weight of seeds/pod (mg) were recorded.

Pod circumference:

Pod circumference increased due to IAA treatment and the increased circumference was significant at 20 ppm (2.18 ± 0.05) and very significant at 30 ppm (2.28 ± 0.07), 40 ppm (2.3 ± 0.05) and 50 ppm (2.4 ± 0.05) than the control (1.98 ± 0.6).

Pod length:

Regarding the pod length an increase in the pod length was noted in all the concentrations and it was significant at 40 ppm (10.35 ± 0.14) and very significant at 50 ppm (10.98 ± 0.18) than the control (9.77 ± 0.21).

Pod weight:

There was a very significant increase at 40 ppm (2.3 ± 0.09) and 50 ppm (2.61 ± 0.08) than the control (1.94 ± 0.09).

Number of seeds/pod:

An increase in the number of seeds/pod was noted at all the concentrations employed. At 20 ppm the increase was significant (4.75 ± 0.18) than the control (4.35 ± 0.18) and very significant at 30 ppm (5.1 ± 0.16), 40 ppm (5.95 ± 0.18) and 50 ppm (5.9 ± 0.16).

Weight of seeds/pod:

Weight of seeds/pod increased very significantly at 50 ppm (115 ± 6.67) than the control 92 ± 6.35).

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