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Effect of organic priming on germination and vigour of cotton (*Gossypium hirsutum* L.) seed

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Abstract

The experiment was conducted in Seed science post Graduate Laboratory, Department of Genetics and Plant Breeding, SHUATS, Allahabad, U.P. In order to standardize the best method of Organic priming specific to cotton, two methods of priming viz., Organic priming and hydropriming and they were evaluated by screening a range of durations and concentrations viz., T₀ - Unprimed Control, T₁ - Distilled water hydration (for 12 hrs), T₂ - Cow urine at 2%, T₃-Cow urine at 6%, T₄ -Cow urine at 10%, T₅ - Curry leaf extract 6%, T₆- Curry leaf extract 10%. It found that all the Organic priming methods showed significance difference with the control and the highest germination %, seedling length (cm), seedling fresh weight (g), seedling dry weight (g) and vigour index were observed in T₃ for Cow urine at 6%. The study helps to improve the quality of seeds with the help of seed organic priming treatments which are cost effective and economic, nontoxic, ecofriendly sources.

Keywords: Cotton (*Gossypium hirsutum* L.), organic priming, cow urine, curry leaf extract, Hydropriming

1. Introduction

Cotton (*Gossypium* sp.) the “white gold” and “king of fibers”, is closely linked to human civilization itself. The English term cotton derives its name from Arabic word “Quotri”, Dutch ‘Katoem’ and French ‘Cotton’. Archaeologists have discovered cotton fibers more than 4,000 years ago in coastal Peru and at Mohenjo-Daro in the Indus valley (Pakistan). But the origin of cotton is shrouded in mystery. India is considered the home of arborium cottons. But *Gossypium* was possibly introduced into Western India from Arabia, Persia and Baluchistan. Cotton is cultivated in tropical and subtropical regions of more than seventy countries across the world and enjoys a predominant position amongst all cash crops in India.

Due to environmental concerns, there is an urgent need to reduce the use of chemical fertilizers and pesticides in agriculture and horticulture and alternative to chemicals are being sought to improve crop establishment and health. One option is the use of organics nutrients or growth regulators to seed or roots, which may promote plant growth or provide diseases control through a variety of mechanisms, including supply of organic nutrients production of plant hormones, antibiotic or enzyme; induced systemic resistance; direct parasitism of plant pathogen or deleterious micro-organisms; or competition with pathogen for or nutrients. Further, organic seed is a crucial link in the chain from research to organic seed production and ultimate supply of high quality seed at reasonable price to the commercial seed producing farmers for promotion of organic seed production. Hence, the safe and feasible approach is the priming of seeds with organics which are safe, ecofriendly, economical and easily available. Organic seed priming provides hardiness to high temperature, low moisture especially in semiarid tropics. It promotes faster germination, higher seedling vigour leading to higher crop productivity. The main benefits of organic seed treatments include increased phosphate levels, nitrogen fixation and root development.

Cow urine contains about 1.0% nitrogen, traces of P₂O₅ and 1.0% of K₂O. Approximately 2400 to 2500 L of urine are produced per year per animal. If this urine were not conserved, nitrogen in the urine, which is mainly in the form of urea, would be quickly lost as ammonia. It is also considered as a natural disinfectant and pest repellent and forms the main component of Panchagavya (an organic crop booster prepared and sprayed by Indian farmers) (Tharmaraj *et al.*, 2011) [16]. Organic seeds priming is more affordable so even small scale farmers can practice.

Curry leaves have been used for centuries almost in all the parts of the world. This herb has several medicinal properties. For instance, its leaves and bark can be used as a tonic, stomachic, stimulant and carminative. It can also help in reducing blood sugar if these leaves are consumed early in the morning in empty stomach.

Curry leaves are also a good source of vitamin A and they provide a rich source of calcium. Curry leaves are a great source of various vitamins and minerals. These include vitamin C, Vitamin A, folic acid, niacin, thiamin and riboflavin. Each of these vitamins plays an important role in development. Vitamin C is important for strengthening the immune system. Thiamin is known to have a role in organ and nervous system development. Other than vitamins and minerals, studies have shown that curry leaves contain antioxidants which are useful against free radical damage and oxidative stress in the body.

2. Materials and Methods

The experiment was conducted in Seed science post Graduate Laboratory, Department of Genetics and Plant Breeding, SHUATS, Allahabad, U.P.

