E-ISSN: 2618-0618
P-ISSN: 2618-060X

NAAS Rating (2025): 5.20
www.agronomyjournals.com
2025; 8(8): 985-989
Received: 19-06-2025
Accepted: 21-07-2025

Anju Ghasil
Research Scholar, Department of Agronomy, Sri Karan Narendra Agriculture University, Jobner, Jaipur, Rajasthan, India

BL Dudwal
Assistant Professor, Sri Karan Narendra Agriculture University, Jobner, Jaipur, Rajasthan, India

Roshan Choudhary
Deputy Director of Research, Sri Karan Narendra Agriculture University, Jobner, Jaipur, Rajasthan, India

Mamta Ghasil
Ph.D. Scholar, Department of Genetics and Plant Breeding, Sri Karan Narendra Agriculture University, Jobner, Jaipur, Rajasthan, India

Divya Soni
Anju Ghasil
Research Scholar, Department of Agronomy, Sri Karan Narendra Agriculture University, Jobner, Jaipur, Rajasthan, India

Corresponding Author:
Anju Ghasil
Research Scholar, Department of Agronomy, Sri Karan Narendra Agriculture University, Jobner, Jaipur, Rajasthan, India

Productivity and quality of mungbean [*Vigna radiata* (L.) Wilczek] as influenced by seed hardening and foliar spray of panchgavya

Anju Ghasil, BL Dudwal, Roshan Choudhary, Mamta Ghasil and Divya Soni

DOI: https://www.doi.org/10.33545/2618060X.2025.v8.i8n.3694

Abstract
A field experiment entitled “Productivity and Quality of Mungbean as Influenced by Seed Hardening and Foliar Spray of Panchgavya” conducted at Agronomy farm, S.K.N. College of Agriculture, Jobner (Rajasthan) during the *Kharif* season, 2024 on loamy sand soil. The experiment was laid out in factorial randomized block design with three replications. The mungbean crop under the influence of seed hardening with $CaCl_2$ @ 2% recorded significantly higher growth parameters *viz.*, plant height (51.26 cm), number of branches per plant (7.95), dry matter accumulation (29.99 g/plant) and seed yield (983 kg/ha).It also recorded maximum quality parameters *viz.*, nitrogen (3.62%), protein content (22.65%), total nitrogen uptake (71.63 kg/ha), phosphorus uptake (14.13 kg/ha) and potassium uptake (47.57 kg/ha)and treatments KNO_3 @ 1%, KH_2PO_4 @ 2% and KCl @ 1% remained at par to each other but significantly higher than control.
Foliar spray of panchgavya @ 5% significantly showed improved growth parameters *viz.*, plant height (51.83 cm), number of branches per plant (8.14), dry matter accumulation (30.17 g/plant) at harvest and seed yield (984 kg/ha). Foliar spray of panchgavya @ 5% also recorded higher N,P,K content, protein content (22.77%), total nitrogen uptake (71.49 kg/ha), phosphorus uptake (14.68 kg/ha) and potassium uptake (47.49 kg/ha)over rest of the treatmentsand control.

Keywords: Zinc solubilizing bacteria, sodic soil, alkaline soil, rice growth

Introduction

Pulses, or grain legumes, hold a crucial position in global agriculture as the second most important crop group after cereals. India leads the world in the production, import and consumption of pulses. Among the diverse range of pulses grown in India, mungbean (*Vigna radiata* L.; 2n = 2x = 22), also known as green gram, plays a vital role due to its rich nutritional profile, short growing period and adaptability to various agro-climatic conditions. It provides around 24.5% protein and is a good source of essential amino acids such as lysine and tryptophan. Additionally, mungbean enhances soil fertility through nitrogen fixation, making it highly suitable for dryland and sustainable farming systems. It ranks third among pulses in terms of area and production.

To overcome these constraints and enhance both productivity and quality in mungbean, the adoption of integrated and eco-friendly agronomic practices has become essential. One such approach is seed hardening, a pre-sowing physiological treatment involving controlled hydration followed by drying. This method induces biochemical and structural changes in the seed, improving its ability to withstand moisture stress and enhancing germination, root growth and seedling establishment (Henckel, 1964; Prajapati, 2017; Bhadane*et al.*, 2022) [, 10, 3]. The application of inorganic salts like KNO_3, $CaCl_2$, and KH_2PO_4 during hardening has shown to improve nutrient absorption and drought resistance in dryland crops, including mungbean.

