Int.J.Curr.Microbiol.App.Sci (2020) *9*(12): 2691-2696

International Journal of Current Microbiology and Applied Sciences
ISSN: 2319-7706 **Volume 9 Number 12 (2020)**
Journal homepage: http://www.ijcmas.com

Original Research Article https://doi.org/10.20546/ijcmas.2020.912.318

Impact of Different Priming Methods on Growth, Yield and Seed Quality Parameters in Cowpea (*Vigna unguiculata* L.)

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Keywords

Cowpea, Different pre-sowing seed treatments, Quality parameters, Vigour and seed yielding attribute

Article Info

Accepted:
18 November 2020
Available Online:
10 December 2020

A B S T R A C T

The experiment was conducted in post graduate Seed Testing Laboratory, Department of Genetics and Plant Breeding, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj (U.P.) during *Kharif* season 2019-2020, in order to standardize the suitable pre-sowing seed treatment of Cowpea (var). Pre-sowing seed treatments with control (Unprimed) were evaluated by screening 12 hour viz., T_0 – Control, T_1 – DH_2O, T_2 – PEG_{6000} @(2%), T_3 – Mannitol @ (2%), T_4 – GA_3 @ (100 ppm), T_5 – SA @ (100 ppm), T_6 – IBA @ (100 ppm), T_7 – KCl @ (2%), T_8 – KNO_3 @ (2%), T_9 – $CaCl_2$ @ (2%), T_{10} – Curry leaf extract @ (5%), T_{11} – Moringa leaf extract @ (5%), T_{12} – Neem leaf extract @(5%). It was found that all the pre-sowing seed treatments showed significance difference with the control and in laboratory condition highest germination per cent, seedling length, seedling fresh weight, seedling dry weight, vigour indices were observed for T_2- PEG_{6000} (2%). In field highest field emergence percentage observed in T_5- SA (100 ppm) and Plant height highest observed in T_4 – GA_3 @(100 ppm), number of pods per plant, seed yield per plant, seed yield per plot, biological yield, harvest index was observed for T_2- PEG_{6000} @ (2%). Observed highest germination and yielding parameters in PEG_{6000} @ (2%). Pre-sowing seed treatment with PEG_{6000} enhance germinability and seedling character, its simplicity and no requirement for expensive equipment and chemical could be used as a simple method for overcoming related to a poor germination and seedling establishment.

Introduction

Pulses are the important sources of proteins, vitamins and minerals and are popularly known as “Poor man’s meat” and “rich man’s vegetable”, contribute significantly to the nutritional security of the country. Currently, we are in the mid-way of self-sustaining in pulses production as we are world leader in production, consumption and import as well. India import 2-3 million tons (MT) of pulses during 2010-11, causing huge hard foreign

earning. By the 2050 we will able to sustain our production and we turned to net importer to net exporter for pulses if every things goes as per plan.

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 tones 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%), riboflavin (0.00042%) and niacin (0.00281%) (El-Adawy, 2002).

Cowpea as the most diverse of the cultivated subspecies and the wide distributed, is an important food legume and versatile crop (Sanginga *et al.,* 2002). Forage yield of cowpea is the highest in sandy loam soils supplemented with suitable irrigation. Cowpea seed yield can be relatively high when grown in soils with low fertility. Moreover, high rates of nitrogen and excessive moisture are detrimental and can result in excessive vegetative growth, delayed maturity and pod shattering (Ali *et al.,* 2004).

In India, it is cultivated mainly in Gujarat, West Bengal, Tamil Nadu, Andhra Pradesh, Kerala and Orissa. In Gujarat, it is mainly grownin Sabarkantha, Banaskantha, Mehasana, Patan, Ahemdabad, Kheda and Anand district and commonly known as "*chowli*" in this area. In India, the total area under beans cultivation is about 136 (000 ha) with the production 1373 (000 MT) (Anonymous, 2014-2015). Mostly, cowpea is grown in warm and *kharif* season in India and often cultivated as intercrop.

Cowpea is more remunerative with other crops with some saving of fertilizers for higher and profitable yield. It can fix atmospheric nitrogen in the soil by their symbiotic relationship with a specific soil-bacteria (*Rhizobium spp.).* It requires very few inputs, as the plants root nodules are able to fix atmospheric nitrogen, making it a valuable crop for resource poor farmers and well-suited to intercropping with other crops. The whole plant is used as forage for animals, with its use as cattle feed likely responsible for its name.

Seed invigoration is a technique of seed enhancement it implies an improvement in seed vigour by any postharvest treatment resulting in improved germination, better field emergence and longer storability than un treated seeds which helps seedlings to grow in biotic and abiotic stress conditions (Ashraf and Foolad, 2005). Priming of seeds has shown to have beneficial effects on germination and emergence of many species (Brad ford, 1986). Pre- soaking of seeds causes hydration of membrane proteins and initiation of several processes (Bewley and Black, 1982)

Materials and Methods

The Research study was conducted at experimental research field, Department of Genetics and Plant Breeding, Naini Agriculture Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj during *kharif-2019*. The experiment was carried out at Field Experimentation Centre of the Department of Genetics and Plant Breeding, Sam Higginbottom University of Agriculture,

Technology & Sciences. Prayagraj (UP) during *Kharif-2019*.

