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## Influence of plant growth regulators on growth and green pop yield of cowpea [*Vigna unguiculata* (L.) Walp] cv. ANAND VEG. COWPEA-1

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**Abstract :** An experiment was conducted at Horticultural Research Farm, Department of Horticulture, B. A. College of Agriculture, Anand Agricultural University, Anand, during the *Kharif* seasons of the year 2008-09 and 2009-10. The seeds of cowpea cv. 'ANAND VEG. COWPEA-1' were treated with plant growth regulators before sowing and foliar application of growth regulators was done at flower initiation stage. The maximum plant height was recorded with seed treatment of GA<sub>3</sub> 25 mg/l, while number of trifoliolate leaves per plant and number of branches per plant were found maximum with NAA 25 mg/l seed treatment. On the other hand, days to 50% flowering were minimum with GA<sub>3</sub> 25 mg/l seed treatment. The yield parameters *viz.*, early picking, maximum pod length, average weight of pods, total number of pods per plant, number of seeds per green pod, yield per plant and pod yield per hectare was observed maximum with GA<sub>3</sub> 25 mg/l seed treatment. Among different foliar application of PGR's, the treatment GA<sub>3</sub> 50 mg/l significantly increased the plant height, while NAA 25 mg/l produced significantly higher number of trifoliolate leaves per plant and number of branches per plant. The days required for 50 % flowering recorded was significantly lowest with MH 50 mg/l. Significantly early picking was registered with the MH 50 mg/l. while, the yield parameters like length of pod, average weight of 10 pods were observed significantly higher with GA<sub>3</sub> 50 mg/l. However, number of pods and number of clusters per plant were recorded significantly higher with NAA 25 mg/l. Whereas, the number of seeds per green pod, total yield per plant and green pod yield per hectare were recorded significantly higher with the foliar application of GA<sub>3</sub> 50 mg/l.

**Key words :** Growth regulators, Cell division and elongation, Photosynthates, Clusters, Pod

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Cowpea [*Vigna unguiculata* (L.) Walp] belongs to family leguminosae is grown throughout the India for its long green pods as vegetable. Seeds used as pulses and foliage as green manure as well as green fodder. Cowpea is the most versatile *Kharif* legume because of its drought tolering character, soil restoring properties and multipurpose use. Plant growth regulators are known to regulate and modify various physiological processes within the plant. Thereby they influence their effect on morphological characters and yield. The production and distribution of photosynthates is related to various physiological and biological processes which are influenced by the plant growth regulators.

### RESEARCH METHODS

The experiment was conducted at Horticultural Research Farm, Department of Horticulture, B. A. College of Agriculture, Anand Agricultural University, Anand during the *Kharif* seasons of the year 2008-09 and 2009-10. The experiment was conducted in Randomized Block Design (Factorial) comprising twenty eight treatment combinations; four seed treatments [S<sub>1</sub>- without treated (control)], S<sub>2</sub>- water soaked for 6 hrs, S<sub>3</sub>- GA<sub>3</sub> 25 mg/l and S<sub>4</sub>- NAA 25 mg/l (each for 6hrs), seven foliar application treatments F<sub>1</sub>- water spray (control), F<sub>2</sub>- GA<sub>3</sub> 25 mg/l, F<sub>3</sub>- GA<sub>3</sub> 50 mg/l, F<sub>4</sub>- NAA 25 mg/l, F<sub>5</sub>- NAA 50 mg/l, F<sub>6</sub>- MH 25 mg/l and F<sub>7</sub>- MH 50 mg/l at flower initiation in three replications. The seed treatments were given at the time of sowing, while the foliar spraying

treatments were given at the time of flower initiation. The seeds were sown during 2<sup>nd</sup> fortnight of August at spacing of 60 x 45 cm. The recommended dose of 20 t/ha FYM and fertilizers 20:40:40 kg/ha N, P<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O, respectively, were applied before sowing.

