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Effect of Seed Priming on Germination and Seedling Growth of Sesame (*Sesamum indicum* L.)

R.B. Mori[1]*, J.B. Patel[2], K.P. Vaghasiya[1], H.V. Bhoot[1] and A.V. Barad[3]

[1]Department of Seed Science and Technology, College of Agriculture, JAU, Junagadh (Gujarat), India.
[2]Associate Professor, Department of Seed Science and Technology, College of Agriculture, JAU, Junagadh (Gujarat), India.
[3]Ph.D. Scholar, Department of Seed Science and Technology, College of Agriculture, JAU, Junagadh, (Gujarat), India.

(Corresponding author: R.B. Mori)*
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ABSTRACT: The laboratory experiment was conducted during summer 2022 to study the "effect of seed priming on germination and seedling growth of sesame". The different 20 seed priming treatments comprising of T_1: Without any treatment (control), T_2: Hydro priming (with water), T_3: Salicylic acid @ 1 %, T_4: $NaCl_2$ @ 2 %, T_5: PEG @ 5 %, T_6: Na_2PO_4 @ 2.0 %, T_7: GA_3 @ 100 ppm, T_8: KCl @ 2 %, T_9: KNO_3 @ 2.0 %, T_{10}: KH_2PO_4 @ 2.0 %, T_{11}: Humic acid @ 1.5 %, T_{12}: Vermiwash @ 5 %, T_{13}: Coconut water @ 5 %, T14: *Trichoderma viride* 0.25 g/100 ml, T_{15}: Neem leaf extract 5 g/100 ml, T_{16}: Cow urine @ 5%, T_{17}: Jivamrut @ 5%, T_{18}: Bijamurt @ 5%, T_{19}: Tulasi leaf extract @ 5% and T_{20}: Moringa leaf extract @ 5% were given to seeds of sesame variety GJT 5. The observations on germination (%), shoot length (cm), root length (cm), seedling length (cm), seedling dry weight (mg), seedling vigour Index I and seedling vigour Index II were recorded. Among seed priming treatments, significantly the maximum germination (88.00 %), shoot length (5.50 cm), root length (2.93 cm), seedling length (8.43 cm), seedling dry weight (48.09 mg), seedling vigour index I (741.33) and seedling vigour index II (4233.54) was recorded in seeds primed with 5 per cent coconut water (T_{13}), The next best treatment with respect to all these traits was seeds primed with 5 per cent vermiwash (T_{12}). Significantly the lower germination (78.75 %), shoot length (3.55 cm), root length (2.45 cm), seedling length (6.00 cm), seedling dry weight (38.89 mg), seedling vigour index I (472.43) and seedling vigour index II (3062.16) was recorded in control (T_1).

Keywords: Coconut water Seed priming, Sesame, GJT 5.

INTRODUCTION

Sesame (*Sesamum indicum* L., 2n = 26) is the oldest known oilseed crop, domesticated nearly 3,000 years ago and the first known oil consumed by man. It belongs to the order *Tubiflorae* and family *Pedaliaceae*. It is known as the "Queen of oilseeds," and an orphan crop because it receives little research attention. However, the demand for sesame seeds has increased in the last two decades due to high oil quality, protein content, antioxidant content, and wide adaptability in extreme climatic and edaphic environments (Myint *et al.,* 2020). Africa has been considered to be the primary center of origin of sesame and it spread early through West Asia to India, China and Japan, which themselves became secondary distribution centers (Weiss, 1983). Sesame is a self-pollinated crop with an average cross-pollination to the extent of 4 to 5 per cent. However, the amount of out-crossing ranges from 0 to 50 per cent depending upon the pressure of pollinating agents, whereas wind plays no part in natural cross-pollination (Weiss, 1983). Sesame seeds are an important source of oil (44–57%), proteins (18–25%), carbohydrates (13.5%) and ash (5%) they also have medicinal and nutritional value (Myint *et al.,* 2020).

