

Original Research Article

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Influence of Seed Fortification on Growth, Yield and Yielding Attributes of Cluster Bean [*Cyamopsis tetragonoloba* (L.)]

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ABSTRACT

Cluster bean (*Cyamopsis tetragonoloba* L.) popularly known as guar is a drought tolerant, deep-rooted, annual legume is grown for Vegetable, Food, Fodder, Green manure, Gum and as a seed. The fortification of seeds for better Growth and Yield has become important and emphasized. The study was conducted to determine the “Influence of seed fortification on growth, yield and seed quality in cluster bean (*Cyamopsis tetragonoloba* (L.)). 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 experiment was laid out in Randomised Blocked Design and comprised of 13 treatments and 3 replications. The treatments were T₀ (Control), T₁ (KH₂PO₄@1%), T₂ (ZnSO₄ @1%), T₃ (MgSO₄ @1%), T₄ (KNO₃@2%), T₅ (Gibberlic Acid@ 200 ppm), T₆ (Salislic Acid@ 2 ml), T₇ (*Pongamia* Leaf Extract@1%), T₈ (*Moringa* Leaf Extract@1%), T₉ (*Curry* Leaf Extract@1%), T₁₀ (*Neem* Seed Kernal Extract @5%), T₁₁(*Cow* Urine@10%), T₁₂ (*Coconut* Water@20 ml) with a soaking duration of 3 hours. The results revealed that seeds fortified with T₁-KH₂PO₄@ 1% improved Germination% and T₄ (KNO₃@2%) improved the Growth, yield and yielding attributes and the least performance was observed in T₀ (control) when compared with other treatments. There was an improvement in seed yield due to T₄ (KNO₃@2%) fortification than unfortified seeds. Hence, seed fortification with 2% of KNO₃ could be recommended for cluster bean as a pre-sowing seed treatment.

Keywords

Cluster bean,
Treatment
Combinations,
Fortification,
Growth, Yield

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Introduction

Cluster bean (*Cyamopsis tetragonoloba* (L.)) also known as gaur, guwar, or guvar bean is an annual self-pollinated leguminous crop and belongs to the family Fabaceae (Hymowitz and Matlock, 1963). The origin of the Cluster

bean has been suggested in India and Pakistan and tropical Africa (Vavilov, 1951). It is assumed to have developed from the African species *Cyamopsis senegalensis*. It is a drought tolerant, deep-rooted, annual legume, used as vegetable, Seed, Green manure, Fodder. It is also used for making gum, which

is used in Oil refineries and Petroleum Industry. It is an important short duration (90-120 days) crop of high nutritive value having high nitrogen fixing ability and is grown during *kharif* as well as summer seasons in arid and semi-arid regions of India. Cluster bean is cultivated mostly in India, Pakistan, USA, Italy, Morocco, Germany, and Spain (Punia *et al.*, 2009).

Young pods are good source of protein, carbohydrate, vitamins ('A' and 'C'), and important minerals like calcium and iron (Kumar and Singh 2002). The endosperm of guar seed contains an important hydrocolloid named galactomannan. Mucilaginous seed flour is used for making guar gum (galactomannan) utilized in textile, paper, cosmetic and oil industries throughout the world and is a useful absorbent for explosives (Smith, 1976). The galactomannan due to its thicker, binder and stabilizing specific qualities, has a diversified industrial applications viz. paper, food, cosmetics, explosives, mining, petroleum, pharmaceuticals and well drilling etc. Recent rise in demand of guar in International market as a gum is attributed to its use in mining industry and petrochemical, where its use as viscous agent has been revolutionized the petrochemical industry and resulted in considerable increase in global natural gas production (Falasca *et al.*, 2015). The cluster bean gum used as: (i) agriculture – as anti-crushing agent and water retainer, (ii) petroleum industry – as gelling and thickening agent, (iii) textile and juice industry – for sizing, as thickener and stabilizer, (iv) waste water purification – as a gelatinising agent, (v) explosives – waterproofing agent, (vi) mining, and (vii) pharmaceutical industries (Girish *et al.*, 2012). Because of its industrial value, guar seed has great demand from foreign countries like USA, Germany, Britain, Italy, France, UAE, China, Japan, South Africa, Hong Kong

and Australia etc. Further, cluster bean meal (husk and germ) are used as high protein cattle feed (Rai and Dharmatti, 2013).

India is the major guar producer accounting for 80% of the world's production. In India, guar is being grown mainly in arid and semiarid regions of North Western states of Rajasthan, Gujarat, Haryana, Punjab, parts of Uttar Pradesh, Madhya Pradesh and Tamil Nadu. It is grown approximately in an area of 3.44 million ha, with a production of 2.21 million tonnes and has productivity of 644 kg/ha (Directorate of Extension and Statistics, 2012). Rajasthan occupies the largest area under guar cultivation (82.1%), followed by Haryana (8.6%), Gujarat (8.3%) and Punjab (1%) which in turn produced 64, 22.12 and 2% guar seeds, respectively (Pathak *et al.*, 2010). Rajasthan is the largest producer accounting for 70% of total guar production of the country followed by Gujarat, Haryana and Punjab. The productivity of cluster bean ranges from 474 kg/ha in Rajasthan to 1200 kg/ha in Haryana (Ahlawat *et al.*, 2013).

