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Effect of seed priming on germination and seed quality parameters of lentil (*Lens culinaris* Medic.)

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Abstract
An experiment was conducted to study the "Effect of seed priming on germination and seed quality parameters of lentil" (*Lens culinaris* Medic.) in the Seed Testing Laboratory of Department of Seed Science and Technology, C. S. Azad university of Agriculture and Technology, on lentil variety KLS-218. The experiment was comprised ten seed priming treatments *viz.*, T_0- Control, T_1- Seed priming with *Trichoderma harzianum* @ 1.5%, T_2- Seed priming with GA_3 @ 50ppm, T_3- Seed priming with Vitavax power @ 0.25%, T_4 - Seed priming with GA_3 @ 50ppm + seed coating with *Trichoderma harzianum* @ 15g/kg seed, T_5- Seed treatment with Bavistin @ 3g/kg seed, T_6- Seed priming with sodium molybdate @ 500 ppm, T_7- Seed priming with sodium molybdate @ 500ppm + seed coating with *Trichoderma harzianum* @ 15 g/kg, T_8- Seed priming with water, T_9- Seed priming with leaf extract of *Lantana camara* @ 10%. The present investigation revealed that seed priming with sodium molybdate @ 500 ppm + seed coating with *Trichoderma harzianum* @ 15g/ kg seed was significantly highest performance to improved the germination and seed quality parameters with 1000 seed wt. (19.87g), germination (95.21%), seedling length (26.23cm.), seedling dry weight (0.125g.), seed vigour index-I (2497.50), seed vigour index-II (11.90), electrical conductivity (0.42) over control. Seed mycoflora (%) was recorded significantly lowest in T_5 (Seed priming with Bavistin 3g/kg seed) i.e. 5.50 (%).

Keywords: Seed priming, germination, seed quality parameters, lentil (*Lens culinaris* Medic.)

Introduction
Pulses are important source of vegetable protein and are the second most important source of human food. These plants fix nitrogen, and improve soil fertility, prevent soil erosion and play an important role in sustainability of agricultural systems (Parsa and Bagheri, 2009) [10]. In countries that are faced with meat shortage or meat consumption or animal products are used less because of religious or economic reasons, pulses such as beans and lentils which are rich in protein, provide a Cheap price source of nutrients (Majnoon Hosseini, 1994) [8]. Lentil (*Lens culinaris* Medic.) is one of the oldest annual grain legumes consumed and cultivated in the world. Originating from South western Asia as early as 6000 B.C., lentil is rich in proteins and contains high concentrations of essential amino acids like isoleucine and lysine, as well as other nutrients like dietary fiber, folate, vitamin B_1, and minerals. Being a leguminous crop, lentil can make use of atmospheric N_2 to fulfill its N requirements through biological nitrogen fixation (Badarneh, 1995) [1]. The most common seed priming treatments used to increase seed germination and synchronization are osmo-priming (immersing the seeds in solutions with osmotic potential), halo-priming (placing the seeds a salt solution), hydro-priming (placing the seeds in water), matrix-priming (placing the seeds between saturated jute mat layers) and hardening (alternately soaking and drying the seeds) (Basra *et al.*, 2003; Khan, 1992; Mc Donald, 2000) [2, 9]. Ghassemi-Golezani *et al.* (2008) [6] reported that hydro-priming treatments increased the weight of the seedling root, the germination rate, as well as shoot, root and seedling dry weight. Currently seed priming is a well-recognized technique to improve the seed vigor with quick and synchronized germination over a range of environmental conditions.

