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EFFECT OF ORGANIC AND INORGANIC PRIMING TREATMENTS ON GERMINATION AND VIGOUR IN COWPEA (*Vigna unguiculata* L.)

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Abstract: Cowpea (*Vigna unguiculata* L.) is a member of the *Leguminaceae* family, which is a self-pollinated crop. The investigation on germination and its related parameters and experiment was conducted at Seed Science and Technology Laboratory, S. D. Agricultural University, Sardarkrushinagar. Recorded data analyzed by using Completely Randomized Design (CRD) with twelve seed priming treatments *viz.*, control (T_1), hydro priming (T_2), moringa leaf extract (2%) (T_3), moringa leaf extract (5%) (T_4), *Breejamrut* (5%) (T_5), cow urine (10%) (T_6), GA_3 (50 ppm) (T_7), GA_3 (100 ppm) (T_8), PEG-6000 (5.0%) (T_9), PEG-6000 (7.5%) (T_{10}), $ZnSO_4$ (0.025%) (T_{11}) and $ZnSO_4$ (0.05%) (T_{12}) for 2 hours and laboratory data showed that the higher value of germination percentage (96.78 %), root length (16.53 cm), shoot length (20.35 cm), seedling length (36.88 cm), root fresh weight (2.79 g), shoot fresh weight (3.26 g), seedling fresh weight (6.06 g), root dry weight (0.182 g), shoot dry weight (0.267 g), seedling dry weight (0.408 g), seedling vigour index I (3473.32) and seedling vigour index II (39.47) were observed with 7.5 % PEG-6000 treatment. So, suggesting that seed priming is a simple, low cost and environmentally friendly technique for improving seed germination and vigour of cowpea (GC-6).

Keywords: **seed germination, vigour, cowpea, PEG-6000**

INTRODUCTION

Cowpea (*Vigna unguiculata* L.) is generally known as lobiya, black eyed pea and choli with having 2n=22 chromosome number and belongs to the family *fabaceae.* Regular consumption of cowpeas reduces total cholesterol level, improves blood circulation, heart health and beneficial for diabetic people. Before sowing of seed, a process called seed priming carried out which includes hydrating of the seeds in sufficient quantities of solvent to allow metabolic processes before to its germination occur with avoiding radicle emergence and this strategy called priming. In order to prevent radicle arising prior to sowing, it involves soaking seeds in various solutions for a certain period under carefully regulated conditions, followed by drying them back to their original moisture content. Priming improves germination and emergence of seeds with also reversing the negative impacts of seed deterioration (Pawar and Laware, 2018).

Cowpea not only important for humans' dietary protein but also it contains fibre (11.3 g), fat (1.26 g), vitamins, minerals and carbohydrate. As compared to cereal, the protein in cowpea is richer in amino acids like lysine and tryptophan along with folic acid, vitamin B which prevents spinal tube abnormalities in children. (Affrifah *et al*., 2022).

Seed priming is considered as a simple, extremely effective, inexpensive, and risk-free approach which will be beneficial for uniform and early germination of seed (Pawar and Laware, 2018). In the process of seed germination, three stages are involved first stage is imbibition phase during this phase, the dormant seed takes water rapidly. Changes occur within the seed during this phase, such as the activation of metabolic activity and translation processes. Second stage is lag phase, also known as the activation stage. In this phase, there is a decrease in water intake compared to the imbibition phase and there is a slight increase in the fresh weight of the seeds. The lag phase is characterized by intense physiological and metabolic activity. During this stage protein synthesis occurs from newly formed mRNA molecules. Mitochondria also mature, leading to the generation of ATP (adenosine triphosphate). The germination phase is the third and final stage of seed germination. In this stage, the radicle, which developed during the lag phase, undergoes regrowth. The radicle is responsible for anchoring the seedling in the soil and absorbing water and nutrients. During the germination phase, there is a rapid intake of water by the seed (Pawar and Laware, 2018).

This study was designed to assess the role of organic and inorganic priming treatments such as hydro priming, moringa leaf extract, *Breejamrut*, cow urine, GA_3, PEG-6000, $ZnSO_4$ on seed germination and seedling vigour of cowpea. This experiment to investigate the comparative efficacy of different priming treatments and to suggest the most suitable priming treatments for cowpea seeds.

MATERIALS AND METHODS

These experiment to study the effect of different priming treatments on seed germination and seedling vigour, a laboratory trial was conducted at Seed Science and Technology Laboratory, S. D. Agricultural University, Sardarkrushinagar during *kharif* 2022. Recorded data analyzed by using Completely Randomized Design (CRD) was replicated three times with twelve seed priming treatments *viz*., control (T_1), hydro priming (T_2), moringa leaf extract (2%) (T_3), moringa leaf extract (5%) (T_4), *Breejamrut* (5%) (T_5), cow urine (10%) (T_6), GA_3 (50 ppm) (T_7), GA_3 (100 ppm) (T_8), PEG-6000 (5.0%) (T_9), PEG-6000 (7.5%) (T_{10}), $ZnSO_4$ (0.025%) (T_{11}) and $ZnSO_4$ (0.05%) (T_{12}) for 2 hours. Observation was germination percentage (According to ISTA), root length, shoot length, seedling length, root fresh weight, shoot fresh weight, seedling fresh weight, root dry weight, shoot dry weight, seedling dry weight, seedling vigour index-1 and seedling vigour index-2 (Abdul-Baki and Anderson, 1973).