In arid and nutrient-deficient soils, where traditional soil fertilization is often ineffective, foliar application of nutrients has emerged as an efficient strategy to enhance crop growth and yield. This method involves spraying nutrients, plant hormones and bio-stimulants directly onto the leaves, ensuring rapid absorption and minimizing losses due to leaching or fixation. Foliar feeding is particularly useful during critical crop growth stages and under stress conditions, where it improves plant vigor, drought tolerance and overall productivity (Alshaal & El-Ramady, 2017) [2]. Among the various organic formulations Panchgavya, a traditional Indian formulation comprising cow dung, urine, milk, curd and ghee, has gained prominence as an eco-friendly growth enhancer. It is rich in essential macro and micronutrients, beneficial microbes and plant growth hormones like indole-3-acetic acid (IAA) and gibberellic acid (GA), which support crop development and yield enhancement

Materials and Methods

The experimented titled "Productivity and Quality of Mungbean [*Vigna radiata* (L.) Wilczek] as Influenced by Seed Hardening and Foliar Spray of Panchgavya" conducted at Agronomy farm, S.K.N. College of Agriculture, Jobner (Rajasthan) during the *Kharif* season, 2024 on loamy sand soil. The experiment was laid out in factorial randomized block design comprising combinations of five seed hardening treatments (control, $CaCl_2$ @ 2%, KH_2PO_4 @ 2%, KNO_3 @ 1%, KCl @ 1%) and four foliar sprays of panchgavya (control, 1%, 3%, 5%). Experimental farm is situated in South-Eastern part of Rajasthan at an altitude of 427 meter above mean sea level with 26° 05' N latitude and 75° 28' E longitude and this area falls under agro-climatic zone III-A (Semi-Arid Eastern Plain) of Rajasthan. The climate of this region is a typically semi-arid, characterized by extremes of temperature during both summers and winters. The average rainfall of Jobner is from 400-450 mm, most of which (80-85%) is received from South-West Monsoon during July to early September. The maximum and minimum temperature during the crop season ranged between 31.41ºC to 37.80 ºC and 23.54 ºC to 27.85 ºC, respectively. A total of 677.6 mm rainfall was recorded during the cropping season. The relative humidity fluctuated between 91 to 96 per cent, while the average sunshine hours ranged between 0.68 to 5.01 hrs/dayand wind velocity fluctuated between 0.88 to 2.82 km/hrs.The observation were recorded was analysed by statistical methods (Fisher, R.A. 1950) [6].

Results and Discussion

Seed hardening with $CaCl_2$ @ 2% significantly enhanced plant height at all growth stages, recording 20.29 cm at 25 DAS, 42.66 cm at 50 DAS and 51.26 cm at harvest. These results align with findings by Rajasekaran *et al.* (2012) [11] and Kumawat *et al.* (2013) [9], who reported that calcium treatment enhances cell elongation and meristematic activity through improved enzymatic functions. The number of branches per plant also increased significantly under this treatment (3.85 at 25 DAS and 7.95 at harvest), likely due to improved apical growth and better nutrient absorption facilitated by seed hardening. Dry matter accumulation was highest in the $CaCl_2$ @ 2% treatment (4.88, 13.23 and 29.99 g/plant at 25, 50 DAS and harvest, respectively), which reflects greater vegetative biomass. This improvement corresponds with the observations of Bhanu *et al.* (2015) [4], who noted a positive relationship between seed priming, shoot growth and dry matter accumulation in legumes. Potassium and phosphate-based treatments (KNO_3 @ 1%, KH_2PO_4 @ 2%, and KCl @ 1%) also showed comparable results, attributed to their roles in enhancing water uptake and enzyme activation during early growth. Chlorophyll content, which indicates photosynthetic potential, was significantly higher in $CaCl_2$ @ 2% treatment (2.82 mg/g of fresh leaf weight at 40 DAS), a 16.04% increase over the control. This improvement supports earlier work by Subbaiah *et al.* (2014) [13] and Ramesh *et al.* (2010) [12], who reported that calcium-based priming enhances membrane stability and chloroplast function, leading to increased chlorophyll biosynthesis and photosynthetic efficiency. The number of root nodules (32.75 per plant at 40 DAS) and their dry weight (70.25 mg/g) were also highest under $CaCl_2$ @ 2%. Enhanced nodulation may result from increased root growth and improved rhizobial colonization, as also observed by Bhanu *et al.* (2015) [4] in nutrient-primed legumes. This contributed to better nitrogen fixation and early vegetative vigor. Seed hardening with CaCl2 @ 2% also recorded the highest seed yield (983kg/ha). The yield increase is attributable to enhanced growth parameters, nutrient uptake, and efficient physiological processes promoted by the respective treatments. These results are consistent with Kumar *et al.* (2022) [8] who reported significant improvements in mungbean yield through $CaCl_2$ priming under field conditions. Seed hardening treatments significantly influenced nitrogen content and protein content in seed and haulm. The $CaCl_2$ @ 2% treatment recorded the highest nitrogen content, which was associated with enhanced nodulation and nitrogen fixation efficiency. These findings are in agreement with Subramaniyan *et al.* (2001) [15], who reported that calcium enhances the activity of nitrate reductase and glutamine synthetase, thus supporting nitrogen assimilation and protein synthesis. Total nutrient uptake (N,P and K) was also highest in $CaCl_2$ @ 2%, while phosphorus and potassium contents in seed and haulm were found to be statistically non-significant. Protein content in seed, a direct outcome of increased nitrogen assimilation, was significantly higher under $CaCl_2$ priming, aligning with the results of Bhanu *et al.* (2015) [4], who reported better protein accumulation in nutrient-primed mungbean. The comparable performance of KNO_3, KH_2PO_4 and KCl indicates their supportive role in nutrient absorption and metabolic enhancement during the reproductive phase.