Materials and methods
The present investigation was conducted at the Seed Testing Laboratory of Department of Seed Science and Technology, C. S. Azad university of Agriculture and Technology. Seeds of lentil cultivar 'KLS-218' were used. Newly harvested seeds were kindly obtained from New Dairy Farm, Kalyanpur, Kanpur during 2016-17 & 2017-18. The experiment was comprised ten seed priming treatments *viz.*, T_0- Control, T_1- Seed priming with *Trichoderma harzianum*@ 1.5%, T_2- Seed priming with GA_3 @ 50ppm, T_3- Seed priming with Vitavax power @ 0.25%,

T_4 - Seed priming with GA_3 @ 50ppm + seed coating with *Trichoderma harzianum* @ 15g/kg seed, T_5- Seed treatment with Bavistin @ 3g/kg seed, T_6- Seed priming with sodium molybdate @ 500 ppm, T_7- Seed priming with sodium molybdate @ 500ppm + seed coating with *Trichoderma harzianum* @ 15 g/kg, T_8- Seed priming with water, T_9- Seed priming with leaf extract of *Lantana camara* @ 10%. All priming seeds were prepared in distilled water. Unprimed seeds were used as a control. The seeds were divided into ten subsamples of 95 g each, and one sub-sample was used as the control (unprimed). The nine other sub-samples were used for priming treatments. Lentil seeds were primed seperately in 1000 ml solutions of each respective priming agent for 12 h under dark conditions in an incubator (Ghassemi-Golezani *et al*., 2008) [6]. These primed seeds were used for germination (%), seedling length (cm), seedling dry weight (g), seed vigour index- I, seed vigour index-II, Electrical conductivity, 1000 seed weight gain (g) and seed mycoflora (%) after priming treatments were analysed with specific methodology.

Results and Discussion

Seed priming treatment with T_7 (sodium molybdate 500ppm + *T.harzianum* @ 15g/kg seed) was shown significantly highest performance over control in terms of 1000 seed weight (g), germination (%), seedling length (cm), seedling dry weight (g), seed vigour-I, seed vigour- II, and electrical conductivity (dSm^{-1}) showed 19.87(g), 95.21(%), 26.23(cm), 0.125(g), 2497.50, 11.90 & 0.48 (dSm^{-1}) respectively. It was shown in table-1 & fig.1, 2. Next to seed priming treatment T_1 (seed (*Trichoderma harzianum* @ 1.5%) gave significantly second highest performance over control for 1000 seed weight (g), germination (%), seedling length (cm), seedling dry weight (g), seed vigour-I, seed vigour- II, and electrical conductivity (dSm^{-1}) showed 19.16 (g), 93.08 (%), 25.81 (cm), 0.118 (g), 2403.41, 10.98 & 0.54 (dSm^{-1}), respectively and lowest quality parameters were seen in unprimed dry seeds. The finding was supported by Khan and Hedge (1989) [7] and El-Hefny *et al*. (1999) [4] in lentil. This was due to hydration of the seeds; hydrolytic enzymes were activated in the endosperm converting complex stored food materials into metabolically useful chemicals that resulted in to growth of the embryo.

Seed priming methods exhibited better performance in seedling vigour over the non-primed seeds. Seed priming with sodium molybdate @ 500ppm + seed coating with *Trichoderma harzianum* @ 15 g/kg seed was significantly higher in term of seed vigour-I showed highest percent improvement in T_7 (61.18%) followed by T_1 (55.22%), T_8 (51.37%), T_4 (50.20%) & inferior performance was shown in T_2 (26.35%) over control with values 2497.50, 2403.41, 2345.92, 2327.24 & 1957.72. Seed vigour-II on pooled mean basis showed highest percent improvement in T_7 (sodium molybdate + *T.harzianum* @ 15g/kg seed) (68.31%) followed by T_1 (55.30 %), T_8 (51.37%), T_6 (41.10%) & inferior performance was shown in T_2 (21.78%) over control. Increase in shoot length & root length simultaneously occurred thereafter resulting in better seedling vigor.

Electrical conductivity was best performance shown by T_7 (sodium molybdate 500ppm + *T.harzianum* @ 15g/kg seed) with lowest value 0.482. The maximum electrical conductivity was recorded & significantly inferior performance was shown in T_0 (0.887). It means higher the value of electrical conductivity poor the storability of seed & less vigorous of the seed.

