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Influence of Seed Priming with Oil Cake Extracts on Quality Parameters of Maize Seeds

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Seed priming is a widely recommended pre sowing seed treatment, proven for its invigorative effect. An investigation was carried out to study the effect of seed priming with oil cake extracts on physiological seed quality parameters *viz.*, speed of germination, germination, root and shoot length, vigour index and biochemical seed quality parameters *viz.*, electrical conductivity and total amino acid content. Seeds of maize cv TNAU Maize hybrid CO 6 were primed with extracts of various oil cake *viz.*, groundnut, sesame, coconut, cotton and neem each at different concentrations of 5, 10, 15 and 20 % and evaluated for their physiological and biochemical quality along with hydro and nonprimed seed. Among the priming treatments, maize seeds primed with sesame oil cake extract 5 % for 12h showed early germination (6.0), highest germination (92 %), root (22.06 cm) and shoot length (18.72 cm) and vigour index (3752) than nonprimed seeds. The biochemical causes responsible for invigourative effect due to seed priming were identified as enhanced total amino acid content with low electrical conductivity of seed leachate.

Key words: Seed priming, Maize, Oil cake extracts, Germination, Vigour

Maize (*Zea mays* L.) is the third important cereal crop next to rice and wheat in the World. It is considered as the “Queen of Cereals”. Since, maize is an industrial important crop the demand for maize seed is more. On realizing the importance of maize in seed industry, the private seed companies are now concentrating more on maize seed production. For existence of any variety or hybrid, timely supply of quality seed is foremost requirement.

Higher production and productivity of crop is possible only through use of good quality seeds and proper management practices. Good quality seeds imply vigour, uniformity and structural soundness besides its genetic and physical purity. The physiological treatments of seeds have not been widely exploited in contrast to the pervasive uptake of crop protectant applied to the seeds. Seed treatment helps to improve germination potential and vigour in addition to resistance to pests and disease. An invigouration treatment should bring about qualitative improvement in the seed, which should persist after the treatment is withdrawn and the treatments are basically physiological in nature. To provide higher quality seeds, many researchers have developed new technologies called seed priming. In the last two decades, seed priming, an effective seed invigouration method has become a common seed treatment to increase the rate and uniformity of emergence. Seed priming is a controlled hydration process that involves exposing seeds to low water potentials that restrict germination, but permits pre germinative physiological and biochemical changes to occur (Heydecker and Coolbear, 1977; Bradford, 1986; Khan, 1992).

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The present study was undertaken with the aim to evaluate the efficacy of oil cake extracts as seed priming agent and nutrient for treating crop seeds for improving seed quality attributes.

Material and Methods

The present experiment was conducted to evaluate the effect of seed priming with oil cake extracts on seed quality parameters in maize cv TNAU Maize hybrid CO 6. Genetically pure, fresh seeds of maize cv. TNAU Maize hybrid CO 6 obtained from Department of Millets, Tamil Nadu Agricultural University, Coimbatore formed the base material for this study. Oil cake extracts of groundnut, sesame, coconut, cotton, neem were used as priming agents. To standardize the concentration of oil cake extracts for seed priming treatment, the various concentrations *viz*., 5, 10, 15 and 20 % of each oil cake extracts were prepared and used to carry out the seed priming experiment along with hydroprimed and nonprimed seeds.

Seeds were soaked in those extracts for 12 h with a seed to a solution ratio of 1:1 (volume: volume). After priming, the seeds were removed from the solutions, shade dried at room temperature and the following seed quality parameters were assessed. The germination test was conducted with 100 seeds in four replications for each treatment in paper medium. The test conditions of 25 ± 2ºC and 95 ± 2 % relative humidity (RH) were maintained in the germination

room. At the end of seventh day, the number of normal seedlings were counted and the mean was expressed as per cent. Final germination per cent, root and shoot length (cm) were recorded after 7 days of planting on germination paper (ISTA, 2011).

