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EFFECT OF NAPHTHALENE ACETIC ACID ON YIELD ATTRIBUTES OF COWPEA CULTIVARS

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Abstract

An experiment was carried out to investigate the response of two different varieties of Cowpea *i.e.* Kashi Unnati and Kashi Kanchan to different concentrations of Naphthalene Acetic Acid (NAA) *i.e.* 10, 20 and 30ppm. These concentrations of NAA were evaluated for physiological efficacy in factorial randomized design with five replications each. Physiological parameters such as germination percentage, shoot, root length, seedling length and seedling vigour index as well as yield parameters such as No. of pods/ plant, No. of seeds/ plant, 1000 seed weight and seed yield/ plant were studied during the present investigation. Each concentration of NAA showed positive effect on all the growth parameters studied, the effect of 30 ppm concentration remained greater on both varieties. However, variety Kashi Kanchan had an edge over Kashi Unnati.

Key words : NAA, Physiological parameters, Yield parameters, Cowpea.

Introduction

In recent years plant hormones and their synthetic analogues are being used in agriculture to enhance crop production. Natural and synthetic plant hormones have multidimensional physiological effects and their physiological responses are concentration dependent and also plant species specific. Some of the synthetic plant growth regulators are reported to be more potent than the natural hormones. A large number of Experimentations and observations have shown that the judicial application of hormones or synthetic analogues could be employed in the field of agriculture to increase crop production and to drive maximum benefit from crops. Pretreatment of the seeds with NAA, IAA, GA, CK, and Brassinolides is reported to be very effective in increasing the germination percentage of seeds as well as the total yield parameters of many crop plants (Singh and Singh 2013). Suitable and effective concentration and the combination of plant hormones have to be investigated for different crop plants. NAA is a synthetic auxin-like growth regulator of higher efficiency. When it is applied in significant concentrations, it promotes adventitious root formation and promotes better rooting activities, thus increasing nutrient absorption. It also works to promote cell division and cell enlargement thus enhancing plant growth. In significant concentrations, it also delays the onset of senescence. NAA is reported to enhance overall crop growth and yield in certain crops at significant levels.

Cowpea (*Vigna unguiculata* (L.) walp), a grain legume plant being termed as black-eye pea, kaffir pea, china pea, southern bean, is considered as a miracle crop of the world. Cowpea belongs to the family Leguminosae (Fabaceae) and genus *Vigna*. *Vigna* is a pantropical genus with about 170 species; out of these 120 being cultivated in Africa, 22 in India and South-East Asia and a few in America and Australia (Pradapati *et al.*, 2015). Cowpea is an important pulse crop of India which occupies an area of 3.9 million hectares with a production of 2.2 million tonnes and productivity of 564 kg/ha. It is often considered as an important minor pulse crop in India and rest of the world. Cowpea fits very well in a various cropping systems and is grown as mixed crop, cover crop, catch crop and manure crop. It has ability to withstand a considerable degree of drought and higher rainfall and can be grown in almost all kinds of soils provided there is proper drainage. Usually, it is cultivated as mixed crop with sorghum and ragi and rarely as pure crop on very

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small scale. Being leguminous in nature it fixes nitrogen from atmosphere thus enriching soil fertility. On an average cowpea grain contains 63.6 per cent carbohydrate, 24.8 per cent protein, 1.9 per cent fat, 3.8 per cent iron, 3.2 per cent minerals and is a good source of vitamin B_2. Apart from this green pod of cowpea contains 84.6 g moisture, 4.3 g protein, 0.2 g fat, 0.9 g minerals, 2.0 g fiber, 8.0 g carbohydrates, 80 mg calcium, 74 mg phosphorus, 2.5 mg iron, 941.1 I.U. vitamin A, 0.09 mg riboflavin, 0.07 mg thiamine, 0.09 mg nicotinic acid and 13.0 g vitamin C per 100 g of edible portion. Cowpea (*Vigna unguiculata* (L.) Walp), a grain legume plant, is a protein source of the diet of many people has long been recognized by the International Institute of Tropical Agriculture (IITA). It has been reported that in some areas of the semi-humid tropics, Cowpea provides more than half the protein in human diet.

