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## Effect of growth regulators on germination and vigour of cow pea (*Vigna unguiculata* L. Walp.) seeds

**BS Thorat, RR Patil and AR Kamble**

**Abstract**

A study was conducted during 2016-17 to evaluate the effects of organic and inorganic growth regulators on germination and vigour of Cowpea (*Vigna unguiculata* L. Walp.) seeds at Graduate laboratory, Department of Agril. Botany, Govindraji Nikam College of Agriculture, Mandki-Palvan, Ratnagiri (MS). The experiment consist of three concentrations of lemon juice (2, 4 and 6%), three concentrations of Coconut Water (2, 4 and 6%), three concentrations of GA3 (10, 20 and 30 ppm) and three concentrations of IAA (10, 20 and 30 ppm). The experiment was laid out in completely randomized block design with four replications. T8 (GA3 20ppm) proved significantly superior in germination per cent, germination index, shoot length, root length, seedling length, fresh weight of seedling, dry weight of seedling, seed vigour index-I, and seed vigour index-II.

**Keywords:** cowpea, growth regulators, germination and vigour

**Introduction**

Cowpea (*Vigna unguiculata* L. Walp.) belongs to family Leguminaceae, an annual legume. It is a self-pollinated crop having chromosome no  $2n=22$ . It is the most important pulse crop in the world for food as well as fodder. In India, cowpea is a premier pulse crop occupying 5.71 million ha and contributing 4.87 million tonnes to pulse basket. It accounts for 5% of the world pulses production. India is the largest producer, with about 5 million tons, accounting of about 60% of total world production. The nutrient composition of cowpea seed has protein (24.8%), fat (1.90%), fiber (6.3%), carbohydrates (63.6%) and minerals (Calcium, Sodium, Magnesium, Phosphorous and Iron) and Vitamins, viz., thiamine (0.00074%), riboflevin (0.00042%) and niacin (0.00281%) (El-Adawy 2002) [4].

Plant growth regulators may be defined as any organic compounds, which are active at low concentrations (1-10 mg / ml) in promoting, inhibiting or modifying growth and development. The naturally occurring (endogenous) growth substances are commonly known as plant hormones, while the synthetic ones are called growth regulator. The impact of PGRs in manipulating physiological processes in crop production include germination, vigour, nutrient uptake from soil, photosynthesis, respiration, partitioning of assimilate, growth suppression, defoliation and post-harvest ripening (Rahman and Nath, 1993; Kathiresan and Balasubramanian, 1995) [12, 8]. These are synthesized within the plant bodies but its exogenous application renders a considerable response (Frankenberger and Arshad, 1991) [5].

The growth regulators were also found to be effective in changing the biochemical properties including protein and amino acids (Oluwatosin, 1997) [9]. These growth regulators may be of natural origin or synthetic. The growth regulators both from organic (Coconut, lemon) and inorganic sources (GA3, IAA) along with some traditional growth regulators were tried to increase the germination and vigour of different pulse seeds. In India a large number of experiments have been undertaken in many field and horticultural crops on Gibberellic acid to evaluate germination and vigour seed and it was found to have increased the growth and yield of various economically important crop plants including cereals, vigour and others attributes of cowpea. Therefore, the present investigation has been undertaken to find out 'the effect of organic and inorganic growth regulators on germination and vigour on cowpea (*Vigna unguiculata* L. Walp.) seed.