For dry matter production, the seedlings selected for root and shoot length were placed in a paper cover, shade dried for 24 hours and dried in a hot air oven maintained at 80 ± 2°C for 24 hours. Then they were cooled in a desiccator, weighed and expressed as milli gram per 10 seedlings. Vigour index values were computed using the formula suggested by Abdul-Baki and Anderson (1973) and the mean values were expressed as whole numbers. [Vigour index = Germination (%) x Total seedling length (cm)]. The electrical conductivity of seed leachate (Presley, 1958) and total amino acid content (Misra *et al.,* 1975) were analysed. Total amino acid content was estimated in the primed seeds. The data were analyzed statistically adopting the procedure described by (Panse and Sukhatme, 1985).

Results and Discussion

Seed priming is a pre sowing strategy for influencing seedling development by modulating pre germination metabolic activity prior to emergence of the radicle and generally enhances germination rate and plant performance (Bradford, 1986; Taylor and Harman, 1990). During priming, seeds are partially hydrated so that pre germinative metabolic activities proceed, while radicle protrusion is prevented, then are dried back to the original moisture level (Mcdonald, 2000).

Table 1. Effect of seed priming with groundnut and sesame oil cake extract on physiological traits in paddy

	Groundnut oil cake extract						Sesame oil cake extract					
Priming Treatments	Speed of germination	Germination (%)	Root length (cm)	Shoot length (cm)	Dry matter production (mg seedlings -10)	Vigour index	Speed of germination	Germination (%)	Root length (cm)	Shoot length (cm)	Dry matter production (mg seedlings -10)	Vigour index
Non primed seed	5.0	86 (68.03)	18.17	13.73	731.2	2743	5.0	86 (68.03)	18.17	13.73	731.2	2743
Hydropriming	5.5	88 (69.73)	20.14	16.90	952.2	3260	5.5	88 (69.73)	20.14	16.90	952.2	3260
5 %	5.3	86 (68.03)	19.18	16.85	1007.4	3099	6.0	92 (73.57)	22.06	18.72	1067.0	3752
10 %	5.4	87 (68.87)	20.91	17	972.4	3298	5.4	92 (73.57)	21.23	17.75	1036	3586
15 %	5.6	87 (68.87)	20.45	16.68	898.9	3230	5.6	91 (72.54)	20.57	18.14	999.2	3523
20 %	5.7	88 (69.73)	21.08	17.21	1008	3370	5.4	89 (70.63)	21.07	17.72	954.1	3452
Mean	5.4	87 (68.87)	19.99	16.40	928.4	3167	5.5	90 (71.57)	20.54	17.16	956.6	3386
SEd	0.08	0.637	0.264	0.326	14.72	48.2	0.08	0.737	0.291	0.241	12.24	50.6
CD (P =0.05)	0.18	1.339	0.555	0.685	30.93	101.2	0.16	1.548	0.610	0.506	25.73	106.3

Figures in parenthesis indicate arcsine transformed values

Table 2. Effect of seed priming with coconut and cotton oil cake extract on physiological traits in paddy

	Coconut oil cake extract						Cotton oil cake extract					
Priming Treatments	Speed of germination	Germination (%)	Root length (cm)	Shoot length (cm)	Dry matter production (mg seedlings-10)	Vigour index	Speed of germination	Germination (%)	Root length (cm)	Shoot length (cm)	Dry matter production (mg seedlings-10)	Vigour index
Nonprimed seed	5.0	86 (68.03)	18.17	13.73	731.2	2743	5.0	86 (68.03)	18.17	13.73	731.2	2743
Hydropriming	5.5	88 (69.73)	20.14	16.90	952.2	3260	5.5	88 (69.73)	20.14	16.90	952.2	3260
5 %	5.5	88 (69.73)	20.47	17.19	1020	3314	5.7	92 (73.57)	21.44	17.87	945.4	3617
10 %	5.7	90 (71.57)	19.38	17.54	911.3	3323	5.4	92 (73.57)	20.57	17.17	902.1	3472
15 %	5.8	90 (71.57)	20.48	17.92	1038.0	3456	5.5	90 (71.57)	20.28	16.53	876.8	3313
20 %	5.7	87 (68.87)	20.30	17.72	994.1	3308	5.5	92 (73.57)	21.16	17.28	861.7	3536
Mean	5.5	88 (69.73)	19.82	16.83	941.1	3234	5.4	90 (71.57)	20.29	16.58	878.2	3323
SEd	0.04	1.136	0.281	0.273	11.08	41.9	0.04	1.184	0.329	0.183	12.57	44.8
CD (P =0.05)	0.09	2.386	0.590	0.573	23.28	88.0	0.10	2.488	0.692	0.384	26.42	94.2

