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Influence of Chemicals, Botanicals and Growth Regulator Treatments on Plant Growth and Yield Attributing Traits of Lentil (*Lens culinaris* L.) Variety: K-75

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

The experiment was conducted in post graduate Seed Testing Laboratory and Field Department of Genetics and Plant Breeding, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj (U.P) during Rabi season 2020-2021, in order to standardize the suitable pre-sowing seed treatment for Lentil (K-75). Different pre-sowing seed treatments viz.,T0-Control (untreated), T1- KCL @1%, T2- KCL @ 3%, T3- KNO3 @ 1%, T4- KNO3 @ 3%, T5- Panchagavya @ 2%, T6 – GA3 @ 20ppm, T7 – Panchagavya @ 4%, T8 – GA3 @ 10ppm,T9 – Panchagavya @ 6%,T10 – Tulasi Leaf Extract @ 2%, T11 – Tulasi Leaf Extract @ 4%,T12 – Tulasi Leaf Extract @ 6% were evaluated by screening of 12 hour. It was found that all the pre-sowing seed treatments recorded the significant difference with that of control. In field condition highest field emergence percentage,yield and yielding attributes was found in T7 -Panchagavya @ 4%. Pre-sowing seed

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treatment with Panchagavya @ 4% followed by GA3 @ 10 ppm, Panchagavya @ 2%, KCL @ 1% significantly increased the germination and yielding attributes of Lentil. Pre-sowing seed treatments with Panchagavya (4%) and GA3 (10ppm) resulted in maximum increase in field emergence, vigour of Lentil seeds and found to be lowest in control seeds. Pre-sowing seed treatment that leads to a physiological condition that allows the seed to germinate more effectively and no costly equipment and chemical requirements could be used. Hence it is a simple method for overcoming weak germination and seedling establishment and helps to preserve agriculture and economical, non-toxic, eco-friendly sources.

Keywords: Lentil seeds; panchagavya; tulasi leaf extract; growth and yield.

1. INTRODUCTION

Lentil (*Lens culinaris* L.) is one of the oldest domesticated plants in the world, originated from the near East and Central Asia, is traditionally cultivated in the Mediterranean basin. Lentil belongs to Fabaceae family and it gains the height of 40 to 50 cm at maturity. The tap root system of the plant grows to a depth of around 30cm that makes it a moderately tolerant to high temperature and drought. It is diploid annual crop with chromosome number 2n=14. Lentil is one of the most important pulse crops of the world that is consumed for its high protein (9gm) and mineral content [1]. Lentil is grown over sub-tropical and temperate climate zones between 58° North and 40° South lattitudes Alghamdi et al. [2]. The major lentil producing states in India are Madhya Pradesh, UP, Bihar and West Bengal and AP, Karnataka account for about 80% of the total production. Lentil (*Lens culinaris* Medik.) is an important food legume cultivated in rainfed areas in many countries including India. The important Lentil growing countries of the worlds are India, Canada, Turkey, Bangladesh, Iran, China, Nepal and Syria Ahlawat, [3]. The total cultivated area in the world around 4.6 million ha producing 4.2 million tons of seeds with an average production of 1095Kg/ha FAO, [4]. Seeds of this species for the human diet and the entire biomass of plant is a valued animal feed. Irrigation generally increases lentil yield Salehi et al. [5]. Improving seed size, seed yield, biomass yield and harvest index Khourgami et al. [6].

Lentil has been part of the human diet, also has the third-highest level of protein, after soybean and hemp. Lentil is deficient in two essential amino acids, methionine and cysteine. Lentil also contains dietary fiber, vitamin B1, and minerals. Lentil is relatively tolerant to drought, and is grown throughout the world. Huda, [7] reported that 10-15% production was found to reduce due to use of poor quality seed. Strategies for improving rapid germination and emergence of crop species through seed priming have been investigated for many years. The seed priming had been demonstrated for many field crops such as sweet corn, mung bean, barley, lentil, cucumber etc, Sadeghian and Yavari [8].