The source of seed material was obtained from Indian Institute of Pulse Research, Kanpur and the experiment was conducted in Randomized block design (R.B.D) with three replications in field followed by Completely Randomized Design (C.R.D) with four replications in lab and the variety used in this Experiment was Swarna (v-38). The data was collected on five randomly selected plants from each plot and measurement of different observations was recorded. The treatments were represented as T0 (Control), T1 (Distilled water), T2 (PEG_{6000} @2%), T3 (Mannitol @2%), T4 (GA_3@100 ppm), T5 (Salicylic acid @ 100 ppm), T6 (IBA@ 100 ppm), T7 (KCl @ 2%)T8 (KNO_3 @2%), T9 ($Cacl_2$ @2%), T10 (Curry Leaf Extract @5%), T11(Moringa Leaf Extract @5%), T12 (Neem Leaf Extract @5%).

Results and Discussion

It is evident from the present investigation that priming treatments has significant effect on growth, quality and yield parameters in Cowpea. pre sowing seed treatment with T0 - Control, T1- Distilled water, T2- PEG_{6000} @2%, T3- Mannitol @2%, T4- GA_3 @100 ppm, T5 (Salicylic acid @ 100 ppm, T6- IBA @ 100 ppm, T7-KCl @ 2%, T8- KNO_3 @2%, T9- $Cacl_2$ @2%, T10- Curry Leaf Extract @5%, T11- Moringa Leaf Extract @5%, T12- Neem Leaf Extract @5% have positive effect on Growth, Yield and Seed quality parameters (Table 1 and 2).

Table.1 Mean performance of cowpea for ten growths and yielding attribute

S.No.	Treatments	Field Emergence percentage	Days to 50% Flowering	Plant height (cm)	Number of Branches Per Plant	Number of Pods Per Plant	Number of Seeds Per Pod	Seed yield per plant (g)	Seed yield per plot (g)	Biological yield (g)	Harvest index
1	**T_0**	75.00	42	69.96	5.00	6.00	8.90	14.78	200.02	678.97	29.48
2	**T_1**	82.67	36	81.66	5.67	7.40	10.15	20.51	266.59	814.60	32.79
3	**T_2**	**88.33**	**34**	**87.08**	**8.00**	**14.00**	**13.13**	**27.12**	**515.28**	**1348.75**	**38.21**
4	**T_3**	79.00	38	83.96	6.00	10.60	12.33	19.23	250.03	786.20	31.84
5	**T_4**	87.33	33	92.06	7.00	13.47	14.75	26.71	480.72	1290.15	37.35
6	**T_5**	88.67	34	90.95	7.00	12.00	13.67	25.30	430.16	1183.92	36.28
7	**T_6**	81.33	37	73.37	6.00	8.00	11.76	16.11	209.39	692.93	30.18
8	**T_7**	80.67	41	74.58	6.00	10.00	11.30	24.09	361.40	1016.86	35.73
9	**T_8**	85.00	35	82.49	7.00	10.35	12.73	20.48	266.28	793.62	33.56
10	**T_9**	84.00	36	72.15	6.00	7.67	10.96	18.82	244.66	767.17	32.03
11	**T_{10}**	78.33	38	84.54	7.00	6.69	9.75	23.51	352.70	1005.64	35.12
12	**T_{11}**	83.67	35	78.48	7.00	7.00	10.64	15.19	212.71	686.98	30.83
13	**T_{12}**	77.33	39	81.81	6.00	9.55	12.03	22.77	318.78	917.60	34.67
Grand Mean		**82.41**	**36.77**	**81.01**	**6.44**	**9.44**	**11.70**	**21.13**	**316.06**	**921.80**	**33.70**
F test		S	S	S	S	S	S	S	S	S	S
C.D.(5%)		5.02	4.67	4.86	2.38	1.37	1.40	4.75	72.48	210.92	2.28
SE(m)		2.13	1.94	2.01	0.82	0.47	0.48	1.63	24.83	72.26	0.78
SE(d)		3.01	2.75	2.84	1.15	0.66	0.68	2.30	35.12	102.20	1.10
C.V.		4.48	10.04	4.29	21.97	8.63	7.08	13.33	13.61	13.58	4.01

