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Effect of Micronutrients on Growth and Quality Parameters of Sponge Gourd Seeds (*Luffa cylindrica*) Through Priming

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Abstract

The experiment of seed priming was conducted in the post-graduate laboratory, Department of Genetics and Plant Breeding, Sam Higginbottom University of Agriculture, Technology & Sciences, SHUATS, Naini, Prayagraj, Uttar Pradesh during 2021 in Pusa chikni of Sponge gourd. The micro-nutrients were used in the treatments of the Sponge gourd seeds which are treated with T_1 - $ZnSO_4$ 0.1%, T_2 - $ZnSO_4$ 0.5%, T_3 - $ZnSO_4$ 1%, T_4 - $MnSO_4$ 0.1%, T_5 - $MnSO_4$ 0.5%, T_6 - $MnSO_4$ 1%, T_7 - $CuSO_4$ 0.1%, T_8 - $CuSO_4$ 0.5%, T_9 - $CuSO_4$ 1%, T_{10} - $B_2(SO_4)_3$- 0.1%, T_{11} - $B_2(SO_4)_3$- 0.5%, T_{12} - $B_2(SO_4)_3$- 1% with T_0 as control for 12 hrs. Between paper method and sand method were adopted to observe the effect of micronutrients on germination percentage, root length, shoot length, seedling length, fresh weight of seedlings, dry weight of seedlings, vigour index I, vigour index II. The highest seed germination percentage was recorded in $ZnSO_4$ 0.5%. $ZnSO_4$ 0.5% showed best result in all the quality parameters followed by $ZnSO_4$ 1%.

Key words : Priming, Micro- nutrients, $ZnSO_4$, $MnSO_4$, $CuSO_4$, $B_2(SO_4)_3$, Sponge gourd.

The Cucurbitaceae family includes the Luffa sponge gourd (Luffa cylindrica) having chromosome number 2n= 26. It is a tropical and subtropical annual climbing vine with tendrils that grows in tropical and subtropical climates. The seeds are smooth, flat, and black or white in colour (Okusanya, O.T, 1978). Sponge gourd is a typical vegetable that looks like ridge gourd. This vegetable is abundant in almost all of India's states. Gilki and Turai are two of the most common names for sponge gourd. Tropical and subtropical zones are where sponge gourd is grown. It thrives in hot and humid environments. It is sensitive to frost and cold temperatures. It can be cultivated in a variety of soil types, however sandy loam soil is the best. When eaten, sponge gourd fruit is highly digested and increases appetite. In most of the developing world, 'hidden hunger,' or mineral shortage in edible grains, is a major health concern for people (Buyckx, 1993; Ramalingaswami, 1995). Humans, for example, may have a decrease of immunity, poor wound healing, and dermatitis as a result of dietary Zn deficiency (van Campen, 1991). Zn nutrition, on the other hand, aids in the prevention of infectious disorders like as diarrhoea (Black, 1998; Fuchs, 1998) and immunity (Shankar and Prasad, 1998).

Plant growth and human health both require micronutrients. The most common means of micronutrient addition are soil and foliar sprays, however in underdeveloped countries, the cost and difficulty in getting high-quality micronutrient fertilizers are key challenges. Micronutrient seed treatments, such as seed priming and seed coating, are a convenient and cost-effective option. Seed priming is a low-cost method of ensuring uniform emergence and high seed vigour, resulting in improved crop establishment and production. It's a simple, low-cost procedure in which seeds are partially wet to the point that pre-germination metabolic

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activities begin without actual germination, then re-dried till close to their original dry weight.