Table 1: Mean table for the effect of seed priming treatments on seed quality parameters of lentil on pooled mean basis.

Treatments		1000 seed wt. (g)	Germination (%)	Seedling length (cm)	Seedling dry weight (g)	Seed vigour index -I	Seed vigour index -II	EC (dSm^{-1})	Seed mycoflora (%)
Control	T_0	17.70	86.20	17.95	0.082	1549.42	7.07	0.89	13.75
Trichoderma harzianum (1.5 %)	T_1	19.16	93.08	25.81	0.118	2403.41	10.98	0.54	8.00
GA_3 (50 ppm)	T_2	18.45	90.25	21.69	0.095	1957.72	8.61	0.75	9.00
Vitavax power (0.25%)	T_3	18.63	92.31	22.75	0.098	2100.42	9.09	0.69	7.00
GA_3 (50 ppm) + *Trichoderma harzianum* (15 g)	T_4	18.79	91.91	25.31	0.109	2327.24	10.01	0.63	7.75
Bavistin (3g)	T_5	18.26	92.50	24.86	0.105	2299.87	9.71	0.68	5.50
Sodium molybdate (500 ppm)	T_6	18.79	92.91	24.23	0.112	2251.95	10.40	0.57	8.00
Sodium molybdate (500 ppm + *Trichoderma harzianum* (15 g)	T_7	19.87	95.21	26.23	0.125	2497.50	11.90	0.48	7.50
Tap water for 8 hours	T_8	18.34	92.79	25.28	0.114	2345.92	10.62	0.56	11.50
Leaf extract of lantana camara	T_9	18.50	91.41	22.19	0.102	2029.24	9.32	0.71	9.00
$S.E_{(diff.)}$		0.37	2.01	0.50	0.002	50.06	0.17	0.01	0.13
$C.D_{(P=0.05)}$		0.78	4.23	1.05	0.004	105.17	0.36	0.02	0.27

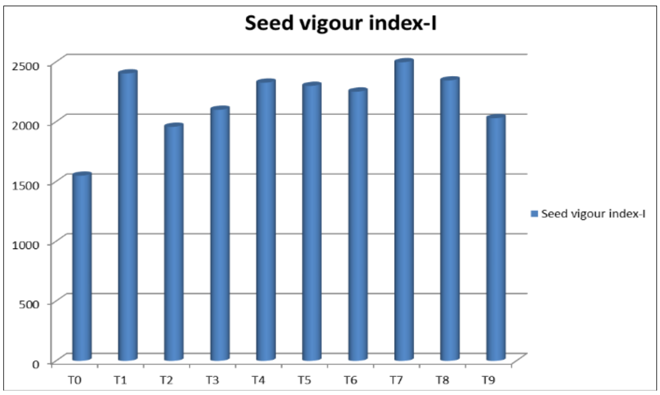

Fig 1: Graphical presentation for the effect of seed priming treatments on seed vigour index-I

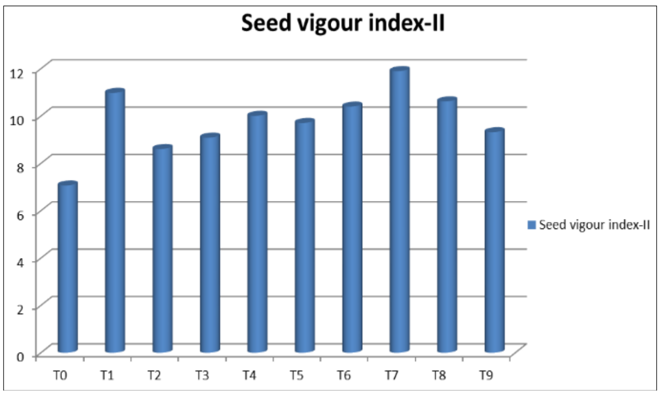

Fig 2: Graphical Presentation for the effect of seed priming treatments on seed vigour index-II

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