Genetically pure seeds of cotton hybrid JK CH 8665 BG 2 used for the study. The seeds were treated with cow urine at the concentration of 2, 6 and 10% and curry leaf extract at the concentration of 6 and 10% along with distilled water and dry seed as control. The seeds were tested for the standard germination test adopting between paper (BP) method and sand method as per the ISTA rules. Locally available cow urine is used for organic seed priming which acts as growth promoter by preventing plant disease. 2, 6, and 10 ml of cow urine were added separately in 100 ml water to get 2%, 6%, 10% of solution which were used for seed treatment as per the required weight by volume ratio of seed to solution. Curry leaf extract solution was prepared by according to Sathish Chand Saini (2013) [14] and distilled water solution was prepared by according to Seed to solution ratio of 1:0.5, were made and soaked to 8 hours for cotton. Then seeds were dried overnight.

The data collected from the experiments were analyzed statistically by the procedure prescribed by The investigations are details of materials and using of experimental design in complete randomized block methods. Critical difference were calculated at 1% level wherever 'F' test was significant. The data on percentage of germination and seed infection were

transferred into arc sine square root percentage values and the transferred data were used for statistical analysis. Absolute control treatment was compared with rest of the treatment by following ANOVA statistical analysis.

3. Result and Discussion

3.1 Germination (%)

A range of 70.25 to 83.25 percent was observed for germination percentage. The mean value for this parameter was 73.43 percent. Maximum germination percentage (83.25) was recorded with T₃ Cow urine at 6%. Whereas minimum significantly germination percentage followed by (73.25) with T₅ application of Curry leaf extract 6%. Minimum germination percentage was recorded by T₀ (70.25) with control.

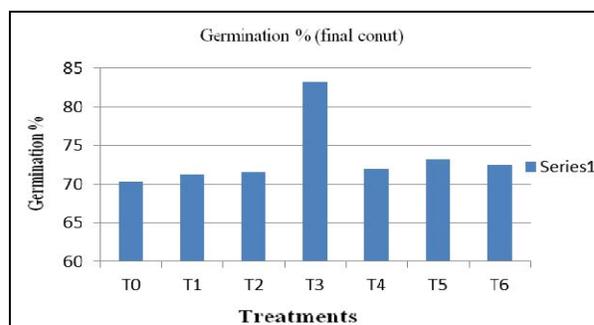


Fig 1: Germination percentages as Influence by different Organic priming treatments on cotton seeds

3.2 Speed of germination

A range of 69 to 78 percent was observed for germination percentage. The mean value for this parameter was 72.14 percent. Maximum germination percentage was recorded with T₃ Cow urine at 6% (78.00). Whereas minimum significantly germination percentage followed by T₅ with application of Curry leaf extract 6% (74.00). Minimum germination percentage was recorded by T₀ (69) with control.

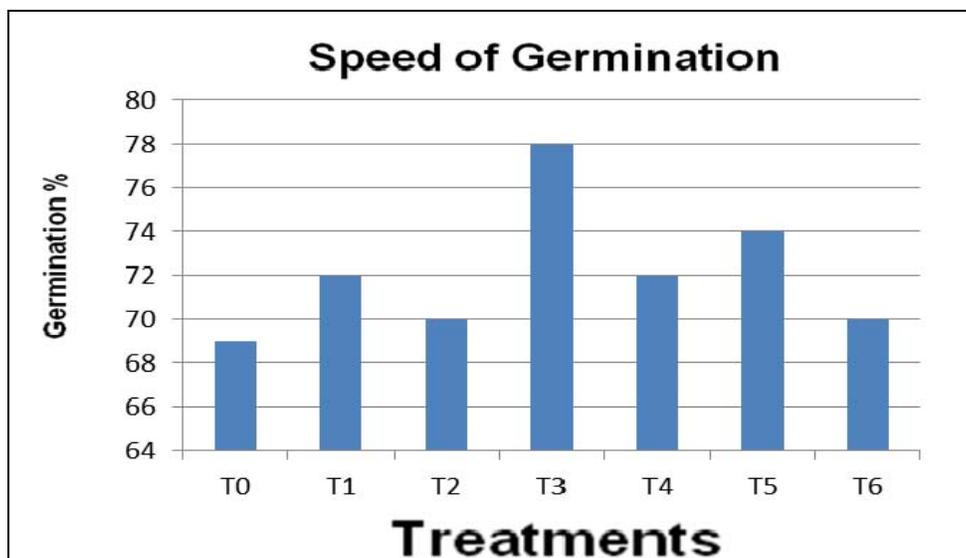


Fig 2: Speed of germination as Influence by different Organic priming treatments on cotton seeds

3.3 Root length

The mean performance of seedling root length ranged from 11.15 cm to 16.54 cm with mean value of 13.21 cm. Maximum root length (16.54 cm) was recorded by T₃ with

application Cow urine at 6% and it was followed by T₅ (14.67 cm) with application of Curry leaf extract 6%. Minimum root length was recorded by T₀ (11.15 cm) with control.