Plant hormones and synthetic growth regulators are recognized as new generation of eco-friendly agro-chemicals after chemical fertilizers, herbicides and pesticides to enhance seed yield and crop quality. All phytohormones are plant growth regulators *i.e.* natural plant products but opposite is not true (Singh and Singh., 2013). They are usually found in plants as free form or in the conjugated forms. The later one are conjugates of either sugars or amino acids or possibly peptides. Free forms plant hormones are usually considered to be physiologically active in executing functions, while the conjugates are generally viewed to regulate the levels of active free forms, transport and storage (Strader and Bartel, 2011). Phytohormones are also a major part of oils and proteins and they are found to increase the quality and yield of crops (Khandaker *et al.*, 2018). Pant hormone auxin plays a central role in regulation of plant development and growth (Frick and Strader,2017). NAA is a synthetic auxin which stimulates root initiation, initiation of cell division and vegetative growth (Ghosh *et al.*, 2017 and Mehta *et al.*, 2018). Hence to find out the effect of NAA on cow pea, these experiment were performed with objective to investigate the effect of Naphthalene Acetic Acid (NAA) on the growth parameters of two varieties (Kashi Kanchan and Kashi Unnati) of Cowpea.

Materials and Methods

The present experiment was conducted at Department of Botany, Raja Balwant Singh College, Agra during *kharif* season of 2018 session. Certified seeds of two varieties of Cowpea i.e. Kashi Unnati and Kashi Kanchan were used. Seeds of both varieties were surface sterilized in 1% sodium hypochlorite (NaOcl) solution for 3 minutes, then rinsed with sterilized water and air dried before the start of experiment. Three different concentrations of NAA *i.e.* 10 ppm, 20 ppm and 30 ppm were prepared in molecular biology grade water. Ethyl Alcohol was used to dissolve the powdered crystals of NAA. Solution was sterilized by autoclave, filtered through 0.2 µm filters and stored at 20^0C. Along with these treatments both the varieties had their separate controls. Concentrations of NAA (0, 10, 20 and 30 ppm) were evaluated for physiological efficacy in factorial randomized design with five replications. Treated seeds were allowed to germinate and foliar spray was given at 07,14,21 and 28th day after seed sowing. Seeds were considered as germinated when there was an emergence of radicle from the seed coat. The final germination percentage was taken after 05 days and for measurement of all the other parameters the plants of each replicate were allowed to grow till the end of seed maturity. Physiological parameters such as germination percentage, shoot, root length, seedling length and seedling vigour index as well as yield parameters such as No. of pods/ plant, No. of seeds/ plant, 1000 seed weight and seed yield/ plant were studied during the present investigation.

Results and Discussion

NAA was applied in three concentrations viz. 10ppm 20ppm and 30ppm on both the varieties of Cowpea *i.e.* Kashi Unnati and Kashi Kanchan. It is clear from the data presented in the tabulated form that both varieties responded positively for each parameter at every concentration of NAA. There was gradual increase in the results corresponding to the increase in concentration of the auxin and maximum increase was found at 30ppm. Howeve, variety Kashi Kanchan kept an edge over Kashi Unnati in almost all the recorded parameters. In the case of two early seedling growth parameters such as germination percentage and seedling vigour index it is quite evident from the data that cultivar Kashi Kanchan had showed better response towards NAA as it was 91.8 % under treatment of 30 ppm in comparison to 82% of control and seedling vigour index was 3387 in comparison of 2804 of control (Table 1). While in the case of Kashi Unnati the germination percentage was 89.8% in comparison to 80% of control and the seedling vigour index was 3268 in comparison to 2696 of control (Table 2). In the case of yield parameters it is quite interesting to see that again the variety Kashi Kanchan did better than Kashi Unnati. In the case of Kashi Kanchan the Number of Pods/Plant was 12.5 in comparison to 7.8 in its control and Seed yield/ Plant was 14.51 in comparison to 6.16 of control table 3 while in the case of Kashi Unnati the Number of Pods/ Plant was 12.1 in comparison to

7.7 of control and the seed yield/ Plant was 14.45 in comparison to 6.14 of control (Table 4). Application of NAA had influenced the early seedling growth in both the cultivars under investigation which is quite evident from the fact that both the cultivars investigated showed good performance in all the treatments as compare to control, the present investigation suggest that application of NAA was beneficial in by enhancing all the parameters studied whether they are early seedling growth parameters or the yield parameters.

