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EFFECT OF GROWTH REGULATORS ON THE GROWTH AND YIELD OF COWPEA (*Vigna unguiculata* (L.) WALP.).

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ABSTRACT

A field experiment was carried out at Sher-e-Bangla Agricultural University, Dhaka, with two growth regulators - Potassium naphthenate (KNap) and Naphthalene acetic acid (NAA) on cowpea cv. Bari Falon-2 under irrigated condition. Three concentrations of KNap (1200, 1300 and 1400 ppm) and two concentrations of NAA (40 and 50 ppm) along with control were tested. Results showed that the highest plant height was obtained when NAA was applied at the concentration of 50 ppm (91.57 cm). Irrespective of treatment, dry matter (DM) increased progressively up to 105 DAS. The treatments 1300 ppm of KNap, 50 ppm of NAA and the combination of 1200 ppm of KNap with 30 ppm of NAA were at par and showed significant higher dry matter, yield attributes and yield. The highest values of dry matter/plant (60.85 g), pod length (14.25 cm), number of pods/plant (13.03), number of seeds/pod (10.96), 1000 seed weight (125 g), seed yield/plant (17.85 g), seed yield/ha (1820 kg) and harvest index (37.90 %) were obtained with KNap1300 ppm.

Key words: Cowpea, *Vigna unguiculata*, height, dry matter, yield attributes

INTRODUCTION

In Bangladesh, the area of pulse crops is gradually decreasing due to increasing the acreage of boro rice and wheat cultivation. As a result, the production of the pulses is decreasing which in tern widened the deficit of pulse grains in our local markets. To meet the production deficit, the pulse grains have been importing during the last decades at the expense of valuable foreign currency. This situation could be prevented by increasing the productivity of the individual crop in terms of grain yield per unit area, as there is a tittle scope to increasing the acreage of pulse crops.

Cowpea is one of the pulse crop which is grown after the harvest of transplant aman rice (Rahman, 1989). During this time, both wheat and boro rice are also grown which are more competitive than cowpea in respect of the yield productivity. So, it is essential to increase the productivity of cowpea. For doing so, various agronomic techniques have been tried by many workers during the last decades (BARI, 1988; Biswas *et al*, 1996). However, its productivity needs to be further increased.

Different growth regulators have been found to increase the productivity of different crops (Fattah and Wort, 1970). Among them potassium naphthenate (KNap) and naphthalene acetic acid (NAA) were tried in field crops (Kalita *et al.* 1995; Karim, 2005). However, works including the effect of these two growth regulators on the productivity of cowpea are either limiting or scanty. So, the objectives of this work was to evaluate the effects of KNap and NAA on the growth and yield of cowpea.

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MATERIALS AND METHODS

The study was carried out at Sher-e-Bangla Agricultural University Farm, Dhaka 1207 during the *rabi* season of 2001-2002. BARI Falon-2 was used as test crop under irrigated conditions. Two growth regulators - potassium naphthenate (KNap) with three concentrations viz. 1200(T_1), 1300(T_2) and 1400(T_3) ppm and naphthaline acetic acid (NAA) with two concentrations viz. 40(T_4) and 50(T_5) ppm; and six combinations of KNap1200-1400 ppm with NAA30-40 ppm, namely, KNap1200NAA30 (T_6), KNap1200NAA40 (T_7), KNap1300NAA30 (T_8), KNap1300NAA40 (T_9), KNap1400NAA30 (T_{10}) and KNap1400NAA40 (T_{11}) along with control (T_0) were used. The experiment was laid out in a randomized complete block design with three replications. The unit plot size was 5m X 4m. The land was opened by a disc plough and finally prepared by three subsequent ploughing with a country plough. At the final land preparation, nitrogen, phosphorus, potassium, boron, sulfur and zinc at the rate of 20 kg N, 50 kg P_2O_5, 40 kg K_2O, 0.60 kg B, 18.0 kg S and 2 kg Zn/ha were applied in the form of urea, triple super phosphate, muriate of potash, borax, gypsum and zinc sulfate respectively.