Similarly, foliar spray of panchgavya @ 5% showed a marked improvement in growth traits, recording the highest plant height (43.37 and 51.83 cm at 50 DAS and harvest), number of branches (8.14 at harvest) and dry matter (13.30 and 30.17 g/plant at 50 DAS and harvest, respectively). These improvements can be attributed to the presence of natural growth-promoting hormones such as IAA, GA_3 and cytokinins in panchgavya, as reported by Somasundaram. Higher microbial activity and better nutrient assimilation also played roles in enhanced vegetative growth. The number of nodules (33.39) and their dry weight (71.12 mg/g) were significantly higher under 5% panchgavya, consistent with the findings of Ghosh *et al.* (2016) [7], who observed that bioenzymes and beneficial microbes in panchgavya stimulate nodulation and root activity. Chlorophyll content also peaked under this treatment (2.83 mg/g), likely due to improved nutrient uptake and stabilized chloroplast membranes (Subhash *et al.*, 2010) [14]. Foliar spray of panchgavya @ 5% treatments recorded the highest seed yield (984kg/ha). The yield increase is attributable to enhanced growth parameters, nutrient uptake and efficient physiological processes promoted by the respective treatments. These results are consistent with Choudhary, who reported significant improvements in mungbean yield through $CaCl_2$ priming and panchgavya foliar application under field conditions. Foliar spray of panchgavya @ 5% also significantly improved quality parameters. It recorded the highest nitrogen, phosphorus, and potassium content in seed and haulm, along with total nutrient uptake and protein content in seed. These enhancements can be credited to the microbial and enzymatic components of panchgavya that improve soil health, nutrient solubilization and root efficiency (Ghosh *et al.*, 2016; AOAC, 1990) [7, 1].

Panchgavya's ability to stimulate nitrogen fixation, solubilizing phosphorus and mobilize potassium has been well documented by and the present results are in line with those findings. The lowest nutrient content and uptake values were consistently observed under the control.

Table 1: Effect of seed hardening and foliar spray of panchgavya on growth parameters of mungbean

Treatment	Plant height (cm)	Dry matter accumulation (g/plant)	Branches/plant	Chlorophyll content
Seed hardening				
Control	41.37	25.41	6.72	2.43
$CaCl_2$ @ 2%	51.26	29.99	7.95	2.82
KH_2PO_4 @ 2%	48.41	28.04	7.67	2.65
KNO_3 @ 1%	48.48	28.12	7.72	2.68
KCl @ 1%	48.30	27.96	7.54	2.62
S.Em+	0.96	0.57	0.13	0.04
CD (P=0.05)	2.76	1.63	0.38	0.11
Foliar spray of panchgavya				
Control	43.03	25.66	6.86	2.46
Panchgavya @ 1%	46.20	27.14	7.35	2.57
Panchgavya @ 3%	49.20	28.63	7.73	2.69
Panchgavya @ 5%	51.83	30.17	8.14	2.83
S.Em+	0.86	0.51	0.12	0.04
CD (P=0.05)	2.46	1.45	0.34	0.10
CV	7.03	7.06	6.13	5.20