Crop plants require 17 key components for healthy growth and development. These minerals are referred to as macronutrients or micronutrients when they are required in relatively large levels. Micronutrients are just as vital as macronutrients for plant growth, even though they are required in lesser amounts. Growth suppression or even complete inhibition may occur if any element is deficient in the soil or is not properly balanced with other nutrients (Mengel *et al*., 2001). In addition to serving as cofactors in enzyme systems and participating in redox reactions, micronutrients play a number of other important roles in plants. Most importantly, micronutrients are engaged in critical physiological activities like as photosynthesis and respiration (Marschner, 1995; Mengel *et al*., 2001), and their deficiency can obstruct these vital physiological processes, limiting yield gains.

In circumstances where micronutrient nutrition from the soil is insufficient, increasing plant micronutrient status would boost yield. However, due to low nutrient-use efficiency, this necessitates applying greater fertilizer doses to soils (Singh, 2007). Micronutrients can be applied to the soil, foliar sprayed, or incorporated as seed treatments in agricultural plants. Although any of these approaches can provide the requisite amounts of micronutrients, foliar sprays have proven to be more effective in terms of yield enhancement and grain enrichment; nonetheless, their high cost has limited their adoption, particularly by resource-constrained farmers (Johnson *et al*., 2005). Furthermore, foliar spraying happens later in the growth cycle, when the crop stand is already established. Seed treatment is a more cost-effective approach because it requires less micronutrient, is simple to apply, and improves seedling growth (Singh *et al*., 2003).

Seeds could be treated with micronutrients by soaking them in a certain concentration of nutrient solution for a specific amount of time (seed priming) or by coating them with micronutrients. Seed invigoration is a new phrase that has been used interchangeably for both seed treatment approaches (Farooq *et al*., 2009).

Techniques for invigorating seeds, such as seed priming, have a significant impact on seed quality. Seed priming is a commercially viable way to improve seed germination and vitality. Seed priming is the process of immersing seeds in water under controlled conditions to promote early germination, then drying the seed back to its original moisture content (Pan and Basu 1985). Priming is a type of induced resistance that is a critical mechanism in plants' tolerance to biotic stressors (Beckers and Conrath, 2007). Priming techniques also include accumulation of dormant signalling proteins or transcription factors, as well as the formation of epigenetic alterations that are controlled and developed quickly in response to stress, resulting in a more effective defence system (Bruce *et al*., 2007). It's been clear over the last few years that priming processes are also implicated in the context of environmental stress (Filippou *et al*., 2012). OBJECTIVES: Keeping in view of the importance of seed treatments in Sponge gourd, hence the present study was planned to determine the "Effect of seed priming with various micronutrients on seedling parameters of sponge gourd [*Luffa cylindrica*]" to look at with the subsequent objectives: 1) To decide a suitable treatment and chemical concentration on germination performance of rag gourd seeds. 2) To edify the effect of seed priming treatment using micronutrients on germination performance and seed quality parameters of the seeds of sponge gourd.

Material and methods

The experiment was carried out in laboratory of Department of Genetics and Plant Breeding, Sam Higginbottom University of Agriculture, Technology and Sciences, Allahabad in year 2021. All the 13 treatments were carried out using between paper method and sand method in Completely Randomized Design (CRD) with 4 replications to analyse the final result of the experiment. The variety Pusa Chikni is used for this experiment. Seeds were soaked in T_0 - Control, T_1 - $ZnSO_4$ 0.1%, T_2 - $ZnSO_4$ 0.5%, T_3 - $ZnSO_4$ 1%, T_4 - $MnSO_4$ 0.1%, T_5 - $MnSO_4$ 0.5%, T_6 - $MnSO_4$ 1%, T_7 - $CuSO_4$ 0.1%, T_8 - $CuSO_4$ 0.5%, T_9 - $CuSO_4$ 1%, T_{10} - $B_2(SO_4)_3$- 0.1%, T_{11} - $B_2(SO_4)_3$- 0.5%, T_{12} - $B_2(SO_4)_3$- 1% for 12 hours. After 12 hours seeds were dried to their original moisture content. Seeds are then placed in germination paper and sand for 14 days. Germination papers are placed in germination chamber at 25°C at an angle of 45°. Later, primed seeds are dried back to their original moisture content under shade to access the quality parameters. Seeds are placed in the between paper method for all the observations.