Seed priming primarily aims to invigourate seed lots; enhance the speed and total seedling emergence potential, plant growth and relative storability of a particular crop. It involves certain physiological and biochemical processes which also interact with each other. Heydecker (1973) defined seed priming as "a pre-sowing treatment in which seeds are soaked in an osmotic solution that allows them to imbibe water and go through the first stage of germination, but does not permit radical protrusion through the seed coat". Various pre-sowing seed treatments have been used to enhance seed performance notably with respect to rate and uniformity of germination thereby enabling better crop establishment (Heydecker, 1978; Bradford, 1986). Generally, any type of priming treatment would cause an effective invigoration of the dry seed, which is the inception of metabolic processes that normally occur during imbibition's and subsequently fixed by drying the seed (Heydecker and Coolbear 1977).

MATERIALS AND METHODS

The laboratory experiment entitled "Effect of seed priming on germination and seedling growth of sesame (*Sesamum indicum* L.)" was carried out during summer 2022 at the Seed Testing Laboratory, Department of Seed Science and Technology, College of Agriculture, Junagadh Agricultural University, Junagadh. The experimental material comprised of genetically pure seeds of sesame variety GJT 5 was obtained from Agricultural Research Station, Junagadh Agricultural University, Amreli. The different 20 seed priming treatments comprising of T_1: Without any treatment (control), T_2: Hydro priming (with water), T_3: Salicylic acid @ 1 %, T_4: $NaCl_2$ @ 2 %, T_5: PEG @ 5 %, T_6: Na_2PO_4 @ 2.0 %, T_7: GA_3 @ 100 ppm, T_8: KCl @ 2 %, T_9: KNO_3 @ 2.0 %, T_{10}: KH_2PO_4 @ 2.0 %, T_{11}: Humic acid @ 1.5 %, T_{12}: Vermiwash @ 5 %, T_{13}: Coconut water @ 5 %, T_{14}: *Trichoderma viride* 0.25 g/100 ml, T_{15}: Neem leaf extract 5 g/100 ml, T_{16}: Cow urine @ 5%, T_{17}: Jivamrut @ 5%, T_{18}: Bijamurt @ 5%, T_{19}: Tulasi leaf extract @ 5% and T_{20}: Moringa leaf extract @ 5% (Fig. 1). Seeds were soaked in respective concentration of each of the priming solutions for 8 hours and were dried back to 8 per cent moisture content and after that, the observations on germination (%), shoot length (cm), root length (cm), seedling length (cm), seedling dry weight (mg), seedling vigour Index I and seedling vigour Index II were recorded. The collected data for various seed quality parameters were analyzed using appropriate statistical procedures recommended for completely randomized design by Panse and Sukhatme (1985).

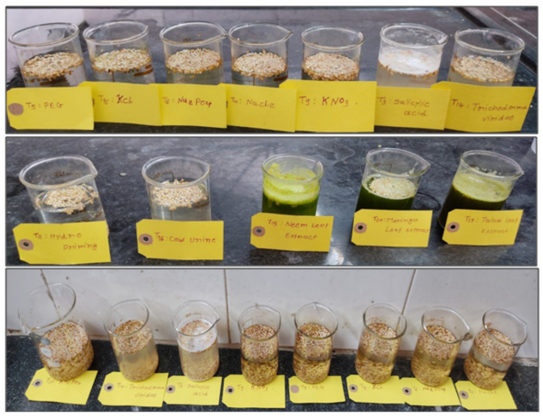

Fig. 1. Different seed priming treatments to sesame seeds.

RESULTS AND DISCUSSION

Germination (%). The effect of different seed priming treatments was found significant for germination percentage. The various seed priming treatments resulted in different germination percentages, with the highest germination percentage (88.00 %) was observed in seeds primed with 5 per cent coconut water (T_{13}) and it was at par with seeds primed with 5 per cent vermiwash (T_{12}), neem leaf extract 5 g/100 ml (T_{15}), bijamurt @ 5 per cent (T_{18}), PEG @ 5 per cent (T_5) and moringa leaf extract @ 5 per cent (T_{20}) recorded germination percentage of 87.00, 86.00, 85.75, 85.50 and 85.50 per cent, respectively (Table 1 and Fig. 2). In contrast, seeds that did not undergo any treatment (control) (T_1) exhibited the lowest germination percentage (78.75 %).