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## Materials and Methods

The experiment entitled "Effects of organic and inorganic growth regulators on germination and vigour of cowpea (*Vigna unguiculata* L. Walp.) Seeds" was carried out during 2016-17 in Graduate laboratory, Department of Agril. Botany, GNCA, Mandki-Palvan, Ratnagiri (MS) which is located at 17°32'17.53" N latitude, 73°31'73.52" E longitude, 7 m altitude above the mean sea level and the city lies near the source of the River Vashishti. The experiment consisted four growth regulators *viz.*, Lemon juice, Coconut water, GA3 and IAA. This experiment had 13 treatments as follows: T0 = control, T1 = lemon juice @ 2%, T2 = lemon juice @ 4%, T3 = lemon juice @ 6%, T4 = Coconut water @ 2%, T5 = Coconut water @ 4%, T6 = Coconut water @ 6%, T7 = GA3 @ 10 ppm, T8 = GA3 @ 20 ppm, T9 = GA3 @ 30 ppm, T10 = IAA @ 10 ppm, T11 = IAA @ 20 ppm, T12 = IAA @ 30 ppm. In this experiment 50 seeds were used in each treatment and seeds were soaked in different concentrations of four growth regulators for 6 hrs.

The experiment was conducted in a Completely Randomized Design (CRD) with four replications. The parameters studied were germination per cent (%), germination index, shoot length (cm), root length (cm), seedling length (cm), seedling fresh weight (g), seedling dry weight (g), vigour index I and II. Observations were recorded on five randomly selected seed for all the parameters from each replication. The performance of organic and inorganic growth regulators was evaluated on basis of laboratory germination test by collecting different germination parameters *viz.*, germination per cent (%), germination index, shoot length (cm), root length (cm), seedling length (cm), fresh weight of seedling (gm), dry weight of seedling (gm), seed vigour index-I, and seed vigour index-II. These parameters were statistically analysed and critical differences were calculated.

## Result and Discussion

### Germination percent (%)

The data revealed that germination per cent (%) shows significant difference among the various treatments. Germination per cent (%) ranged from 82.08 to 97.50 (Table 1). The maximum germination per cent (97.50%) was observed in T8 (GA3 20ppm) which was found followed by T5 (Coconut Water @ 4%) 96.50% whereas, minimum germination per cent was recorded in control T0 (74.50%). Maximum germination percentage was recorded when seeds soaked in GA3 might be due to the fact that GA3 involved in the activation of cytological enzymes which stimulates  $\alpha$  – amylase enzyme that converts insoluble starch into soluble sugars and it also initiates the radical growth by removing some metabolic blocks Babu *et al.*, 2010 [2]. GA3 also plays an important role in leaching out of the inhibitors which in turn helps in breaking the seed dormancy. Similar finding has been found by Pandit *et al.*, 2001, [10] Anburani and Shakila (2010) [1].

### Germination Index

The data revealed that speed of germination shows significant difference among the various treatments. The speed of germination in cowpea as influenced by various seed treatments are presented in Table 1. The speed of germination ranged from 11.56 to 15.04. The maximum speed of germination (15.04) was observed in T8 (GA3 20 ppm) which was found to be significantly superior followed by T5 (Coconut Water @ 4%) 14.75 whereas, minimum speed of germination was recorded in control T0 (11.56).

The maximum speed of germination with GA3 might be due to its influence in early germination and increased percent germination. The results are in conformity with findings of Rajamanickam and Anbu (2001) [13].

**Table 1:** Mean performance of cowpea for germination per cent, germination index and vigour index.

Treatment	Germination per cent (%)	Germination index	Vigour Index I	Vigour Index II
T0	82.08	11.56	1236.59	82.49
T1	93.50	14.34	2419.75	121.42
T2	92.00	14.12	2593.59	99.58
T3	92.50	14.08	2308.03	94.80
T4	95.50	14.15	2782.09	122.88
T5	96.50	14.75	3148.77	138.71
T6	95.00	14.24	2688.23	74.75
T7	94.00	13.80	2789.68	132.72
T8	97.50	15.04	3223.04	149.94
T9	94.50	14.00	2903.22	135.14
T10	90.50	13.75	2078.04	97.43
T11	91.00	13.92	2257.63	105.39
T12	86.00	11.67	1652.69	65.80
G Mean	92.39	13.57	2467.79	109.31
C.D. (5%)	5.23	5.22	317.51	14.26
SE(m)	1.76	1.80	110.98	4.98
SE(d)	2.54	2.56	156.95	7.04
C.V.	3.95	23.55	8.97	9.28