Table 2: Effect of seed hardening and foliar spray of panchgavya on nodulation and seed yield of mungbean

Treatment	Nodules/plant	Dry weight of nodules	Seed yield (kg/ha)
Seed hardening			
Control	27.55	60.29	784
$CaCl_2$ @ 2%	32.75	70.25	983
KH_2PO_4 @ 2%	31.03	66.55	915
KNO_3 @ 1%	31.11	66.59	923
KCl @ 1%	30.99	66.47	908
S.Em+	0.57	1.23	21
CD (P=0.05)	1.63	3.52	59
Foliar spray of panchgavya			
Control	27.57	60.98	821
Panchgavya @ 1%	30.10	64.34	876
Panchgavya @ 3%	31.69	67.67	930
Panchgavya @ 5%	33.39	71.12	984
S.Em+	0.51	1.10	18
CD (P=0.05)	1.45	3.14	53
CV	6.43	6.46	8.0

Table 3: Effect of seed hardening and foliar spray of panchgavya on nutrient content of mungbean

Treatment	Nitrogen content (%)		Phosphorus content (%)		Potassium content (%)		Protein content (%)
	Seed	Straw	Seed	Straw	Seed	Straw	
Seed hardening							
Control	3.16	1.321	0.752	0.261	0.689	1.515	19.73
$CaCl_2$ @ 2%	3.62	1.511	0.785	0.269	0.769	1.685	22.65
KH_2PO_4 @ 2%	3.44	1.411	0.774	0.266	0.740	1.605	21.53
KNO_3 @ 1%	3.47	1.441	0.784	0.268	0.742	1.625	21.71
KCl @ 1%	3.36	1.381	0.754	0.262	0.737	1.585	21.03
S.Em+	0.05	0.019	0.010	0.003	0.008	0.018	0.29
CD (P=0.05)	0.13	0.054	NS	NS	NS	NS	0.82
Foliar spray of panchgavya							
Control	3.17	1.330	0.727	0.252	0.696	1.531	19.83
Panchgavya @ 1%	3.33	1.390	0.752	0.260	0.720	1.581	20.83
Panchgavya @ 3%	3.50	1.440	0.787	0.269	0.749	1.627	21.89
Panchgavya @ 5%	3.64	1.492	0.813	0.281	0.776	1.673	22.77
S.Em+	0.04	0.017	0.009	0.003	0.007	0.016	0.26
CD (P=0.05)	0.12	0.048	0.024	0.007	0.021	0.045	0.73
CV	4.61	4.606	4.31	3.81	3.81	3.80	4.66

Table 4: Effect of seed hardening and foliar spray of panchgavya on nutrient uptakebymungbean

Treatment	Nitrogen uptake (kg/ha)	Phosphorus uptake (kg/ha)	Potassium uptake (kg/ha)
Seed hardening			
Control	50.26	10.94	34.57
$CaCl_2$ @ 2%	71.63	14.13	47.57
KH_2PO_4 @ 2%	63.01	13.02	42.47
KNO_3 @ 1%	64.41	13.25	43.19
KCl @ 1%	61.19	12.66	41.74
S.Em+	1.36	0.34	1.14
CD (P=0.05)	3.87	0.98	3.25
Foliar spray of panchgavya			
Control	52.85	11.02	36.48
Panchgavya @ 1%	58.91	12.12	40.01
Panchgavya @ 3%	65.14	13.37	43.65
Panchgavya @ 5%	71.49	14.68	47.49
S.Em+	1.21	0.31	1.02
CD (P=0.05)	3.46	0.88	2.91
CV	7.56	9.32	9.41