1.Preparation of moringa leaf extract

Moringa leaf extract was prepared in laboratory by mixing 1 g dried and powdered leaves of *Moringa Oleifera* with 10 ml boiling water for 5 minutes. The mixture was then filtered twice through a 2 µm pore sterile filter paper into a sterile tube. The extract stock solution was freshly prepared and stored at 4 °C for up to 5 days. (Berkovich *et al.*, 2013)

2.Preparation of *Breejamrut* solution

Breejamrut was prepared in laboratory by mixing Cow dung (50 g), cow urine (50ml), fresh cow milk (50 ml), lime stone (2 g) and water (1 liter). All the ingredients are mixed thoroughly in a plastic jar and left for fermentation overnight (Vaish *et al.*, 2020).

STATISTICAL ANALYSIS

All data collected were analyzed by using Completely Randomized Design (CRD) and compare treatments means for results (Panse and Sukhatme, 1985).

RESULTS AND DISCUSSION

The effect of seed priming on germination percentage, root length, shoot length, seedling length, root fresh weight, shoot fresh weight, seedling fresh weight, root dry weight, shoot dry weight, seedling dry weight, seedling vigour index-1 and seedling vigour index-2 was highly significant (table-1).

Table 1: Analysis of variance (mean sum of square) for experimental design CRD of twelve treatments for various characters in cowpea

Source	d.f.	Germination (%)	Root length (cm)	Shoot Length (cm)	Seedling length (cm)
Treatments	11	46.26**	6.23**	7.55**	26.78**
Error	24	2.74	0.76	1.15	2.15

Table 4.1 continue…

Source	d.f.	Root fresh weight (g)	Shoot fresh weight (g)	Seedling fresh weight (g)	Root dry weight (g)
Treatments	11	0.70**	0.99**	3.22**	0.0034**
Error	24	0.02	0.02	0.09	0.0001

Table 4.1 continue…

Source	d.f.	Shoot dry weight (g)	Seedling dry weight (g)	Vigour index I	Vigour index II
Treatments	11	0.0055**	0.0176**	384808.58**	202.55**
Error	24	0.0001	0.0002	28570.36	1.96

Where, df= Degree of freedom

- **Germination percentage, root length, shoot length and seedling length (cm)**

Priming effect on germination percentage, root length, shoot length and seedling length revealed significant difference among all the treatments. Superior value of germination percentage (96.78 %), root length (16.53 cm), shoot length (20.35 cm) and seedling length (36.88 cm) recorded with treatment 7.5 % PEG-6000 followed by 5 % PEG-6000, 0.05 % $ZnSO_4$, 0.025 % $ZnSO_4$, 100 ppm GA_3 and 50 ppm GA_3 though, lowest value of germination percentage (85.44 %), root length (11.68 cm), shoot length (15.62 cm) and seedling length (27.30 cm) were observed with control. These results were also supported by the findings of Jat *et al*. (2015) in cluster bean, Mishra *et al*. (2017) in pigeon pea and Singh (2017) in pea.

- **Fresh and dry weight of root, shoot and seedling (g)**

From the data, it was concluded that the seed priming effect on fresh weight of root, shoot and seedling differed significantly among all the treatments. Highest fresh weight of root (2.79 g), shoot (3.26 g) and seedling (6.06 g) also dry weight of root (0.181 g), shoot (0.227 g) and seedling (0.408 g) were recorded with treatment 7.5% PEG-6000 followed by 5 % PEG-6000, 0.05 % $ZnSO_4$, 0.025 % $ZnSO_4$, 100 ppm GA_3 and 50 ppm GA_3 while, the lowest fresh weight of root (1.44 g), shoot (1.71 g) and seedling (3.16 g) also dry weight of root (0.097 g), shoot (0.124 g) and seedling (0.221 g) were reported with control as compared to the rest of other treatments. Present findings were also supported by the results of Singh (2017) in pea, Sohail *et al*. (2018) in kabuli chickpea, Afaryeem *et al*. (2018) in black gram, Ghasemi Golezani *et al*. (2008) in lentil and Uddin *et al*. (2021) in mung bean.

- **Seedling vigour index-I and vigour index-II**
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Data revealed that the priming effect on seedling vigour index–I and II significantly differed among all the treatments. Superior value of seedling vigour index–I (3473.32) and seedling vigour index-II (39.47) obtained with 7.5 % PEG-6000 treatment followed by 5 % PEG-6000, 0.05 % $ZnSO_4$, 0.025 % $ZnSO_4$, 100 ppm GA_3 and 50 ppm GA_3 although, lowest value of seedling vigour index–I (2495.97) and II (18.76) were observed with control as compared to all other treatments. These results were consistent with the findings obtained by Sadeghi *et al*. (2011), Singh (2017) in pea, Das *et al*. (2020) in rapeseed and mustard, Uddin *et al*. (2021) in mung bean.