Seeds were sown on November 15 maintaining row to row distance and plant to plant distance 50 and 20 cm respectively. The depth of sowing was 2-3 cm. Growth regulators as per treatments were sprayed on the aerial parts of the plants at 45 days after sowing (DAS).

Data on plant height and total dry matter were taken from the ten plants which were selected randomly from each plot at 60, 75, 90 and 105 DAS which were the stages of onset of branching, onset of flowering, pod formation and maturity respectively. Data on pod length was taken at 75, 90 and 105 DAS. At harvest - number of pods/plant, number of seeds/pod and 1000 seed weight were collected. Data on yield/ha and harvest index were taken from the samples, which were harvested at maturity from the pre-demarcated area at the middle of each plot. Data were statistically analyzed and means were compared by LSD at 5 per cent level of significance.

RESULTS AND DISCUSSION

Results showed that the plant height continued to increase with the advancement of age (Fig 1). Highest plant height was exhibited by T_5 (NAA50) which was also identical with those of KNap1300 (T_2) and 1200 KNap 40 NAA (T_7). The positive effect of KNap and NAA on grain legumes was also reported by Uddin *et al.,* 1994 and Maske *et al.*, 1997. Such effect has been attributed to the acceleration of cell division and elongation of internodes due to the application of growth regulators (Brain and Hemming, 1958; Fattah and Wort, 1970).

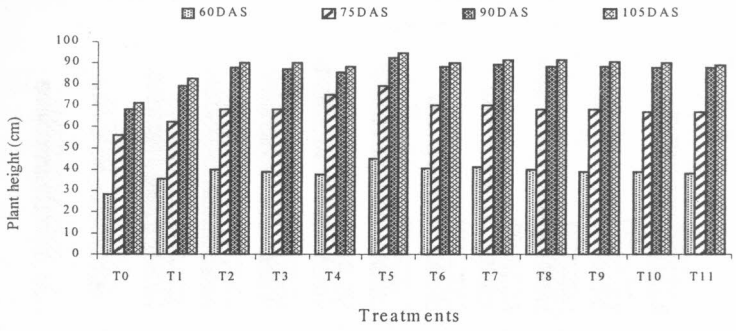

Fig. 1 Effect of growth regulators on plant height of cowpea at different growth stages.

The dry matter initiated to increase from 60 DAS and continued to 105 DAS (Fig 2). Dry matter increased with the increased concentration up to 1300 and 50 ppm of KNap and NAA respectively and there was no significant difference between these two treatments in this respect. This positive effect of KNap and NAA on the dry matter of crops is in conformation with the previous reports (Saxena, 1994; Patel and Saxena, 1994; Kalita *et al.*, 1995; Karim 2005).

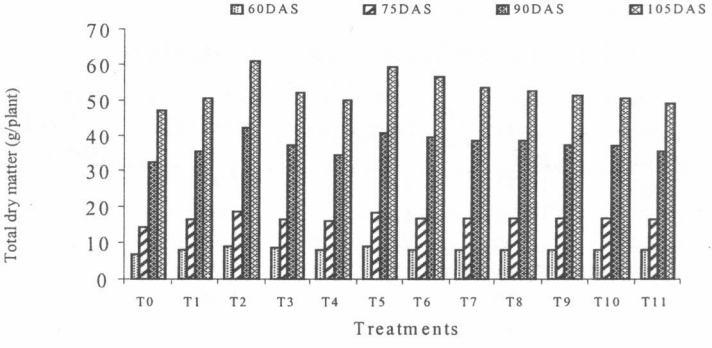

Fig. 2 Effect of growth regulators on total dry matter (g/plant) of cowpea at different growth stages.

Growth regulators at higher concentrations showed lower dry matter and seed yield. Such effects have been attributed to the inhibition in metabolic pathways due to the application of growth regulators (Siddiqui and Krishnamoorthy, 1991).