### Shoot Length (cm)

The data revealed that shoot length (cm) shows significant difference among the various treatments. The shoot length in cowpea as influenced by various seed treatments are presented in Table 2. The shoot length ranged from 10.01cm to 17.90cm. The maximum shoot length (17.90cm) was observed in T8 (GA3 20ppm) which was found to be significantly superior followed by T5 (Coconut water @ 4%) *i.e.* 17.80cm whereas, minimum shoot length was observed in

control T0 (10.01cm).

This improvement in shoot growth could be due to activation of dormant embryo of seeds with GA3 and also GA3 treatment helps to increase cell division, cell elongation and cell multiplication which might have reflected into maximum seedling shoot length. These results are in accordance with results obtained by Gawade (2008) [6] and Gholap *et al.*, (2000) [7].

### Root length (cm)

The data revealed that root length (cm) shows significant difference among the various treatments. The root length (cm) in cowpea as influenced by various seed treatments are presented in Table 2. The root length ranged from 7.90cm to 15.76cm. The maximum root length (15.76 cm) was observed in T8 (GA3 20ppm) which was found to be significantly superior followed by T10 (IAA 10 ppm) *i.e.* 15.50cm whereas, minimum root length was recorded in control T0 (7.90cm).

The maximum root length with GA3 might be due to its influence to promoted more root formation through root cell elongation and more nutrient uptake as suggested by Shanmugavelu (1970) [14]. It has been reported that GA3 at lower concentration initiate the growth of the roots whereas higher concentration has little effect on root growth Wittwer and Bukovac (1958) [15].

### Seedling length (cm)

The data revealed that seedling length (cm) shows significant difference among the various treatments. The seedling length (cm) in cowpea as influenced by various seed treatments are presented in Table 2. The seedling length ranged from 16.87cm to 33.70cm. The maximum seedling length (33.70cm) was observed in T8 (GA3 20 ppm) which was found to be significantly superior followed by T5 (Coconut water @ 4%) *i.e.* 33.01cm whereas, minimum seedling height was recorded in control T0 (16.87cm).

This improvement in seedling growth could be due to activation of dormant embryo of seeds with and also GA3 treatment helps to increase cell division, cell elongation and cell multiplication which might have reflected into maximum seedling growth. These results are in accordance with results obtained by and Gawade (2008) [6] and Gholap *et al.* (2000) [7].

**Table 2:** Mean performance of cowpea for shoot length, root length, seedling length, fresh weight and dry weight.

Treatment	Shoot length (cm)	Root length (cm)	Seedling length (cm)	Seedling fresh weight (gm)	Seedling dry weight (gm)
T0	10.01	7.90	16.87	4.04	0.81
T1	14.20	12.89	26.89	6.42	1.15
T2	14.02	13.70	27.38	6.91	1.17
T3	12.90	13.40	24.98	5.89	1.13
T4	16.90	12.90	29.79	6.92	1.31
T5	17.80	13.78	33.01	7.76	1.46
T6	17.30	12.22	28.89	6.90	1.21
T7	17.10	15.09	31.50	7.56	1.43
T8	17.90	15.76	33.70	7.70	1.55
T9	16.40	15.23	30.73	7.65	1.39
T10	12.09	15.50	24.46	5.20	1.09
T11	13.45	14.90	24.79	5.85	1.05
T12	12.94	15.00	27.15	4.80	0.82
G Mean	14.84	13.71	11.76	6.43	1.19
C.D. (5%)	1.07	2.55	2.74	1.14	0.15
SE(m)	0.38	0.87	0.96	0.38	0.05
SE(d)	0.54	1.26	1.35	0.57	0.06
C.V.	5.46	13.43	7.12	12.67	8.67

### Fresh Weight (g)

The data revealed that seedling fresh weight (g) shows significant difference among the various treatments. The fresh weight (g) in cowpea as influenced by various seed treatments are presented in Table 2. The seedling fresh weight ranged from 4.04g to 7.76g. The maximum fresh weight (7.76g) was observed T5 (Coconut water @ 4%) which was found to be significantly superior followed by T8 (GA3 20 ppm) *i.e.* 7.70g whereas, minimum fresh weight was recorded in control T0 (4.04g).