## RESEARCH FINDINGS AND DISCUSSION

The results obtained from the present investigation are summarized below :

### Growth parameters:

The effect of seed treatment on plant height and number of trifoliolate leaves per plant was found significant. The seed treatment with GA<sub>3</sub> 25mg/l(S<sub>3</sub>) registered significantly maximum plant height (64.60 cm) at 60 DAS (Table 1). This might be due to cell elongation and cell wall extensibility. The results are in accordance with the findings of Ogbonna and Abraham (1989), Zaghlood and Ibrahim (2000) in cowpea. While, NAA 25mg/l(S<sub>4</sub>) recorded significantly higher number of trifoliolate leaves per plant 101.80 at 105 DAS in pooled data. The increase in number of trifoliolate leaves per plant under NAA and GA<sub>3</sub> treatments might be due to enhanced cell elongation and cell division. The above results were in consonance with Deotale *et al.* (1998) in soybean and Hoque and Haque (2002) in mung bean.

The number of branches per plant was also found

significantly higher with NAA 25mg/l(S<sub>4</sub>) *i.e.* 7.95 as compared to S<sub>1</sub> and S<sub>2</sub> treatments at last picking in pooled result (Table 1). The increase in number of branches with NAA treatment might be due to the fact that exogenous application of auxin would have stimulate metabolic activity which influenced axillary bud growth resulting in increased number of branches. The days to 50% flowering (48.57 days) found significantly minimum in GA<sub>3</sub> 25mg/l (S<sub>3</sub>) while, the maximum days to 50% flowering (51.83 days) was observed with NAA 25mg/l (S<sub>4</sub>). The maximum days taken for 50% flowering under the treatment NAA 25mg/l (S<sub>4</sub>) might be due to more time taken for vegetative phase, whereas GA<sub>3</sub> 25mg/l (S<sub>3</sub>) enhanced the flowering by modifying the vegetative growth into reproductive growth. The results are in conformity with the findings of Mukhtar and Singh (2006) in cowpea.

Different foliar applications of PGR significantly influenced plant height at 60 DAS on pooled basis and significantly maximum plant height was recorded under GA<sub>3</sub> 50mg/l (F<sub>3</sub>) (64.79 cm) at 60 DAS (Table 1). The increase in plant height with GA<sub>3</sub> application might be due to the encouraged cell division and cell enlargement processes. These findings are in agreement with those of Yadava and Sreenath (1975), Mohandoss and Rajesh (2003) in cowpea.

On the other hand, foliar application of NAA 25mg/l

**Table 1: Influence seed treatment and foliar spray of PGR's on growth characters of cowpea**

Treatments	Plant height (cm) at 60 DAS	No. of trifoliolate leaves / plant at 105 DAS	No. of branches/plant at last picking	Days to 50 % flowering
<b>Seed treatment</b>				
S <sub>1</sub> : (Un treated)	60.27	91.17	7.27	50.62
S <sub>2</sub> : (Soaked in water for 6 hrs)	60.64	93.80	7.45	49.98
S <sub>3</sub> : (Soaked in GA <sub>3</sub> 25 mg/l for 6 hrs)	64.60	97.98	7.81	48.57
S <sub>4</sub> : (Soaked in NAA 25 mg/l for 6 hrs)	61.76	101.80	7.95	51.83
S.E.±	0.84	1.35	0.082	0.46
C.D. (P=0.05)	2.35	3.78	0.230	1.28
<b>Foliar application</b>				
F <sub>1</sub> : Water spray(Control)	60.43	93.32	7.42	52.17
F <sub>2</sub> : GA <sub>3</sub> 25 mg/l	63.15	98.56	7.63	51.04
F <sub>3</sub> : GA <sub>3</sub> 50 mg/l	64.79	98.63	7.81	49.54
F <sub>4</sub> : NAA 25 mg/l	62.83	101.07	7.85	51.71
F <sub>5</sub> : NAA 50 mg/l	61.66	98.13	7.81	50.25
F <sub>6</sub> : MH 25 mg/l	60.16	93.32	7.44	49.50
F <sub>7</sub> : MH 50 mg/l	59.704	90.27	7.38	47.54
S.E.±	1.11	1.78	0.108	0.61
C.D. (P=0.05)	3.11	5.00	0.304	1.70
<b>Interaction</b>				
S x F	NS	NS	NS	NS
C. V. (%)	8.78	9.08	6.97	5.91

NS=Non-significant

l (F<sub>4</sub>) recorded significantly higher number of trifoliolate leaves per plant (101.07) at 105 DAS on pooled basis, while the number of branches per plant were found significantly higher (7.85) in NAA 25mg/l (F<sub>4</sub>) as compared to control (F<sub>1</sub>) (7.42) in pooled results at last picking (Table 1). Plant growth regulators act on all developmental plant processes, ultimately enhance the photosynthesis, respiration and catalyzed activities in plant, hence enhanced the number of leaves and branches per plant.