The length of pods were in the range of 4.92 – 5.25, 11.32 - 13.52 and 11.81 - 14.25 cm at 75, 90 and 105 DAS respectively (Fig 3). This range was supported by the previous reports of Naidu *et al.* (1996) and BARI (1988). Treatments had significant effect on pod length at 90 and 105 DAS. At these stages, T_2 and T_5 showed significantly longer pods than rest of the treatments. The highest number of pods were shown by T_2 which however, was at par with T_5 and T6. Such positive effect of KNap and NAA on the number of pods is in conformation with the reports of Uddin *et al.*, 1994; Rao and Narayan, 1998 and Karim, 2005.

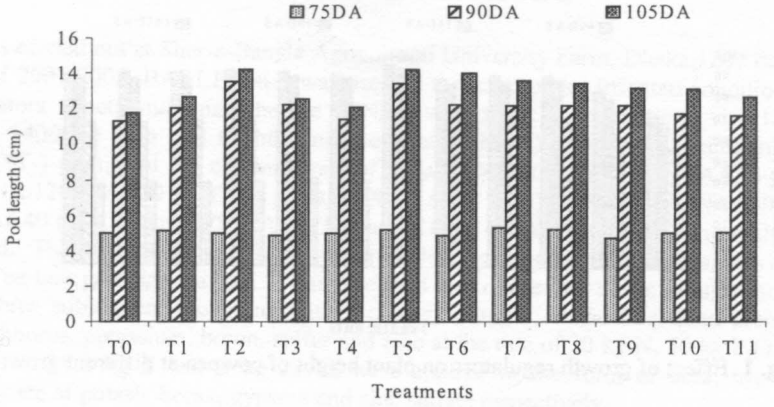

Fig. 3 Effect of growth regulators on pod length of cowpea at different growth stages.

The treatments T_1 and T_2 produced highest number of seeds/pod (Table 1). The treatment T_2 also showed the highest 1000 seed weight, seed yield (both per plant and per hectare) and harvest index (Table 1). However, treatments T_2, T_5 and T_6 were at per in these aspects. Such increase in yield and yield parameters is in agreement with the previous reports on grain legumes (Uddin *et al.,* 1994; Rao and Narayanan, 1998; Karim, 2005).

Table 1. Effect of growth regulators on yield and yield attributes of cowpea

Treatments	Number of pods/ plant	Number of seeds/ pod	1000 seed weight (g)	Seed yield/ plant (g)	Seed yield/ha (kg)	Harvest index (%)
T_0	10.84	10.77	115	13.43	1419	28.51
T_1	11.25	10.96	118	14.55	1491	30.89
T_2	13.03	10.96	125	17.85	1820	37.90
T_3	11.37	10.33	121	14.21	1463	30.18
T_4	11.29	10.77	118	14.35	1502	30.47
T_5	12.98	10.88	123	17.37	1779	36.88
T_6	12.45	10.67	123	16.34	1682	34.69
T_7	11.45	10.65	119	14.51	1503	30.81
T_8	11.35	10.52	119	14.21	1471	30.17
T_9	11.25	10.51	118	13.95	1429	29.63
T_{10}	11.15	10.20	117	13.31	1356	28.25
T_{11}	11.01	10.06	116	12.85	1316	27.28
LSD (0.05)	**1.00**	**0.49**	**4.00**	**1.53**	**182**	**1.39**
CV (%)	4.80	2.55	1.93	5.77	6.64	7.21

It was found that there was a positive correlation among all the yield components (Table 2). However, the correlation between number of pods/plant and number of seeds/pod, between number of seeds/pod and 1000 seed weight and between 1000 seed weight and HI were not found to be significant.

Table 2 Correlation analysis among different yield components of cowpea

No. pods/plant	No. seeds/pod	1000 seed weight	Seed weight/ plant	Seed yield/ha	HI
No. pods/plant	0.52	0.93*	0.98*	0.96*	0.65*
No. seeds/pod		0.44	0.67*	0.71*	0.91*
1000 seed weight			0.93*	0.91*	0.55
Seed weight/plant				1.00*	0.76*
Seed yield/ha					0.80*

* Significant at 5 % level.