Seed fortification is one of the ways in which the seedling may have improved competitive ability which may improve the establishment of seedlings under field condition and thereby could compete aggressively with weeds (Cooks, 1980). The Seed fortification has resulted in some outstanding achievements in growth and production of a number of crops. Seed fortification is a physiological method of seed invigoration that aids in improving the initial stamina of seed that helps in improving the initial field stand and that of final yield. Seed fortification is the impregnation of the needy substance into the seed through the imbibition phase and enriches the endogenous level of the needy bioactive substances. Therefore the main objective of seed fortification is to invigorate the seed for better establishment and improved productivity. Sometimes it is also used as protective

treatment. The seed fortification has resulted in excellent growth and production in number of crops. In the present investigation also, seed fortification had a significant positive influence on the plant growth and seed yield parameters.

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 and the genotype used in this Experiment was GR-6. 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 (KH₂PO₄@1%), T₂ (ZnSO₄ @1%), T₃ (MgSO₄ @1%), T₄ (KNO₃@2%), T₅ (Gibberlic Acid@ 200 ppm), T₆ (Salislic Acid@ 2 ml), T₇ (*Pongamia* Leaf Extract@1%), T₈ (*Moringa* Leaf Extract@1%), T₉ (Curry Leaf Extract@1%), T₁₀ (Neem Seed Kernal Extract @5%), T₁₁(Cow Urine@10%), T₁₂ (Coconut Water@20 ml).

Results and Discussion

It is evident from the present investigation, influence of seed fortification with T₀

(Control), T₁ (KH₂PO₄@1%), T₂ (ZnSO₄ @1%), T₃ (MgSO₄ @1%), T₄ (KNO₃@2%), T₅ (Gibberlic Acid@ 200 ppm), T₆ (Salislic Acid@ 2 ml), T₇ (*Pongamia* Leaf Extract@1%), T₈ (*Moringa* Leaf Extract@1%), T₉ (Curry Leaf Extract@1%), T₁₀ (Neem Seed Kernal Extract @5%), T₁₁(Cow Urine@10%), T₁₂ (Coconut Water@20 ml) have positive effect on the growth, yield and yield attributes. 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 field emergence, the maximum was recorded in T₁-KH₂PO₄@ 1% (94.07) and it was followed by T₅-Gibberlic acid @ 200 ppm, (92.08) and the lowest was Observed in T₀-control, (82.87).

In Plant Height the maximum was recorded in T₄- KNO₃@2%(129cms) and it was followed by T₁-KH₂PO₄ @ 1% (120.33cms) and the lowest was observed in T₀-control,(79cms).In Days to 50% Flowering and Days to maturity the maximum was recorded in treatment T₀ (control) and it was followed by treatment T₁₂(Coconut Water@20 ml) and the the minimum Days to 50% flowering and Days to 50% maturity was recorded in T₄ (KNO₃@2%). However in No. of clusters/plant, No. of Pods/clusters, No. of Pods/plant, Pod length (cm), Seed yield/plot (gm), the maximum was recorded in T₄(KNO₃@2%)and it was followed by T₂(ZnSO₄ @1%) with the least recorded in T₀ (control).

Based on the present investigation it is concluded that the treatment combinationT₁-KH₂PO₄@ 1% was found best in terms of Field emergence and the treatment combination T₄ (KNO₃@2%) was found best in the Growth and Yield parameters and it was followed by treatment T₂(ZnSO₄ @1%) as compared to the treatment T₀ (Control).

Table.1 Mean performance of growth and yield parameters in cluster bean

Treatments	Field emergence	Plant height (cm)	Days to 50% flowering	Days to maturity	No. of clusters/plant	No. of Pods/clusters	No. of Pods/plant	Pod length (cm)	Seed yield/plot (gm)
T₀	82.87	79.00	36.33	108.33	9.83	3.82	37.622	6.80	313.38
T₁	94.07	120.33	28.33	97.33	11.67	4.95	57.666	8.26	370.28
T₂	91.79	103.67	27.33	95.33	12.10	5.30	64.0767	9.11	391.72
T₃	88.66	119.00	27.67	96.33	11.93	5.13	61.2833	8.69	384.61
T₄	90.33	129.00	26.33	94.67	12.67	5.83	73.8633	9.83	416.65
T₅	92.08	117.33	28.67	97.67	11.97	4.95	59.2687	8.57	373.60
T₆	87.30	107.33	29.33	98.33	11.30	4.42	49.9863	7.86	369.83
T₇	89.14	98.67	32.67	102.33	10.50	4.54	47.6777	8.55	365.12
T₈	88.18	93.00	34.33	104.67	10.53	4.26	44.8667	7.82	341.40
T₉	85.42	99.00	33.67	103.33	10.27	4.33	44.4703	7.22	323.16
T₁₀	87.07	118.00	31.33	100.33	10.10	4.79	48.4033	7.35	349.37
T₁₁	90.23	106.67	30.67	99.67	11.47	4.43	50.7967	8.75	377.34
T₁₂	85.82	93.67	34.67	105.67	10.73	4.40	47.1667	7.36	334.92
Mean	88.69	106.51	30.87	100.31	11.16	4.71	52.8575	8.17	362.41
CD	1.65055	3.39366	0.62802	0.958	0.57028	0.15667	2.71496	0.17831	16.7614
SE. m	0.97946	2.01384	0.37267	0.569	0.33841	0.09297	1.61109	0.10581	9.94642
SE. d	0.79973	1.64429	0.30429	0.4643	0.27631	0.07591	1.31545	0.08639	8.12122

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