Table 4.2: Effect of different priming treatments on seed germination, root length, shoot length and seedling length of cowpea

Priming Treatments	Germination (%)	Root length (cm)	Shoot length (cm)	Seedling length (cm)
Control	84.77	11.68	15.62	27.30
Hydro priming	87.26	12.88	16.32	29.20
Moringa leaf extract (2%)	90.22	14.52	17.23	31.75
Moringa leaf extract (5%)	93.55	14.82	18.30	33.12
Beejamrut (5%)	92.22	14.58	17.65	32.23
Cow urine (10%)	89.33	13.20	17.00	30.20
GA_3 (50 ppm)	94.89	15.33	18.92	33.92
GA_3 (100 ppm)	95.44	15.48	19.02	34.50
PEG-6000 (5%)	96.11	16.00	20.10	36.10
PEG-6000 (7.5%)	96.78	16.53	20.35	36.88
$ZnSO_4$ (0.025%)	95.66	15.65	19.66	35.31
$ZnSO_4$ (0.05%)	95.78	15.78	20.07	35.85
S.Em. ±	0.96	0.50	0.62	0.85
C.D. at 5%	2.79	1.47	1.81	2.47
C.V. %	**1.79**	**5.94**	**5.85**	**4.44**

Table 4.3: Effect of different priming treatments on fresh weight of root and shoot and seedling fresh weight of cowpea

Priming Treatments	Root fresh weight (g)	Shoot fresh weight (g)	Seedling fresh weight (g)
Control	1.44	1.71	3.16
Hydro priming	1.65	1.82	3.49
Moringa leaf extract (2 %)	2.03	2.39	4.42
Moringa leaf extract (5 %)	2.10	2.61	4.71
Beejamrut (5 %)	2.09	2.70	4.79
Cow urine (10%)	1.69	2.12	3.81
GA_3 (50 ppm)	2.57	3.13	5.68
GA_3 (100 ppm)	2.62	3.16	5.74
PEG-6000 (5 %)	2.75	3.22	5.91
PEG-6000 (7.5%)	2.79	3.26	6.06
$ZnSO_4$ (0.025 %)	2.64	3.16	5.79
$ZnSO_4$ (0.05 %)	2.68	3.19	5.83
S.Em. ±	0.08	0.08	0.18
C.D. at 5%	0.25	0.22	0.51
C.V. %	**6.47**	**4.90**	**6.13**

Table 4.4: Influence of different priming treatments on dry weight of root, shoot and seedling of cowpea

Priming Treatments	Root dry weight (g)	Shoot dry weight (g)	Seedling dry weight (g)
Control	0.097	0.124	0.221
Hydro priming	0.105	0.131	0.235
Moringa leaf extract (2 %)	0.116	0.144	0.260
Moringa leaf extract (5 %)	0.130	0.166	0.296
Beejamrut (5 %)	0.120	0.155	0.275
Cow urine (10%)	0.105	0.132	0.238
GA_3 (50 ppm)	0.169	0.216	0.386
GA_3 (100 ppm)	0.170	0.219	0.389
PEG-6000 (5 %)	0.179	0.225	0.404
PEG-6000 (7.5%)	0.181	0.227	0.408
$ZnSO_4$ (0.025 %)	0.171	0.221	0.392
$ZnSO_4$ (0.05 %)	0.175	0.222	0.397
S.Em. ±	0.004	0.005	0.008
C.D. at 5%	0.013	0.014	0.022

C.V. %	**5.42**	**4.73**	**4.08**

Table 4.5: Effect of different priming treatments on seedling vigour index-I and vigour index-II of cowpea

Priming Treatments	Seedling vigour index-I	Seedling vigour index-II
Control	2495.97	18.76
Hydro priming	2561.17	20.54
Moringa leaf extract (2 %)	2865.62	23.48
Moringa leaf extract (5 %)	3129.81	27.74
Beejamrut (5 %)	2972.82	25.39
Cow urine (10%)	2681.88	21.24
GA_3 (50 ppm)	3250.11	36.66
GA_3 (100 ppm)	3291.65	37.10
PEG-6000 (5 %)	3454.20	38.82
PEG-6000 (7.5%)	3473.32	39.47
$ZnSO_4$ (0.025 %)	3377.66	37.51
$ZnSO_4$ (0.05 %)	3433.94	38.02
S.Em. ±	97.59	0.81
C.D. at 5%	284.84	2.36
C.V. %	**5.48**	**4.60**

CONCLUSION

Our findings revealed that the treatment PEG-6000 (5 % and 7.5 %) found best in term of germination and its related parameters so, suggest PEG-6000 treatment improve the seed germination and vigour of cowpea seeds.

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