Table.2 Mean performance of cowpea for eight seedling characters

S.NO.	Treatments	Germination percentage	Root Length (cm)	Shoot Length (cm)	Seedling Length (cm)	Fresh Weight of Seedling (g)	Dry Weight of Seedling (g)	Seed Vigour Index-I	Seed Vigour Index-II
1	**T_0**	77.00	10.03	12.30	22.33	2.69	0.328	1721.38	25.17
2	**T_1**	84.25	10.59	12.05	22.64	3.14	0.386	1912.19	32.50
3	**T_2**	**91.00**	**14.47**	**20.20**	**34.41**	**5.71**	**0.779**	**3128.82**	**70.77**
4	**T_3**	81.75	13.26	15.70	28.96	4.87	0.577	2373.31	47.12
5	**T_4**	89.50	14.21	18.62	33.09	5.47	0.724	2962.47	64.54
6	**T_5**	88.00	14.01	17.52	31.53	5.33	0.666	2771.94	58.62
7	**T_6**	84.50	12.98	13.20	26.18	4.45	0.503	2212.77	42.52
8	**T_7**	78.25	13.26	14.40	27.66	4.69	0.547	2164.00	42.80
9	**T_8**	87.00	13.51	16.10	29.61	5.04	0.605	2579.97	52.63
10	**T_9**	86.00	11.63	12.60	24.23	3.74	0.414	2086.03	35.58
11	**T_{10}**	80.75	10.03	12.42	22.45	3.06	0.353	1815.19	28.51
12	**T_{11}**	85.25	11.03	12.25	23.28	3.31	0.395	1981.08	33.64
13	**T_{12}**	79.50	11.93	13.01	24.94	4.05	0.442	1981.97	35.13
Grand Mean		**84.06**	**12.38**	**14.64**	**27.02**	**4.27**	**0.517**	**2283.93**	**43.81**
F test		**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**
C.D.(5%)		2.95	2.59	3.43	4.19	0.44	0.12	376.59	10.25
SE(m)		1.03	0.90	1.20	1.46	0.15	0.04	131.65	3.58
SE(d)		1.46	1.28	1.69	2.07	0.22	0.06	186.18	5.07
C.V.		2.45	14.67	16.39	10.86	7.34	16.70	11.52	16.36

In general, most of the treatment was found effective in increasing the yield attributes at all stages significantly as compared to control. In the growth, yield attributing parameters such as Plant Height, the maximum was recorded in T4-GA_3 @100 ppm (92.06cms) and it was followed by T5-Salicylic acid @ 100 ppm (90.95cms) and the lowest was observed in T0-control, (69.96cms).

In Days to 50% Flowering the maximum was recorded in treatment T0 (control) and it was followed by treatment T7 (KCl @ 2%) and the minimum Days to 50% flowering was recorded in T2 (PEG_{6000} @2%). However in No. of Pods/plant, Seed yield/plant (gm), Seed yield/plot (gm),Biological yield, Harvest index the maximum was recorded in T2-PEG_{6000} @2% and it was followed by T_4-GA_3 @100 ppm with the least recorded in T0 (control). In Germination the maximum was recorded in T2-PEG_{6000} @ 2% (91.00%) and it was followed by T_4-GA_3 @ 100ppm (89.50%). In seedling length the maximum was recorded in T2-PEG_{6000} @ 2% (34.41cm) and it was followed by T_4-GA_3 @ 100 ppm(33.09 cm). In fresh weight and Dry weight of seedlings the maximum was recorded in T2-PEG_{6000} @2% (5.71g & 0.77g) respectively. In seed vigour index-I and seed vigour index-II the maximum was recorded in T2-PEG_{6000} @ 2% (3128.82 & 70.77) respectively. Based on the present investigation it is concluded that Seed priming with PEG_{6000} (2%) showed best results for all field parameters and lab parameters followed by GA_3 (100 ppm).

From the present investigation it is concluded that the Pre-sowing seed treatment increases the germinability and vigour of cowpea seeds, significantly in both lab and field condition. Pre-sowing treatment with polyethylene glycol (2%) followed by Gibberellic Acid (100 ppm), Salicylic Acid (100 ppm), Potassium nitrate(2%), Potassium Chloride

(2%) and Mannitol (2%) significantly increased the seed quality parameters of cowpea. Pre-sowing seed treatment with PEG_{6000} and GA_3 showed maximum increase in germinability and vigour of cowpea seeds and found to be lowest in control seeds. Priming of the cowpea seeds for 12 hrs, in which PEG_{6000} give best result to enhanced germinability, vigour and quality parameters. These conclusions are based on the results of six months investigation and therefore further investigation is needed to arrive at valid recommendations. The Pre-sowing seed treatment with PEG_{6000} are eco-friendly and economic in use.

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How to cite this article:

Yeluri Bharath Chandu, PulivarthiVineela, Arun Kumar Chaurasia, KandulaUma Maheswari and Bhavana Stella, N. 2020. Impact of Different Priming Methods on Growth, Yield and Seed Quality Parameters in Cowpea (*Vigna unguiculata* L.). *Int.J.Curr.Microbiol.App.Sci.* 9(12): 2691-2696. doi: https://doi.org/10.20546/ijcmas.2020.912.318