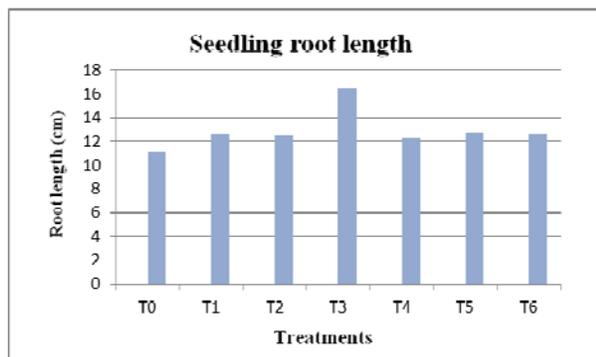


Fig 3: Root length (cm) as Influence by different Organic priming treatments on cotton seeds

3.4 Shoot length

Among shoot length there exists a significant variation as influenced by organic priming methods and seeds primed with T₃ with application of Cow urine at 6% (17.39 cm) has highest root length, control (10.63 cm) has lowest root length. Seeds primed with cow urine at 2% and hydro primed seeds (11.83), curry leaf extract 10% (12.81) have statistically on par results.

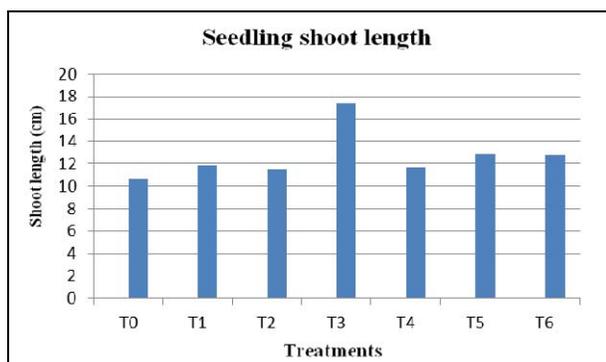


Fig 4: Shoot length (cm) as Influence by different Organic priming treatments on cotton seeds

3.5 Seedling length

The mean performance of seedling length ranged from 22.66 cm to 29.38 cm with mean value of 25.01 cm. Maximum seedling length (29.38 cm) was recorded by T₃ with application of Cow urine 6% and it was followed by T₅ (26.20 cm) with application of Curry leaf extract 6%. Shortest seedling length was recorded by T₀ (22.66 cm) with control.

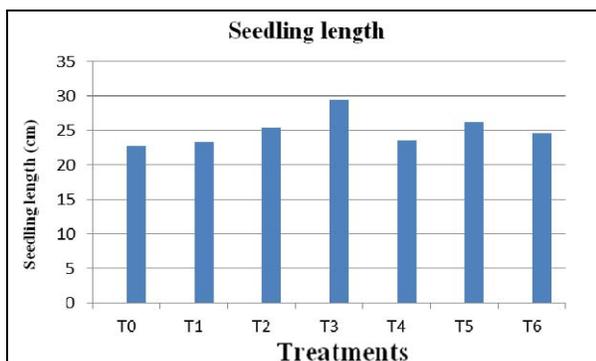


Fig 5: Seedling length (cm) as Influence by different Organic priming treatments on cotton seeds

3.6 Seedling fresh weight

The mean performance of seedling fresh weight ranged from 5.47 g to 7.46 g with mean value of 6.38 g. Maximum seedling fresh weight (7.46 g) was recorded by T₃ with application of Cow urine 6% and it was followed by T₅ (6.68 g) with application of Curry leaf extract 6%. Lowest value of seedling fresh weight was recorded by T₀ (5.47 g) with control.

