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

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Abstract

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., T0 – Control, T1 – DH2O, T2 – PEG6000 @ (2%), T3 – Mannitol @ (2%), T4 – GA3 @ (100 ppm), T5 – SA @ (100 ppm), T6 – IBA @ (100 ppm), T7 – KC1 @ (2%), T8 – KNO3 @ (2%), T9 – CaCl2 @ (2%), T10 – Curry leaf extract @ (5%), T11 – Moringa leaf extract @ (5%), T12 – 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 T2 – PEG6000 @ (2%). In field highest field emergence percentage observed in T5 – SA (100 ppm) and Plant height highest observed in T4 – GA3 @ (100 ppm), number of pods per plant, seed yield per plant, seed yield per plot, biological yield, harvest index was observed for T2 – PEG6000 @ (2%). Observed highest germination and yielding parameters in PEG6000 @ (2%). Pre-sowing seed treatment with PEG6000 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.

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

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 be able to sustain our production and we will turn to net exporter for pulses if everything goes as planned.

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 for 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 grown in Sabarkantha, Banaskantha, Mehasana, Patan, Ahmedabad, 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 untreated 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 (Bradford, 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 (PEG6000 @2%), T3 (Mannitol @2%), T4 (GA3@100 ppm), T5 (Salicylic acid @ 100 ppm), T6 (IBA@ 100 ppm), T7 ( KCl @ 2%)T8 (KNO3 @2%), T9 (CaCl2 @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- PEG6000 @2%, T3- Mannitol @2%, T4- GA3 @100 ppm, T5 (Salicylic acid @ 100 ppm, T6- IBA @100 ppm, T7-KCl @ 2%, T8- KNO3 @2%, T9- CaCl2 @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).

| 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) | Biologic al yield (g) | Harvest index |
|-------|------------|---------------------------|------------------------|-------------------|-----------------------------|-------------------------|-------------------------|------------------------|------------------------|------------------|--------------|
| 1     | T0         | 75.00                     | 42                     | 69.96             | 5.00                        | 6.00                    | 8.90                    | 14.78                  | 200.02                 | 678.97           | 29.48        |
| 2     | T1         | 82.67                     | 36                     | 81.66             | 5.67                        | 7.40                    | 10.15                   | 20.51                  | 266.59                 | 814.60           | 32.79        |
| 3     | T2         | **88.33**                 | **34**                 | **87.08**         | **8.00**                    | **14.00**               | **13.13**               | **27.12**              | **515.28**             | **1348.75**      | **38.21**    |
| 4     | T3         | 79.00                     | 38                     | 83.96             | 6.00                        | 10.60                   | 12.33                   | 19.23                  | 250.03                 | 786.20           | 31.84        |
| 5     | T4         | 87.33                     | 33                     | 92.06             | 7.00                        | 13.47                   | 14.75                   | 26.71                  | 480.72                 | 1290.15          | 37.35        |
| 6     | T5         | 88.67                     | 34                     | 90.95             | 7.00                        | 12.00                   | 13.67                   | 25.30                  | 430.16                 | 1183.92          | 36.28        |
| 7     | T6         | 81.33                     | 37                     | 73.37             | 6.00                        | 8.00                    | 11.76                   | 16.11                  | 209.39                 | 692.93           | 30.18        |
| 8     | T7         | 80.67                     | 41                     | 74.58             | 6.00                        | 10.00                   | 11.30                   | 24.09                  | 361.40                 | 1016.86          | 35.73        |
| 9     | T8         | 85.00                     | 35                     | 82.49             | 7.00                        | 10.35                   | 12.73                   | 20.48                  | 266.28                 | 793.62           | 33.56        |
| 10    | T9         | 84.00                     | 36                     | 72.15             | 6.00                        | 7.67                    | 10.96                   | 18.82                  | 244.66                 | 767.17           | 32.03        |
| 11    | T10        | 78.33                     | 38                     | 84.54             | 7.00                        | 6.69                    | 9.75                    | 23.51                  | 352.70                 | 1005.64          | 35.12        |
| 12    | T11        | 83.67                     | 35                     | 78.48             | 7.00                        | 7.00                    | 10.64                   | 15.19                  | 212.71                 | 686.98           | 30.83        |
| 13    | T12        | 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             |              |
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-GA3 @100 ppm (92.06/cms) and it was followed by T5-Salicylic acid @100 ppm (90.95/cms) and the lowest was observed in T0-control, (69.96/cms).