The observation on the characters *viz.*, Germination percent (ISTA 2004), Root length (cm), Shoot length (cm), Seedling length (cm), Seedling fresh weight (mg), Seedling dry weight (mg), Seedling vigour index I and Seedling vigour index II (Abdul Baki and Anderson 1973) were recorded. The experimental data were noted and subjected to statistical analysis for the analysis of variance, range, and mean, critical Difference and coefficient of variation (Fisher, 1936).

Result and Discussion

Because all the treatments are affected by the treatments, showed significant difference between the control (untreated seed) and primed seeds in both the paper and sand methods, as shown in Table 1. All seedling characters were efficiently altered by $ZnSO_4$ 0.5 percent by both the paper and sand methods.

The important takeaway from Table 2 is that the paper method outperforms the sand method. The SEM denotes the difference between the population and sample means. Because it quantifies uncertainty, the Standard Error of Difference (SED) should always be greater than the Standard Error of Measurement (SEM). The critical difference (CD) is used to

Table 1. Analysis of Variance for Vigour Characters in Sponge gourd

Characters	Mean sum of squares			
	Between paper method		Sand method	
	Treatment (df=12)	Error (df=39)	Treatment (df=8)	Error (df=27)
Germination percentage	65.167*	1.590	67.917*	1.564
Root length (cm)	2.569*	0.272	4.804*	0.290
Shoot length (cm)	2.863*	0.343	4.736*	0.194
Seedling length (cm)	9.818*	0.457	16.724*	0.309
Seedling Fresh weight (mg)	3.309*	0.554	1.692*	0.179
Seedling Dry weight (cm)	2.313*	0.072	0.575*	0.060
Seed Vigour index I	156765.435*	3492.111	200028.691*	2740.683
Seed Vigour index II	20449.660*	495.004	6328.096*	375.496

*Significant at 5% level of significance

Table 2. Analysis of variance for seedling traits of Sponge Gourd Seeds for Between Paper method

Treatment	Germination %	Root length	Shoot length	Seedling length	Fresh weight	Dry weight	Vigour index I	Vigour index II
1	70.25	9.125	8.725	17.85	5.825	2.633	1,252.50	184.87
2	81.5	11.175	11.025	22.2	7.938	3.378	1,809.03	275.26
3	83.75	12	11.5	23.5	9.385	5.463	1,968.18	457.59
4	82.25	11.35	11.225	22.575	8.283	4.158	1,856.78	342.46
5	78.75	11.025	9.85	20.875	7.385	3.928	1,643.33	309.35
6	79.75	9.975	9.275	19.25	7.278	4.108	1,536.08	327.27
7	77.25	9.803	10.185	19.988	7.5	4.05	1,544.37	312.98
8	76.75	10.275	10.17	20.445	7.548	3.598	1,569.15	276.1
9	75.25	10.14	9.325	19.465	6.575	3.275	1,465.77	246.42
10	75	9.55	10.15	19.7	7.15	2.975	1,477.33	223.02
11	72.5	10.195	10.125	20.32	6.45	3.075	1,473.46	223.07
12	73.5	10.35	9.55	19.9	7.175	3	1,462.60	220.50
13	74.5	9.9	9.075	18.975	8.247	4.365	1,413.85	324.968
G. Mean	77	10.37	10.01	20.38	7.44	3.69	1574.8	286.45
C.D.	1.81	0.749	0.841	0.971	1.068	0.384	84.839	31.941
SE(m)	0.63	0.261	0.293	0.338	0.372	0.134	29.547	11.124
SE(d)	0.892	0.369	0.414	0.478	0.526	0.189	41.786	15.732
C.V.	1.637	5.028	5.849	3.317	10	7.252	3.752	7.767