2. MATERIALS AND METHODS

The present investigation was carried out at the laboratory and field of Seed Science and Technology in the department of Genetics and Plant Breeding, Prayagraj School of Agriculture, Sam Higginbottom University of Agriculture, Technology and Sciences Prayagraj (UP). Located at latitude of 25.35° N and longitude 82.25° E at an altitude of 78m above mean sea level, the soil is sandy loam in texture with moderate water holding capacity having pH of 7.0 to 8.0. Field experiment was laid down using Randomized Block Design in three replications. After cleaning and grading of lentil seeds variety K-75 were treated with different priming treatments viz distilled water (**T0**), potassium chloride (KCL) @ 1% [**T1**], Potassium chloride (KCL) @ 3% [**T2**], Potassium Nitrate (KNO3) @ 1% [**T3**], Potassium Nitrate (KNO3) @ 3% [**T4**], Panchagavya @ 2% [**T5**], Gibberellic acid (GA3) @ 20 ppm [**T6**], Panchagavya @ 4% [**T7**], Gibberellic acid (GA3) @ 10 ppm [T8], Panchagavya @ 6% [T9], Tulasi Leaf Extract @ 2% [**T10**], Tulasi Leaf Extract @ 4% [**T11**]. Field emergence (%), plant height (cm), number of branches plant-1, Number of days to 50% flowering, Number of pods plant-1, Number of seeds pod- 1, Seed yield plant-1, Seed yield plot-1(g), Biological yield and Harvest Index was observed.

3. RESULTS AND DISCUSSION

It is evident from the present investigation that different types of priming methods had positive

effects on the growth and yield of lentil crop. In general, most of the pre-sowing seed treatments were found effective in increasing the yield attributes at all stages significantly as compared to Control. The data presented in the (Table-1) shows the mean performance of 13 treatments for 10 growth and yield attributing traits of lentil crop.

3.1 Field Emergence

In case of different pre-sowing seed treatments, field emergence percentage was found to significantly higher in Panchagavya @ 4% (87.30%), followed by GA3 @ 10ppm (82.29%) and KNO3 @ 3% (81.25%) when compared to control (distilled water) (70.83%). The data regarding the field emergence percentage found best in panchagavya 4% among all the treatments. These similar results of field emergence percentage was observed by Khan et al. [9] Singh et al. [10].

3.2 Days to 50% Flowering

In case of different pre-sowing seed treatments, Days to 50% flowering was found to be significantly lowest in panchagavya @ 4% (68.67%), followed by KNO3 @ 1% (70.33%) and KCL @ 3% (70.43%) when compared with the Control (unprimed seeds) (75.67%). When the data regarding the days to 50% flowering found best in Panchgavya 4% among all the treatments. These similar results was observed by Beaulah et al. [11], Kumaravelu et al. [12].

3.3 Plant Height

In case of different pre-sowing seed treatments, Plant height was found to be significantly higher in panchagavya @ 4% (34.77cm), followed by GA3 @ 20ppm (31.42cm) and KNO3 @ 1% (31.10cm) when compared to the unprimed seeds (27.07cm). The data regarding the plant height found to be best in panchagavya 4% among the all treatments (34.77cm). The similar results was observed by Ali M.N.et al. [13] Chadha Sanjay et al. [14] Ghodrat and rousta et al. [15].

3.4 Number of Branches per Plant

In case of different pre-sowing seed treatments, Number of branches per plant was found to be significantly higher in panchagavya @ 4 % (5.13), followed by KCL @ 1% (4.20) and GA3 @ 20ppm (4.13), when compared to the control (unprimed seeds) (3.33). The data regarding to the number of branches per plant found best in panchagavya 4% among all the treatments (5.13). Similar results was observed by Anburani and Shakila [16] Bajehbaj [17].

3.5 Number of Pods per Plant

In case of different pre-sowing seed treatment, Number of pods per plant was found significantly higher in panchagavya @ 4% (55.33), followed by the GA3 @ 10ppm (51.47) and panchagavya @ 6% (47.02) when compared to the control seeds (45.00). The data regarding to the number of pods per plant found best in panchagavya 4% among all the treatments (55.33). The similar results was observed by Babu et al. [18]; Saglam et al. [19].

3.6 Number of Seeds per Pod

Number of seeds per pod recorded high in case of primed seeds compared to unprimed seeds in this experiment. Among all different pre- sowing seed treatments, panchagavya @ 4% found to be highest (2.0) and control found to be lowest (1.20) among all treatments. The similar results was observed by Sarmadi et al. [20].

3.7 Seed Yield per Plant

Seed yield per plant recorded high in case of primed seeds compared to unprimed seeds in this experiment. Among all different pre-sowing seed treatments, seed treated with panchagavya @ 4% recorded highest seed yield (3.37gm/plant); followed by GA3 @ 10ppm (3.18gm/plant) and KNO3 @ 1% (2.05gm/plant) when compared to the Tulasi leaf extract (1.56gm/plant). The data regarding the seed yield per plant found best in panchagavya 4% due to. Similar findings was observed by Shakuntala et al. [21].