In Days to 50% Flowering the maximum was recorded in treatment T0 (control) and it was followed by treatment T7 (KCI @ 2%) and the minimum Days to 50% flowering was recorded in T2 (PEG6000 @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-PEG6000 @2% and it was followed by T4-GA3 @100 ppm with the least recorded in T0 (control). In Germination the maximum was recorded in T2-PEG6000 @ 2% (91.00%) and it was followed by T4-GA3 @ 100ppm (89.50%). In seedling length the maximum was recorded in T2-PEG6000 @ 2% (34.41cm) and it was followed by T4-GA3 @ 100 ppm (33.09 cm). In fresh weight and Dry weight of seedlings the maximum was recorded in T2-PEG6000 @2% (5.71g & 0.77g) respectively. In seed vigour index-I and seed vigour index-II the maximum was recorded in T2-PEG6000 @ 2% (3128.82 & 70.77) respectively. Based on the present investigation it is concluded that Seed priming with PEG6000 (2%) showed best results for all field parameters and lab parameters followed by GA3 (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

### Table 2: Mean performance of cowpea for eight seedling characters

| S.NO. | Treatment | 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     | T0        | 77.00                 | 10.03            | 12.30            | 22.33                | 2.69                        | 0.328                       | 1721.38            | 25.17               |
| 2     | T1        | 84.25                 | 10.59            | 12.05            | 22.64                | 3.14                        | 0.386                       | 1912.19            | 32.50               |
| 3     | T2        | 91.00                 | 14.47            | 20.20            | 34.41                | 5.71                        | 0.779                       | 3128.82            | 70.77               |
| 4     | T3        | 81.75                 | 13.26            | 15.70            | 28.96                | 4.87                        | 0.577                       | 2373.31            | 47.12               |
| 5     | T4        | 89.50                 | 14.21            | 18.62            | 33.09                | 5.47                        | 0.724                       | 2962.47            | 64.54               |
| 6     | T5        | 88.00                 | 14.01            | 17.52            | 31.53                | 5.33                        | 0.666                       | 2771.94            | 58.62               |
| 7     | T6        | 84.50                 | 12.98            | 13.20            | 26.18                | 4.45                        | 0.503                       | 2212.77            | 42.52               |
| 8     | T7        | 78.25                 | 13.26            | 14.40            | 27.66                | 4.69                        | 0.547                       | 2164.00            | 42.80               |
| 9     | T8        | 87.00                 | 13.51            | 16.10            | 29.61                | 5.04                        | 0.605                       | 2579.97            | 52.63               |
| 10    | T9        | 86.00                 | 11.63            | 12.60            | 24.23                | 3.74                        | 0.414                       | 2086.03            | 35.58               |
| 11    | T10       | 80.75                 | 10.03            | 12.42            | 22.45                | 3.06                        | 0.353                       | 1815.19            | 28.51               |
| 12    | T11       | 85.25                 | 11.03            | 12.25            | 23.28                | 3.31                        | 0.395                       | 1981.08            | 33.64               |
| 13    | T12       | 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
- C.D.(5%) S S S S S S S S
- SE(m) 2.95 2.59 3.43 4.19 0.44 0.12 376.59 10.25
- SE(d) 1.03 0.90 1.20 1.46 0.15 0.04 131.65 3.58
- C.V. 1.46 1.28 1.69 2.07 0.22 0.06 186.18 5.07
- 2.45 14.67 16.39 10.86 7.34 16.70 11.52 16.36
(2%) and Mannitol (2%) significantly increased the seed quality parameters of cowpea. Pre-sowing seed treatment with PEG6000 and GA3 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 PEG6000 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 PEG6000 are eco-friendly and economic in use.

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