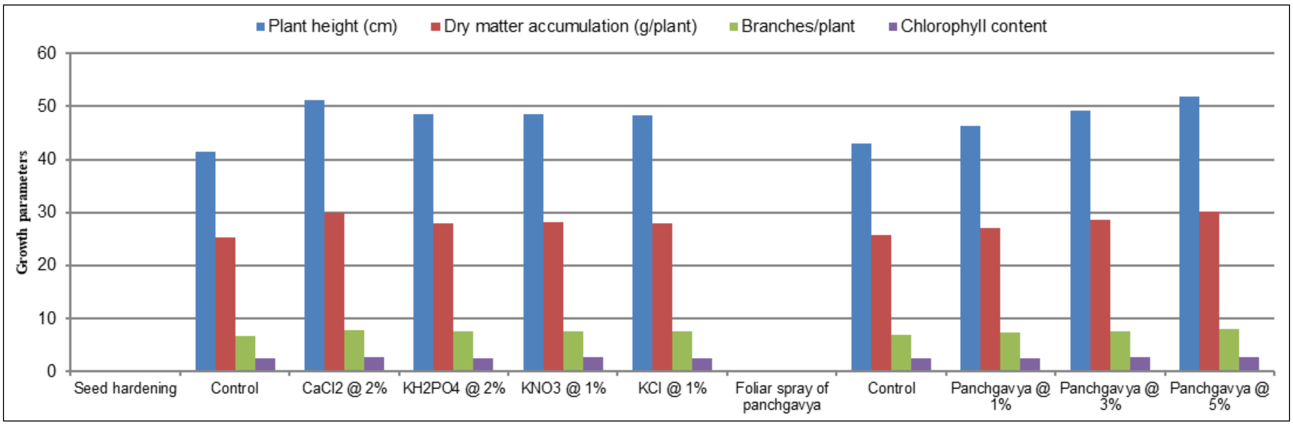

Fig 1: Effect of seed hardening and foliar spray of panchgavya on growth parameters of mungbean

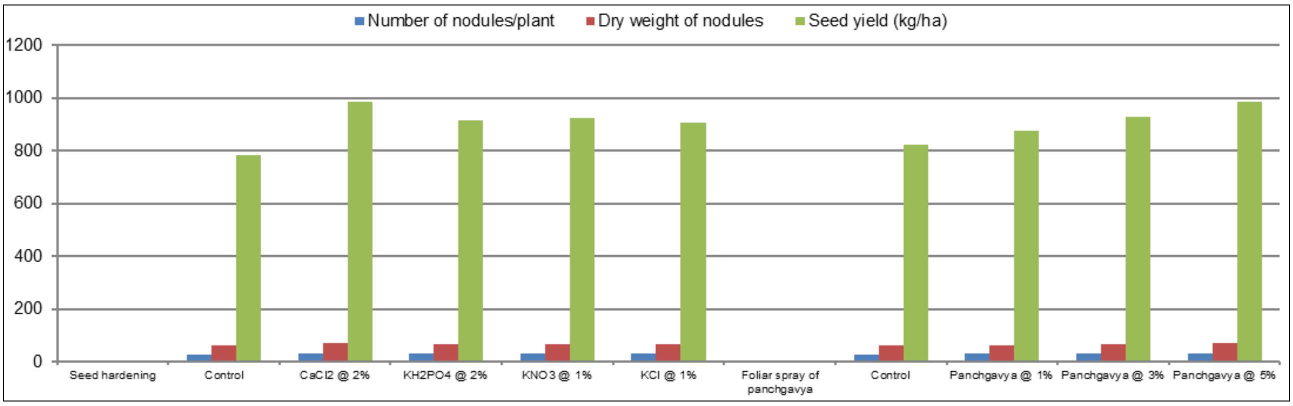

Fig 2: Effect of seed hardening and foliar spray of panchgavya on nodulation and seed yield of mungbean

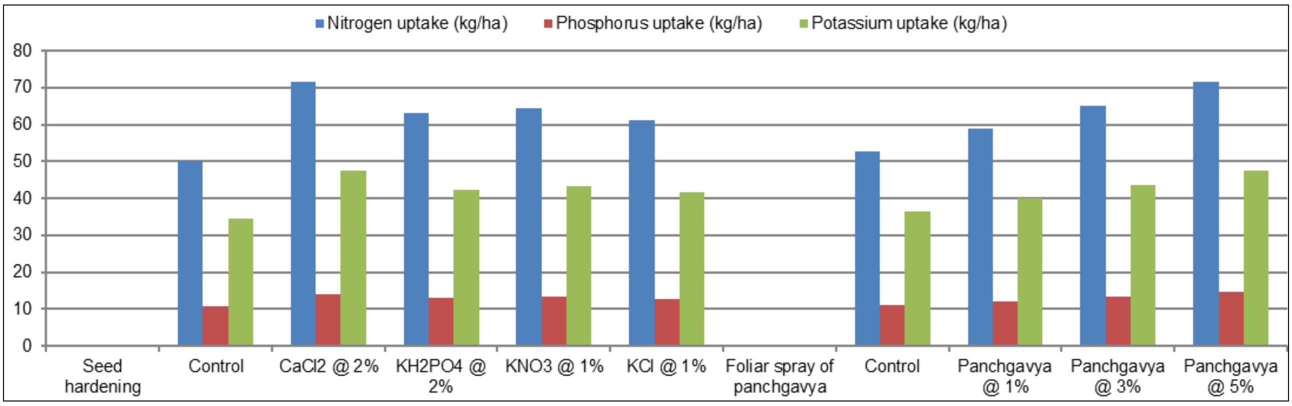

Fig 3: Effect of seed hardening and foliar spray of panchgavya on nutrient uptake by mungbean