The higher fresh weight of seedling with coconut water pre-soaking seed treatment can be correlated with higher overall growth in the corresponding treatment of coconut water. Hence, it can be stated that increase in overall growth of the seedling has lead to the overall assimilation and redistribution of food material with the seedling (Brian and Hemming, 1955) [3] and hence, resulted in higher fresh weight.

### Dry Weight (g)

The data revealed that dry weight (g) shows significant difference among the various treatments. Dry weight (g) in cowpea as influenced by various seed treatments are presented in Table 2. The seedling fresh weight ranged from 0.81g to 1.55g. The maximum dry weight (1.55g) was observed T8 (GA3 20 ppm) which was found to be significantly superior T5 (Coconut water @4%) *i.e.* 1.46g

whereas minimum seedling dry weight was recorded in Control T0 (0.80g).

The maximum dry weight of seedling with GA3 pre-soaking seed treatment can be correlated with higher overall growth in the corresponding treatment of GA3. Hence, it can be stated that increase in overall growth of the seedling has lead to the overall assimilation and redistribution of food material with the seedling (Brian and Hemming, 1955) [3] and hence, resulted in higher fresh weight. Thus, increased growth is a consequence of increased dry matter accumulation.

### Vigour Index I

The data revealed that vigour index I shows significant difference among the various treatments. Vigour index I in cowpea as influenced by various seed treatments are presented in Table 1. The Vigour Index I ranged from 1236.59 to 3223.04. The maximum vigour index I (3223.04) was observed in T8 (GA3 20 ppm) which was found to be significantly superior T7 (GA3 10 ppm) *i.e.* 3214.04 whereas, minimum vigour index I was recorded in control T0 (1236.59).

The vigour index I of seedlings is directly dependent on germination percentage and seedling length. Higher seedling vigour index I in GA3 treated seeds might be due to the cumulative effect of higher seedling length and germination percentage which were greatly influenced by GA3 in chickpea

seed at laboratory conditions. The results are in line with the findings of Anburani and Shakila (2010)<sup>[1]</sup>.

### Vigour Index II

The data revealed that vigour index II shows no significant difference among the various treatments. Vigour index in cowpea as influenced by various seed treatments are presented in Table 1. The Vigour Index II ranged from 82.49 to 149.94. The maximum vigour index I (149.94) was observed in T8 (GA3 20 ppm) which was found to be significantly superior T7 (GA3 10 ppm) *i.e.* 139.37 whereas, minimum vigour index I was recorded in control T0 (82.49).

The vigour index II of seedlings is directly dependent on germination percentage and seedling dry weight. The maximum vigour index II with GA3 pre-soaking seed treatment might be due to cumulative effect of seedling dry weight and germination percentage which were greatly influenced by GA3 in chickpea seed at laboratory conditions. The results are in line with the findings of Babu *et al.* (2010)<sup>[2]</sup>.

### Conclusion

It was concluded from the present investigation that the seed treated with GA3 20 ppm was found to be the most suitable growth regulator for germination and vigour of cowpea since it revealed superior performance in most of the parameter *viz.*, germination per cent (97.50%), germination index (15.04), shoot length (17.90cm), root length (15.76cm), seedling length (33.70 cm), seedling fresh weight (7.65g), seedling dry weight (1.39g), vigour index I (3223.04) and vigour index II (149.94). As the experiment is based on one trial, further research has to be done for conformity and recommendation.

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