The foliar application of MH 50 mg/l (F<sub>7</sub>) recorded significantly minimum days to 50% flowering (47.54 days) as compared to rest of the treatments. The earliness in 50% flowering by MH might be due to stimulation of respiration rate in plant tissue after MH treatment.

**Yield and yield parameters:**

The days to 1<sup>st</sup> picking (55.12 days) were found significantly minimum with GA<sub>3</sub> 25 mg/l (S<sub>3</sub>) as compared to rest of the treatments, while the maximum days to 1<sup>st</sup> picking (58.71) were noted with NAA 25mg/l (S<sub>4</sub>) as compared to S (Table 2). This might be as a result of earliness in the reproductive stage and the days required for flowering.

Significantly maximum pod length (15.43 cm), average weight of ten pods (34.42 g), number of pods per plant (148.54) and number of seeds per green pod

(12.78) was observed with GA<sub>3</sub> 25mg/l (S<sub>3</sub>) as compared to control (S<sub>1</sub> and S<sub>2</sub>) at 5<sup>th</sup> picking (Table 2).

Different seed treatments could not showed any significant effect on the yield parameters like number of clusters per plant and number of pods per cluster.

Different levels of seed treatments were also differed significantly over control on green pod yield per plant, green pod yield per hectare. The GA<sub>3</sub> 25mg/l (S<sub>3</sub>) treated plants produced higher green pod yield per plant (403.00 g) and green pod yield per hectare (152.44 q) on pooled basis.

In general, seed treatment with GA<sub>3</sub> at 25 mg/l found superior over all the seed treatments in respect to all the growth and yield parameters. Pre-sowing treatment of seeds with PGR's could lead to increase nutrient availability, higher respiratory activities and enhancement of seedling growth, dry matter accumulation, early flowering, fruiting and yield of cowpea (Ogbonna and Abraham, 1989).

The foliar application of MH 50 mg/l (F<sub>7</sub>) recorded significantly minimum days to 1<sup>st</sup> picking (54.67) as compared to control F<sub>1</sub> (59.08 days). However, F<sub>7</sub> treatment (54.67 days) was at par with GA<sub>3</sub> 50 mg/l (F<sub>3</sub>) and MH 25mg/l (F<sub>6</sub>) i.e. 55.75 and 56.29 days, respectively. The early picking may be as a result of earliness in flowering as reported by Mukhtar and Singh (2006) in cowpea.

**Table 2 : Influence of seed treatment and foliar spray of PGR's on yield attributing characters of cowpea**

Treatments	Days to 1 <sup>st</sup> picking	Length of pod (cm)	Average weight of ten pods (g)	Total number of pods per plant
<b>Seed treatment</b>				
S <sub>1</sub> : (Un treated)	57.05	14.22	32.70	136.30
S <sub>2</sub> : (Soaked in water for 6 hrs)	56.60	14.69	33.23	139.64
S <sub>3</sub> : (Soaked in GA <sub>3</sub> 25 mg/l for 6 hrs)	55.12	15.43	34.42	148.54
S <sub>4</sub> : (Soaked in NAA 25 mg/l for 6 hrs)	58.71	15.33	33.79	144.29
S.E.±	0.44	0.17	0.43	1.72
C.D. (P=0.05)	1.23	0.48	1.22	4.81
<b>Foliar application</b>				
F <sub>1</sub> : Water spray(Control)	59.08	14.03	31.53	129.13
F <sub>2</sub> : GA <sub>3</sub> 25 mg/l	57.33	15.17	32.91	143.14
F <sub>3</sub> : GA <sub>3</sub> 50 mg/l	55.75	15.79	36.05	147.83
F <sub>4</sub> : NAA 25 mg/l	57.38	15.06	34.59	153.95
F <sub>5</sub> : NAA 50 mg/l	57.58	14.87	33.77	145.25
F <sub>6</sub> : MH 25 mg/l	56.29	14.78	33.10	138.71
F <sub>7</sub> : MH 50 mg/l	54.67	14.73	32.81	137.35
S.E.±	0.58	0.23	0.57	2.27
C.D. (P=0.05)	1.62	0.64	1.61	6.37
<b>Interaction</b>				
S x F	NS	NS	NS	NS
C. V. (%)	4.99	7.45	8.38	7.83