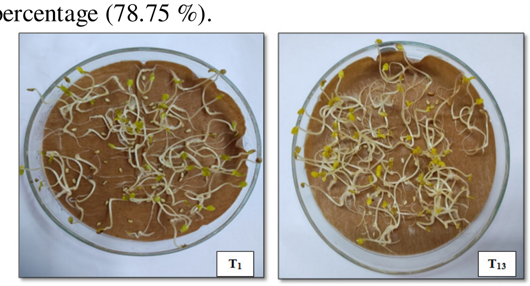

Fig. 2. Germination in control treatment (T_1) and coconut water (T_{13}) priming treatment.

The results obtained in this study are consistent with the findings of previous research workers. Shafiya *et al.* (2021) also observed a higher germination percentage in groundnut seeds when primed with 5 per cent coconut water, which aligns with our results showing 88 per cent germination. Similarly, Vinothini and Bhavyasree (2019) reported the highest seed germination in brinjal seeds when primed with coconut water, reinforcing the effectiveness of coconut water. Our findings are in line with the findings of Catada *et al.* (2016) in rice, Dunsin *et al.* (2016) in cucumber and Chuwang *et al.* (2018) in soybean, all had demonstrated improved germination rates with coconut water seed priming, providing further support for the benefits of coconut water across different crop species. Coconut water is widely used, the liquid endosperm contains minerals such as amino acids, sugars, vitamins and plant regulators in the form of auxins, cytokinins and gibberellins so they can stimulate germination and growth in cell division (Prawiranata *et al.,* 1981).

Additionally, the research conducted by Javed *et al.* (2020) on wheat and mustard reported that vermiwash had a positive impact on germination. This corresponds with our results, which showed a germination of 87 per cent for seeds primed with 5 per cent vermiwash. These findings collectively emphasize the potential of vermiwash as a seed priming treatment to enhance germination in various crop species.

Shoot length (cm). The effect of different seed priming treatments was found significant for shoot length. Significantly the maximum shoot length (5.50 cm) was observed in seeds primed with 5 per cent coconut water (T_{13}) and it was followed by seeds primed with 5 per cent vermiwash (T_{12}) with shoot length of 5.03 cm. Seeds that did not undergo any treatment (control) (T_1) exhibited significantly the lowest shoot length (3.55 cm) (Table 1). Shafiya *et al.* (2021) also observed a higher shoot length in groundnut seeds when primed with 5 per cent coconut water, which aligns with our results showing 5.50 cm shoot length.

Similarly, Vinothini and Bhavyasree (2019) reported the highest shoot length in brinjal seeds when primed with coconut water, reinforcing the effectiveness of coconut water. Our findings are in line with the findings of Catada *et al.* (2016) in rice, Dunsin *et al.* (2016) in cucumber and Chuwang *et al.* (2018) in soybean, all had demonstrated improved shoot length with coconut water seed priming, providing further support for the benefits of coconut water across different crop species.

Table 1: Effect of seed priming on germination (%), shoot length (cm), root length (cm) and seedling length (cm).

Treatment	Germination (%)	Shoot length (cm)	Root length (cm)	Seedling length (cm)
T_1	78.75	3.55	2.45	6.00
T_2	79.25	3.75	2.68	6.43
T_3	81.75	4.35	2.70	7.05
T_4	79.50	3.78	2.43	6.20
T_5	85.50	4.55	2.60	7.15
T_6	80.50	4.18	2.43	6.60
T_7	81.25	4.38	2.75	7.13
T_8	80.75	4.23	2.45	6.68
T_9	84.00	4.45	2.43	6.88
T_{10}	80.75	4.68	2.48	7.15
T_{11}	83.75	4.40	2.35	6.75
T_{12}	87.00	5.03	2.83	7.85
T_{13}	88.00	5.50	2.93	8.43
T_{14}	84.25	4.43	2.75	7.18
T_{15}	86.00	4.90	2.40	7.30
T_{16}	80.50	4.18	2.43	6.60
T_{17}	84.75	4.48	2.78	7.25
T_{18}	85.75	4.60	2.65	7.25
T_{19}	79.50	3.78	2.43	6.20
T_{20}	85.50	4.55	2.60	7.15
S.Em ±	0.93	0.08	0.05	0.08
C.D. at 5%	2.64	0.21	0.15	0.24
CV %	2.26	3.45	4.06	2.39