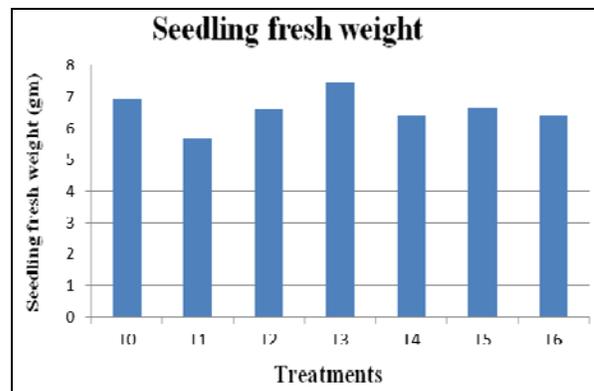


Fig 6: Seedling fresh weight (g) as Influence by different Organic priming treatments on cotton seeds

3.7 Seedling dry weight

The mean performance of seedling dry weight ranged from 1.11 mg to 1.66 mg with mean value of 1.26 mg. Maximum seedling fresh weight (1.66 mg) was recorded by T₃ with application of Cow urine 6% and it was followed by T₅ (1.50 mg) with application of Curry leaf extract 6%. Lowest value of seedling fresh weight was recorded by T₀ (1.11 g) with control.

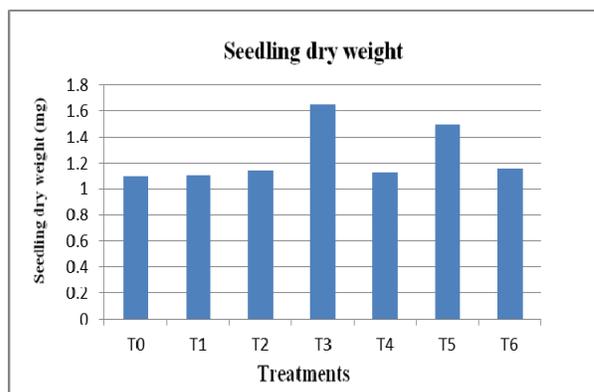


Fig 7: Dry weight of seedling (g) as Influence by different Organic priming treatments on cotton seeds

3.8 vigour Index I

The mean performance of seedling vigour index length ranged from 165.38 to 223.11 with mean value of 181.22. Maximum seedling vigour index length (223.11) was recorded by T₃ with application of Cow urine at 6% and it was followed by T₅ (192.21) with application of Curry leaf extract 6%. Minimum seedling vigour index length was recorded by T₀ (165.38) with control.

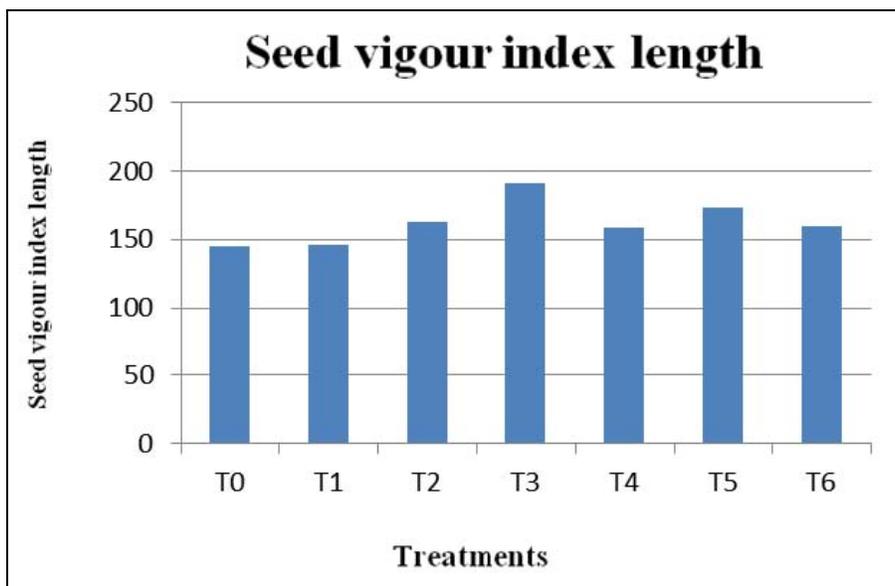


Fig 8: Seed vigour index I as Influence by different Organic priming treatments on cotton seeds

3.9 Seed vigour Index II

The mean performance of seedling vigour index mass ranged from 77.46 to 137.72 with mean value of 93.042. Maximum seedling vigour index mass (137.72) was recorded by T₃ with application of Cow urine at 6% and it was followed by T₅ (109.56) with application of Curry leaf extract 6%. Minimum seedling vigour index mass was recorded by T₀ (77.46) with control.