Conclusion
Based on the results of above experiment it is, concluded that seed hardening with $CaCl_2$ @ 2% and foliar spray of panchgavya @ 5% significantly improved the growth, yield and quality of mungbean.

Acknowledgement
I express my sincere gratitude to my Major Advisor for their invaluable guidance, encouragement and constant support throughout the course of this study. I am also deeply thankful to the members of my advisory committee for their constructive suggestions and valuable insights. My heartfelt appreciation extends to the Head, faculty members and non-teaching staff of the Department of Agronomy, S.K.N. College of Agriculture, Jobner (Rajasthan), for their continued assistance and kind cooperation.

References
1. A.O.A.C. Official Methods of Analysis. 15th Edition, Association of Official Analytical Chemists, Washington D.C., USA; 1990.
2. Alshaal T, El-Ramady H. Foliar application: from plant nutrition to biofortification. Environental Biodiversity Soil Security. 2017;1:71-83.
3. Bhadane RS, Prajapati KR, Patil K, Patel DB. Seed hardening in relation to seedling quality characters of green gram (*Vigna radiata* L.). Legume Research-An International Journal. 2022;45(6):749-755.
4. Bhanu R, Padmaja G, Srivalli B. Effect of seed priming with nutrients on nutrient uptake and yield of mungbean (*Vigna radiata* L.). International Journal of Agricultural Sciences. 2015;7(1):280-283.
5. Chaudhary SN, Patel PH, Chaudhary PR. Effect of organic formulations on growth and yield of summer greengram (*Vigna radiata* L.). Agronomy Journals. 2024;7(2F).
6. Fisher RA. Statistical Methods for Research Workers. Oliver and Boyd; 1950. p. 57-63.
7. Ghosh R, Senapati SK, Mandal B. Effect of Panchagavya on growth and productivity of pulses under organic farming. Journal of Eco-friendly Agriculture. 2016;11(1):93-97.
8. Kumar P, Sharma M, Gupta R. $CaCl_2$ priming in pulses improved germination, photosynthetic activity, and yield under field conditions. Frontiers in Plant Science. 2022;13:1023.
9. Kumawat RN, Meena RS, Meena VK. Influence of seed treatment on growth, yield and nutrient uptake of mungbean (*Vigna radiata* L.). Legume Research. 2013;36(4):358-361.
10. Prajapati KR, Patel DB, Patil K, Bhadane RS. Effect of seed hardening on morpho-physiological and yield parameters in black gram (*Vigna mungo* L.). International Journal of Chemical Studies. 2017;5(4):439-41.
11. Rajasekaran R, MurugesaBoopathi P, Vijayalakshmi K. Influence of seed hardening on drought tolerance in green gram (*Vigna radiata* L.). Madras Agricultural Journal. 2012;99(7&9):504-506.
12. Ramesh N, Chandrasekaran B. Seed hardening techniques to improve crop performance under rainfed conditions. Indian Journal of Dryland Agricultural Research and Development. 2010;25(2):49-54.
13. Subbaiah G, Satyanarayana V, Reddi M. Seed hardening treatments to overcome moisture stress in green gram (*Vigna radiata*). Indian Journal of Agricultural Research. 2014;48(3):210-215.
14. Subhash B, Shivaraj Y, Sharanappa S. Effect of Panchagavya on growth and yield of pulse crops. International Journal of Agricultural Sciences. 2010;6(1):189-192.
15. Subramaniyan K, Kumar S. Seed hardening for drought tolerance in green gram. Madras Agricultural Journal. 2001;88(4&6):309-311.
16. Vallimayil J, Sekar R. Investigation on the effect of panchgavya on southernsunnhemp mosaic virus (SSMV) infected plant systems. Global Journal of Environmental Research. 2012;6(2):75-79.