Table 3. Analysis of variance for seedling traits of Sponge Gourd Seeds for Sand method

Treatment	Germination %	Root length	Shoot length	Seedling length	Fresh weight	Dry weight	Vigour index I	Vigour index II
1	73	8.3	7.4	15.7	5.815	2.71	1146.1	197.83
2	80.75	10.5	9.4	19.9	7.33	3.17	1,607.40	256.145
3	83	11.3	10.725	22.025	8.563	4.255	1,827.98	353.108
4	81.5	10.825	10.1	20.925	7.348	3.213	1,705.60	261.845
5	77.75	9.41	8.163	17.573	7.045	3.125	1,366.38	242.905
6	78.5	8.795	7.4	16.18	6.79	2.88	1,270.78	226.17
7	76	8.448	8.378	16.825	7.078	3.32	1,278.67	252.36
8	75.5	8.83	8.275	17.105	7.025	3.293	1,291.32	248.618
9	74.25	9.975	7.6	17.575	6.255	3.2	1,305.83	237.675
10	74.25	9.375	7.45	16.825	6.45	2.85	1,249.43	211.5
11	71.25	10.1	8.05	18.15	6.75	2.9	1,293.18	206.6
12	72.75	9.325	7.8	17.125	7.195	3.025	1,243.80	220.05
13	73.25	8.375	8.4	16.775	6.95	3.28	1,228.15	240.363
Total mean	76	9.43	8.36	17.80	6.96	3.17	1359.01	241.92
C.D.	1.795	0.773	0.632	0.798	0.608	0.352	75.159	27.82
SE(m)	0.625	0.269	0.22	0.278	0.212	0.123	26.176	9.689
SE(d)	0.884	0.381	0.311	0.393	0.299	0.174	37.018	13.702
C.V.	1.646	5.708	5.263	3.121	6.078	7.742	3.852	8.01

compare the means of different treatments with the same number of replications. Between paper and sand methods, the Grand Mean (GM) is higher. The larger the extent of dispersion around the mean, the higher the coefficient of variance. The more precise the estimation, the smaller the coefficient of variance. In general, a coefficient of variance (CV) of less than ten is regarded good. From the above statements, it is verified that between paper method performed better in respect to all observations under the lab condition as compared to sand method.

Seed priming with micronutrients significantly affected seed germination percent in lab conditions, with 82% (between paper) and 80% (sand method) treatment with $ZnSO_4$, while seed treatment with MnSO4 was found to be on par with 79% (between paper method) and 76% (sand method), whereas the control had the lowest percentage.

A similar finding was reported by Babaeva *et al*. (1999), who found that priming Echinacea purpurea (L.) seed with 0.05 percent ZnSO4 solution improved germination and field emergence by 38% and 41%, respectively. Seed priming with Zn considerably enhanced yield and associated parameters in common bean (Phaseolus vulgaris L.) (Kaya *et al*., 2007). Seed priming with Zn boosted germination and seedling development in drought-stressed barley (Hordeum vulgare L.) and increased water use efficiency by 44%. (Ajouri *et al*., 2004).

Conclusion

In lab conditions, the non-identical priming treatments resulted in considerable improvements in germination and vigour in sponge gourd seeds. $ZnSO_4$ (0.5%) was shown to significantly boost germination and vigour in sponge gourd seeds in both traits when compared to the paper method and the sand approach. In comparison to the control, soaking sponge gourd seeds for 12 hours increased germinability and vigour. So, by inducing a range of biochemical, physiological, molecular, and subcellular changes in plants, seed priming is a simple and effective method for improving stand establishment, economic yields, and tolerance to biotic and abiotic challenges in a variety of crops.

Future scope

In the future, it will be necessary to investigate the mechanisms of seed enhancement; there are many additional seed priming methods that may be studied in sponge gourd, and it will be necessary to conduct research and study on sponge gourd in order to make any meaningful recommendations.

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