By evaluating the above results, it may be concluded that the NAA treated plants had higher plant height than the KNap treated ones. Among the treatments studied, KNap1300 (T_2) showed highest values of dry matter, pod length, number of pods/plant, number of seeds/pod, 1000 seed weight, seed yield/plant, seed yield/ha and harvest index. The treatment NAA50 (T_5) had highest values among the NAA treatments, which was also at par with KNap1300. Combination also increased the values of dry matter, all the yield attributes and yield in comparison to the control. Among the combination treatments, KNap1200NAA40 (T_6) gave the highest values which was at par with KNap1300 and NAA50.

REFERENCES

BARI (Bangladesh Agricultural Research Institute). 1988. Annual Report for 1986-1987. BARI, Joydebpur, Gazipur, Bangladesh.

Biswas, P. K., Ahmed, J. U., Saha, R. R. and Torofder, G. S. 1996. Response of different nitrogen levels on nodulation, dry matter and seed yield in cowpea genotypes. *Bangladesh J. Agril. Res.* 21(1): 75-79.

Brain, P. W. and Hemming, H. G. 1958. Complementary action of gibberellic acid and auxins in pea internode extension. *Ann. Bot.* 22: 1-17.

Fattah, Q. A. and Wort, D. J. 1970. Metabolic responses of bush bean plants to naphthenate application. *Can. J. Bot.* 48: 861-866.

Kalita, P., Dey, S. C. and Chandra, K. 1995. Influence of foliar application of phosphorus and naphthalene acetic acid on nitrogen, dry matter accumulation and yield of green gram. *Indian J. Pl. Physiol.* 38(3): 197-202.

Karim, M. F. 2005. Physiological and biochemical responses of chickpea (*Cicer arietenum* L.) following application of fertilizers and growth regulators. Ph. D. Thesis. Dept. of Botany, Dhaka Univ., Dhaka, Bangladesh.

Khanom, S. A. 1992. Physiological and biochemical studies of growth and yield of mustard (*Brassica campestris* L. var. Sampad) following potassium naththenate application. M.Sc. Thesis, Dept. of Botany, Dhaka Univ., Dhaka, Bangladesh.

Maske, V. G., Deotale, R. D., Sorte, P. N., Tale, N. D., and Chore, C. N., 1997. Germination, root and shoot studies in soybean as influenced by GA_3 and NAA. *J. Soils and Crops.* 72(2): 147-149.

Naidu, N.V., Satyanarayana, A., and Seenaiah, P. 1996. Inter-relationships between yield and yeild attributes in cowpea (*Vigna unguiculata* L. Walp). *Ann. Agric. Res.* 17(4): 337-341.

Patel, I. and Saxena, O. P.1994. Screening of PGRs for seed treatment in green gram and black gram. *Indian J. Plant Physiol.* XXXVII(3): 206-208.

Rao, J. S. P. and Narayanan, A. 1998. Effect of water and light stress and foliar application of auxin on flower abscission and seed yield of pigeon pea. *Field Crop Abstract* No.5191.

Rahman, M. M. 1989. Progress and prospect of minor pulses in Bangladesh. In: *Advances in Pulse Research in Bangladesh.* pp. 43-50.

Siddiqui, S. and Krishnamoorthy, H. N. 1991. Effect of B-nine on nodulation and nitrogen fixation in cowpea (*Vigna unguiculata* L.) and gram (*Cicer arietinum* L. under saline conditions. *Haryana Agric. Univ. J. Res.* 21: 10-17.

Saxena, O. P. 1994. Screening of PGRs for seed treatments in green gram and black gram. Indian *J. Pl. Physiol.* 37(3): 206-208.

Uddin, M. M., Quadir, M. A., Choudhury, A. R. and Choudhury, M. K. 1994. Effects of growth regulators on growth and pod yiel d of lablab bean grown in summer. *Ann. Bangladesh Agric.* 4(2): 79-85.