Figures in parenthesis indicate arcsine transformed values

The extracts of different oil cakes with the concentrations of 5, 10, 15 and 20 % of each used for carrying out the seed priming experiment. Among the different concentrations, groundnut oil cake extract 20 %, sesame oil cake extract 5 %, coconut oil cake extract 15 %, cottonseed oil cake extract 5 % and neem oil cake extract 10 % recorded the highest germination (88, 92, 90, 92 and 89 %, respectively) and seedling vigour (3370, 3752, 3456, 3617 and 3529, respectively) when compared to the nonprimed

Table 3. Effect of seed priming with neem oil cake extract on physiological traits in paddy

Priming Treatments	Speed of emergence	Germination (%)	Root length (cm)	Shoot length (cm)	Dry matter production (mg seedlings^{-10})	Vigour index
Nonprimed seed	5.0	86 (68.03)	18.17	13.73	731.2	2743
Hydropriming	5.5	88 (69.73)	20.14	16.90	875.3	3260
5 %	5.3	87 (68.87)	21.70	16.12	745.8	3290
10 %	5.7	89 (70.63)	21.79	17.86	952.2	3529
15 %	5.5	86 (68.03)	21.33	16.86	827.5	3284
20 %	5.6	85 (67.22)	21.23	15.66	844.3	3136
Mean	5.4	87 (68.87)	20.73	16.19	829.4	3207
SEd	0.07	0.938	0.254	0.136	7.08	27.9
CD (P = 0.05)	0.14	1.970	0.534	0.286	14.88	58.7

Figures in parenthesis indicate arcsine transformed values

seeds which was having lowest germination (86 %) and vigour index (2743) of maize seeds.

Among the various cake extracts, the seeds treated with sesame oil cake extract 5 % showed an increased germination (92 %) which was on par with cottonseed oil cake extract 5 %. Seed priming with other oil cake extracts such as groundnut oil cake extract 20 %, coconut oil cake extract 15 %, neem oil cake extract 5% were also effective in enhancing the germination significantly, over non primed seed.

The root length of 22.06 cm and shoot length of 18.72 cm were observed in seeds treated with sesame oil cake extract 5 %. Seedling dry weight and vigour index were also higher in seeds primed with sesame oil cake extract 5 % (1067 mg seedling-10 and 3752, respectively). Sesame oil cakes are rich in protein, calcium, phosphorus and amino acids (Yasothai, 2014). The increase in seed quality attributes of maize due to priming with sesame oil cake extract might be attributed to the presence of vitamin tocopherol and antioxidants like sesamol in the sesame seeds (Ranken *et al*., 1997).

Table 4. Influence of seed priming with different oil cake extracts on physiological traits in maize

Priming Treatments	Speed of emergence	Germination (%)	Root length (cm)	Shoot length (cm)	Dry matter production (mg seedlings-10)	Vigour index
Nonprimed seed	5.0	86 (68.03)	18.17	13.73	731.2	2743
Hydropriming	5.5	88 (69.73)	20.14	16.90	952.2	3260
Oil cake extract Groundnut 20 %	5.7	88 (69.73)	21.08	17.21	1007.4	3370
Sesame 5 %	6.0	92 (73.57)	22.06	18.72	1067.0	3752
Coconut 15 %	5.8	90 (71.57)	20.48	17.92	1038.0	3456
Cotton 5 %	5.7	92 (73.57)	21.44	17.87	945.4	3617
Neem 10 %	5.7	89 (70.63)	21.79	17.86	875.3	3529
Mean	5.6	89 (70.63)	20.74	17.17	945.2	3389
SEd	0.07	1.093	0.295	0.245	13.32	49.8
CD (P = 0.05)	0.16	2.272	0.613	0.510	27.72	103.6

Figures in parenthesis indicate arcsine transformed values

Ashraf and Rauf (2001) reported that the final germination per cent, fresh and dry weight of corn seed increased by seed priming significantly. Copeland and McDonald (1995) observed that most seeds imbibed in water and sown in moist environment, germinate faster than untreated seeds.