**Table 3: Influence of seed treatment and foliar spray of PGR's on yield and yield attributing characters of cowpea**

Treatments	Number of clusters/ plant from total pickings	Number of pods per cluster	Number of seeds per green pod	Total green pod yield per plant (g)	Green pod yield per hectare (q)
<b>Seed treatment</b>					
S <sub>1</sub> : (Un treated)	51.09	3.72	11.61	372.87	138.08
S <sub>2</sub> : (Soaked in water for 6 hrs)	51.87	3.73	12.06	379.95	140.43
S <sub>3</sub> : (Soaked in GA <sub>3</sub> 25 mg/l for 6 hrs)	53.20	3.80	12.78	403.00	152.44
S <sub>4</sub> : (Soaked in NAA 25 mg/l for 6 hrs)	52.53	3.75	12.70	398.24	149.54
S.E.±	0.80	0.05	0.17	5.68	2.74
C.D. (P=0.05)	NS	NS	0.47	15.92	7.68
<b>Foliar application</b>					
F <sub>1</sub> : Water spray(Control)	47.59	3.64	11.40	360.60	133.05
F <sub>2</sub> : GA <sub>3</sub> 25 mg/l	52.21	3.76	12.57	387.82	142.58
F <sub>3</sub> : GA <sub>3</sub> 50 mg/l	53.89	3.78	13.16	414.75	157.56
F <sub>4</sub> : NAA 25 mg/l	55.34	3.85	12.43	403.72	151.81
F <sub>5</sub> : NAA 50 mg/l	52.83	3.73	12.21	395.37	147.69
F <sub>6</sub> : MH 25 mg/l	51.43	3.77	12.14	379.16	141.86
F <sub>7</sub> : MH 50 mg/l	51.90	3.73	12.10	378.17	141.31
S.E.±	1.06	0.06	0.22	7.51	3.62
C.D. (P=0.05)	2.96	NS	0.63	21.07	10.15
<b>Interaction</b>					
S x F	NS	NS	NS	NS	NS
C. V. (%)	9.91	7.84	8.92	9.48	12.23

NS=Non-significant

The length of pod and average weight of 10 pods were significantly differed with different foliar spray of PGR's. The plants treated with GA<sub>3</sub> 50 mg/l gave significantly maximum pod length (15.79 cm) and average weight of 10 pods (36.05 g) at 5<sup>th</sup> picking (Table 3). The maximum length of pod due to GA<sub>3</sub> treatment might be due to enhanced cell elongation and cell division which ultimately increased the pod length. The results are in agreement with the findings of Shinde *et al.* (1991).

The foliar application of NAA at 25 mg/l (F<sub>4</sub>) produced significantly maximum number of pods per plant (153.95) and number of clusters per plant (55.34) from total pickings. This might be due to exogenous application of plant growth regulators (GA<sub>3</sub> and NAA) stimulating the enzymatic activities for naturally occurring hormones that increase the size of photosynthetic apparatus leaf growth and in terms of foliage weight as well as increased assimilation rate contributed for increased number of pods as well as clusters per plant. The treatment with NAA also increases retention of flowers and thereby pods per clusters which indirectly enhance the pod setting. The results are in accordance with the findings of Thaware *et al.* (2006) and Emongor (2007) in cowpea.

The number of seeds per green pod was also found significantly higher with foliar application of GA<sub>3</sub> 50 mg/l

(13.16) as compared to control (11.40) at 5<sup>th</sup> picking (Table 3). The increase in number of seeds per green pod under GA<sub>3</sub> treatment might be due to enhanced flowering and pod setting. The results are in line with the findings of Thaware *et al.* (2006) and Emongor (2007) in cowpea.

The foliar application of GA<sub>3</sub> 50 mg/l recorded significantly higher yield per plant (414.75g) and green pod yield per hectare (157.56q) on pooled basis (Table 3). The exogenous application of GA<sub>3</sub> 50mg/l and NAA 25mg/l might have stimulated the effects of enzymatic activities which enhanced the naturally occurring hormones that accelerated and modified the growth and development of plants. The same treatment increased the yield parameters *viz.*, pod length, average pod weight, number of seeds per pod, number of pods and clusters per plant which ultimately helps in increased yield of cowpea. These results are in conformity Singh and Sharma (1996), Mukhtar and Singh (2006) and Patel (2008) in cowpea.

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