Table 1: Effect of NAA on early seedling growth of Cowpea cultivar (Kashi Kanchan).

Treatment	Germination %	Shoot length (cm)	Root length (cm)	Total Seedling	Seedling vigour index
0	82	18.7	15.5	34.2	2804
10	90.4	19.2	15.7	34.9	3154
20	91.2	19.6	16.8	36.4	3319
30	91.8	19.8	17.1	36.9	3387
S.Em ± CD	0.48	0.23	0.34	0.43	53.40

Table 2: Effect of NAA on early seedling growth of Cowpea cultivar (Kashi Unnati).

Treatment	Germination %	Shoot length (cm)	Root length (cm)	Total Seedling	Seedling vigour index
0	80	18.5	15.2	33.7	2696
10	88.4	19.0	15.4	34.4	3040
20	89.2	19.4	16.5	35.9	3202
30	89.8	19.6	16.8	36.4	3268
S.Em ± CD	0.47	0.22	0.33	0.44	53.40

Table 3: Effect of NAA on seed yield and yield component of Cowpea cultivar (Kashi Kanchan).

Treatment	No. of Pods/ plant	No. of Seeds/ plant	1000 seed weight (gm)	Seed yield/ plant (gm)
0	7.8	10.5	98.6	6.16
10	9.5	10.7	98.9	8.62
20	11.9	11.9	101.9	14.4
30	12.5	12.2	102.4	14.51
S.Em ± CD	0.23	0.13	0.33	0.43

Table 4: Effect of NAA on seed yield and yield component of Cowpea cultivar (Kashi Unnati).

Treatment	No. of Pods/ plant	No. of Seeds/ plant	1000 seed weight (gm)	Seed yield/ plant (gm)
0	7.7	10.2	98.3	6.14
10	9.3	10.4	98.7	8.60
20	11.8	11.6	101.8	14.2
30	12.1	11.9	102.1	14.45
S.Em ± CD	0.24	0.12	0.32	0.42

Numerous studies have demonstrated improvement in seed germination of different plant species in response to priming with plant growth hormones (Bideshk and Arvin, 2013). NAA has been reported to increase germination percentage and seedling growth as it has been found to play a central role in the integration of the responses expressed by plants. This could be explained by more rapid water uptake in primed seeds because germination in primed seeds started after 24 hr. It supports that priming caused more rapid water uptake than control. These results agree with Azizi *et al*., (2015) in cowpea. The Pre-sowing treatments cause initiation of the early metabolic processes and the re-drying of seeds arrest, but do not reverse, the initial stages of germination so that on the availability of suitable conditions, the time taken to germinate is reduced (Maku *et al., 2014*). Priming induced activation of metabolic events (Singh, 2013) has been reported in seeds of various plant species. It was observed that priming improved root and shoot growth as compared to control. Higher fresh weight of plants, roots and shoots were also recorded from the primed seeds as compared to control. The major effects of seed treatment on the seedling growth observed were due to the faster emergence of radicle and plumule and thus providing seedlings a sufficient time to grow and develop (Colebrook *et al.,* 2014). These results indicate that NAA has stimulatory effect on different yield attributes, and it depends on several factors including the varietal difference and concentration of the chemical used.

Conclusion

In present experiment exogenous application of NAA is shown to effectively improve growth and yield of two varieties of cow pea. From this experiment it can be concluded that treatment of NAA has following possible effects on cow pea: (i) Efficient rooting activities leading to improved nutrient absorption for better plant growth; (ii) Improvement in growth and yield parameters; (iii) A significant rise in pod size and grain yield; (iv) Delay in the onset of senescence thus providing sufficient time for photoassimilate synthesis and its transport from source to sink. By this study it can be inferred that there is a good and clear positive effect of NAA hormone on growth and yield parameters of both the varieties and we suggest

that by the use of moderately high concentration (30 ppm) of NAA the farmers will get the better yield of this crop.

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