Root length (cm). The effect of different seed priming treatments was found significant for root length. Significantly the maximum root length (2.93 cm) was observed in seeds primed with 5 per cent coconut water (T_{13}) and it was statistically at par with seeds primed with 5 per cent vermiwash (T_{12}) and seeds primed with 5 per cent jivamrut (T_{17}) with shoot length of 2.83and 2.78 cm, respectively. Significantly the lowest root length (2.35) exhibited by the seeds primed with humic acid @ 1.5 per cent (Table 1). Shafiya *et al.* (2021) also observed a higher root length in groundnut seeds when primed with 5 per cent coconut water, which aligns with our results. Similarly, Vinothini and Bhavyasree (2019) reported the highest root length in brinjal seeds when primed with coconut water, reinforcing the effectiveness of coconut water. Our findings are in line with the findings of Catada *et al.* (2016) in rice, Dunsin *et al.* (2016) in cucumber and Chuwang *et al.* (2018) in soybean, all had demonstrated improved root length with coconut water seed priming, providing further support for the benefits of coconut water across different crop species.

Seedling length (cm). The effect of different seed priming treatments was found significant for seedling length. Significantly the maximum seedling length (8.43 cm) was observed in seeds primed with 5 per cent coconut water (T_{13}) and it was closely followed in seeds primed with 5 per cent vermiwash (T_{12}) with seedling length of 7.85 cm. Seeds that did not undergo any treatment (control) (T_1) exhibited significantly the lowest seedling length (6.00 cm) (Table 1). Shafiya *et al.* (2021) also observed a higher seedling length in groundnut seeds when primed with 5 per cent coconut water, which aligns with our results. Similarly, Vinothini and Bhavyasree (2019) reported the highest seedling length in brinjal seeds when primed with coconut water, reinforcing the effectiveness of coconut water. Our findings are in line with the findings of Catada *et al.* (2016) in rice, Dunsin *et al.* (2016) in cucumber and Chuwang *et al.* (2018) in soybean, all had demonstrated improved seedling length with coconut water seed priming, providing further support for the benefits of coconut water across different crop species.

Seedling dry weight (mg). The effect of different seed priming treatments was found significant for seedling dry weight. Significantly the maximum seedling dry weight (48.09 mg) was observed in seeds primed with 5 per cent coconut water (T_{13}) and it was statistically at par with seeds primed with 5 per cent vermiwash (T_{12}) with seedling dry weight of 47.08 mg. Seeds that did not undergo any treatment (control) (T_1) exhibited significantly the lowest seedling dry weight (38.89 mg) (Table 2). Shafiya *et al.* (2021) also observed a higher seedling dry weight in groundnut seeds when primed with 5 per cent coconut water, which aligns with our results. Similarly, Vinothini and Bhavyasree (2019) reported the highest seedling dry weight in brinjal seeds when primed with coconut water, reinforcing the effectiveness of coconut water.

Table 2: Effect of seed priming on seedling dry weight (mg), seedling vigour index I and seedling vigour index II.

Treatment	Seedling dry weight (mg)	Seedling vigour index I	Seedling vigour index II
T_1	38.89	472.43	3062.16
T_2	39.42	509.20	3124.30
T_3	40.50	576.43	3311.45
T_4	39.19	493.20	3115.29
T_5	41.34	611.33	3534.30
T_6	40.32	531.25	3245.26
T_7	42.58	579.05	3459.08
T_8	41.05	539.08	3315.19
T_9	41.95	577.30	3524.21
T_{10}	42.69	577.65	3446.65
T_{11}	42.04	565.35	3521.58
T_{12}	47.08	683.23	4095.90
T_{13}	48.09	741.33	4233.54
T_{14}	40.29	604.63	3394.80
T_{15}	44.17	627.80	3798.91
T_{16}	42.51	531.23	3421.70
T_{17}	44.01	614.38	3729.37
T_{18}	43.78	621.70	3753.97
T_{19}	39.14	493.00	3110.20
T_{20}	42.64	611.40	3645.58
S.Em ±	0.41	10.41	53.47
C.D. at 5%	1.16	29.45	151.26
CV %	1.95	3.60	3.06