Electrical conductivity of the seed leachate as a measure of membrane integrity is considered as a good index for seed viability (Matthews and Bradnock, 1968). The present study revealed that the primed seeds recorded lower electrical conductivity and increased total amino acid content compared to hydroprimed and nonprimed seeds. The activities of several anti-oxidative and hydrolytic enzymes raised considerably after the start of seed imbibitions (Umair *et al*., 2012).

Conditions during germination also may affect the response to seed pre sowing treatments. When seed lot viability is high but germination is low, or the conditions for germination are less than optimal, a pre sowing seed treatment could be beneficial. But these oil cake extract priming will have its additive

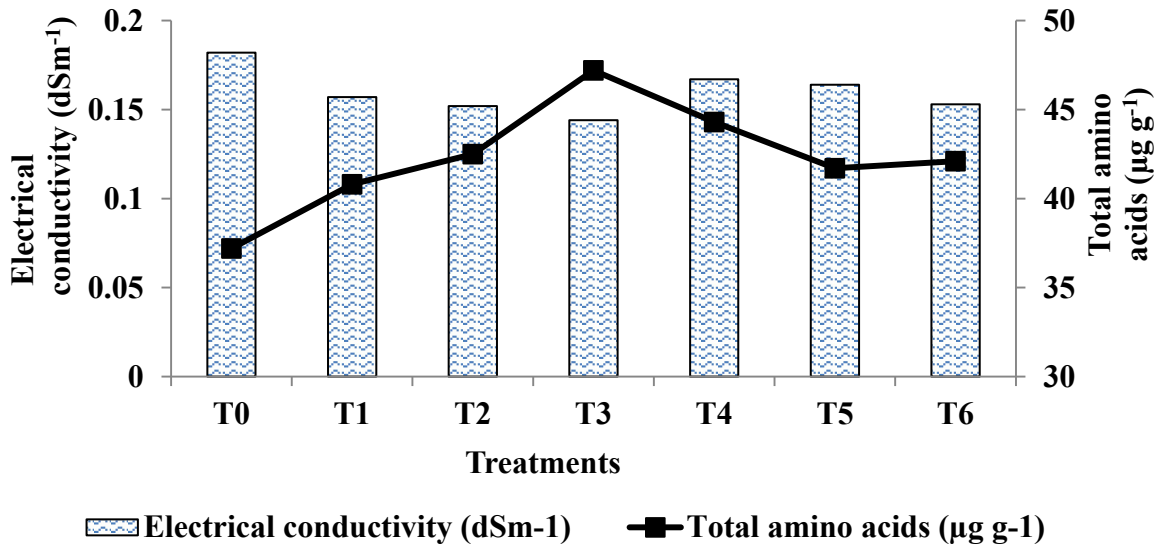

Fig 1. Influence of seed priming on EC (dSm^{-1}) and total amino acids (µg/g) of maize

T_0 – Control; T_1- Hydro priming; T_2 - Groundnut oil cake extract 20 %
T_3 - Sesame oil cake extract 5 %; T_4 - Coconut oil cake extract 15 %
T_5 - Cotton oil cake extract 5 %; T_6 - Neem oil cake extract 10 %

effect on the germination of the seeds and oil cake extract are an ecologically accepted, cheap source of rich nutrients affordable and easily accessible to farming community. The experimental observation on the increase in the germination of the maize is indicative to the priming with oil cake extract have effect on the physiological processes of the seeds.

Conclusion

Among the different oil cake extract used for seed priming, sesame oil cake extract 5 % induced the maximum germination per cent, root and shoot length, dry matter production of seedlings and vigour index. The present study proved that the sesame oil cake extract 5 % can be effectively used for seed priming.

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