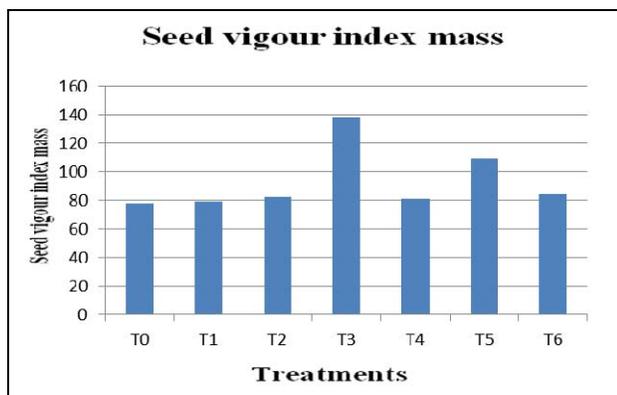


Fig 9: Seed vigour index II as Influence by different Organic priming treatments on cotton seeds

4. Conclusion

All the priming methods have positive influence on seed quality parameters of cotton individually but the effect of priming method was found significant. Speed of germination and Germination percentage (78 and 83.25%) respectively and were highest in Cow urine at 6% seeds and it was significantly low in unprimed (control) seeds (69 and 70.25%). However seedling attributes were also positively influenced by organic priming and highest seedling length (29.38 cm) and seedling dry weight (1.66 mg) was observed in Cow urine at 6% seeds followed by Curry leaf extract 6%. Seeds having seed vigour index length and seed vigour index mass (191.60 and 137.72 mg) respectively and found to be lowest in unprimed seeds having seedling attributes (145.06 and 77.46 mg respectively).

Organic Priming increases the germinability and vigour of cotton seeds, significantly in lab condition. Cow urine at 6% and Curry leaf extract 6% significantly increased the germination and vigour of cotton. Organic priming of the cotton seeds for 12 hrs. enhanced germinability, vigour of cotton seeds. These conclusions are based on the results of three months investigation and therefore further investigation is needed to arrive at valid recommendations.

Table 1: Analysis of variance for 8 seedling characters in cotton

S. No.	Characters	Mean sum of squares		
		Replication (d. f. = 03)	Treatments (df=6)	Error (df=21)
1.	Germination percentage	6.000	78.643**	20.905
2.	Speed of germination	4.952	37.536**	11.833
3.	Root length	5.457	12.921**	1.390
4.	Shoot length	0.838	19.739**	1.265
5.	Seedling length	6.734	20.879**	2.022
6.	Seedling fresh weight	0.186	1.764**	0.175
7.	Seedling dry weight	0.004	0.198**	0.002
8.	Seed vigour index length	464.972	1798.270**	209.675
9.	Seed vigour index mass	30.372	2030.699**	36.332

** significant at 5% and 1% level of significance, respectively.

Table 2: Mean performance of cotton for 9 seedling characters

S. No	Treatments	Germination %	Speed of germination	Root Length (cm)	Shoot Length (cm)	Seedling Length (cm)	Fresh Weight of Seedling (g)	Dry Weight of Seedling (g)	Seed Vigour Index Length	Seed Vigour Index Mass
1	T ₀	70.25	69	11.15	10.63	22.66	5.47	1.11	165.38	77.46
2	T ₁	71.25	72	12.60	11.83	23.53	5.67	1.11	166.33	78.97
3	T ₂	71.50	70	12.55	11.51	25.34	6.64	1.15	180.76	81.97
4	T ₃	83.25	78	16.54	17.39	29.38	7.46	1.66	223.11	137.72
5	T ₄	72.00	72	12.34	11.63	23.34	6.39	1.13	162.82	81.30
6	T ₅	73.25	74	14.67	12.85	26.20	6.68	1.50	192.21	109.56
7	T ₆	72.50	70	12.62	12.81	24.57	6.40	1.16	177.98	84.32
G.MEAN		73.42	72.14	13.21	12.66	25.01	6.38	1.26	182.22	93.042
C.D.(5%)		6.723	5.058	1.733	1.654	2.091	0.615	0.065	21.293	8.864
SE(m)		2.286	1.720	0.589	0.562	0.711	0.209	0.022	7.240	3.014
C.V.		6.227	4.759	8.925	8.881	5.688	6.553	3.502	7.990	6.478

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