Our findings are in line with the findings of Catada *et al.* (2016) in rice, Dunsin *et al.* (2016) in cucumber and Chuwang *et al.* (2018) in soybean, all had demonstrated improved seedling dry weight with coconut water seed priming, providing further support for the benefits of coconut water across different crop species.

Seedling vigour index I. The effect of different seed priming treatments was found significant for seedling vigour index I. Significantly the maximum seedling vigour index I (741.33) was observed in seeds primed with 5 per cent coconut water (T_{13}) and it was followed by seeds primed with 5 per cent vermiwash (T_{12}) with seedling vigour index I of 683.23. Seeds that did not undergo any treatment (control) (T_1) exhibited significantly the lowest seedling vigour index I (472.43) (Table 2). Shafiya *et al.* (2021) also observed a higher seedling vigour index I in groundnut seeds when primed with 5 per cent coconut water, which aligns with our results. Similarly, Vinothini and Bhavyasree (2019) reported the highest seedling vigour index I in brinjal seeds when primed with coconut water, reinforcing the effectiveness of coconut water. Our findings are in line with the findings of Catada *et al.* (2016) in rice, Dunsin *et al.* (2016) in cucumber and Chuwang *et al.* (2018) in soybean, all had demonstrated improved seedling vigour index I with coconut water seed priming, providing further support for the benefits of coconut water across different crop species.

Seedling vigour index II. The effect of different seed priming treatments was found significant for seedling vigour index II. Significantly the maximum seedling vigour index II (4233.54) was observed in seeds primed with 5 per cent coconut water (T_{13}) and it was followed by seeds primed with 5 per cent vermiwash (T_{12}) with seedling vigour index II of 4095.90. Seeds that did not undergo any treatment (control) (T_1) exhibited significantly the lowest seedling vigour index II (3062.16) (Table 2). Shafiya *et al.* (2021) also observed a higher seedling vigour index II in groundnut seeds when primed with 5 per cent coconut water, which aligns with our results. Similarly, Vinothini and Bhavyasree (2019) reported the highest seedling vigour index II in brinjal seeds when primed with coconut water, reinforcing the effectiveness of coconut water. Our findings are in line with the findings of Catada *et al.* (2016) in rice, Dunsin *et al.* (2016) in cucumber and Chuwang *et al.* (2018) in soybean, all had demonstrated improved seedling vigour index II with coconut water seed priming, providing further support for the benefits of coconut water across different crop species.

CONCLUSIONS

Among seed priming treatments, seeds priming with 5 % coconut water (T_{13}) was recorded the maximum germination, shoot length, root length, seedling length, seedling dry weight, seedling vigor index I and seedling vigor index II. Coconut water (coconut liquid endosperm), with its many applications, is nutritious and beneficial for health. Some of the most significant and useful components in coconut water are cytokinins, (e.g., kinetin and trans-zeatin) which are a class of phytohormones, indole-3-acetic acid (IAA), the primary auxin in plants and other components like sugars, sugar alcohols, lipids, amino acids, nitrogenous compounds, organic acids and enzymes, and they play different functional roles in plant and human systems due to their distinct chemical properties. The seeds primed with 5 per cent coconut water resulted into higher germination with good vigour in sesame.

FUTURE SCOPE

Coconut priming in sesame seeds cultivation includes enhanced germination rates, improved seedling vigor, and increased crop yield, leading to greater agricultural productivity and sustainability. Additionally, research into innovative priming techniques and the development of specialized priming formulations may further optimize sesame seed cultivation for better resilience to environmental stressors.

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Conflict of Interest. None.

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