3.8 Seed Yield per Plot

Seed yield per plot recorded high in case of primed seeds compared to the unprimed seeds in this experiment. Among all different pre-sowing seed treatments, panchagavya @ 4% recorded highest seed yield (242.40 gm/plot), followed by GA3 @ 10ppm (228.96 gm/plot) and KCL @ 1% (172.56 gm/plot). Seed yield per plot found best in panchagavya 4% compared to the control. The similar results was observed by the Vazirimehr et al. [22].

Table 1. Mean performance of Lentil for Growth and yielding attributing characters

S.NO.	Treatments	Field Emergence percentage	Days to 50% Flowerin g	Plant height (cm)	Number of Branches Per Plant	Number of Pods Per Plant	Number of Seeds Per Pod	Seed yield per plant (g)	Seed yieldper plot (g)	Biological yield (g)	Harvest index (%)
1	**T0**	70.83	75.67	27.07	3.33	45.00	1.87	1.86	134.07	3.59	51.78
2	**T1**	76.04	72.33	30.51	4.20	44.47	1.60	2.40	172.56	4.05	44.67
3	**T2**	71.88	70.33	28.93	3.40	40.80	1.53	2.00	144.00	3.86	52.14
4	**T3**	72.92	70.33	28.60	4.13	37.07	1.60	2.05	147.36	4.01	41.92
5	**T4**	81.25	75.33	29.83	3.93	41.47	1.67	1.76	126.72	3.49	45.83
6	**T5**	78.13	70.67	31.10	3.73	51.47	1.73	3.18	228.96	5.01	62.53
7	**T6**	73.96	72.00	31.42	4.13	42.73	1.33	1.77	127.31	3.37	53.40
8	**T7**	87.50	68.67	34.77	5.13	55.53	2.00	3.37	242.40	5.17	65.07
9	**T8**	82.29	74.00	30.10	3.73	42.33	1.80	1.75	126.12	3.25	55.61
10	**T9**	79.17	71.00	30.23	3.40	47.07	1.20	1.95	140.23	3.23	56.06
11	**T10**	80.21	77.00	28.49	3.67	41.00	1.60	1.70	122.15	3.20	52.20
12	**T11**	78.13	74.00	30.14	3.73	42.80	1.60	1.77	127.51	3.26	54.95
13	**T12**	75.12	70.33	29.43	4.13	37.67	1.47	1.56	112.22	3.55	44.52
Grand Mean		**77.48**	**72.28**	**72.28**	**3.90**	**43.80**	**4.85**	**2.09**	**150.12**	**48.92**	**52.44**
C.D.(5%)		**4.32**	**2.38**	**2.38**	**0.61**	**2.36**	**0.16**	**0.27**	**19.14**	**0.44**	**5.57**
SE(m)		**1.48**	**0.82**	**0.82**	**0.21**	**0.81**	**0.05**	**0.09**	**6.56**	**0.15**	**1.91**

Legends: *T0 – Control, T1 – Potassium chloride (KCL) @ 1%, T2 – potassium chloride (KCL) @ 3%, T3 – Potassium Nitrate (KNO3) @1%, T4 - Potassium Nitrate (KNO3) @ 3%, T5 - Panchagavya @ 2%, T6 – Gibberellic Acid (GA3) 20 ppm, T7 – Panchagavya @ 4%,T8- Gibberellic Acid (GA3) 20 ppm,T9- Panchagavya @ 6%, T10 - Tulasi Leaf Extract @ 2%, T11 – Tulasi Leaf Extract @ 4%,T12 – Tulasi Leaf Extract @ 6%.*

3.9 Biological Yield

Biological yield recorded high in case of primed seeds when compared to the unprimed seeds in this experiment. Among different pre-sowing seed treatments, panchagavya @ 4% recorded highest (5.17) biological yield and GA3 @ 10ppm (5.01) found to be highest and KNO3 @ 3% (4.05) is found to be lowest among all the treatments**.** The similar results was observed by Farooq et al. [23].

3.10 Harvest Index

In case of different pre-sowing seed treatment, harvest index was found significantly higher in panchagavya @ 4% (65.07%), followed by GA3 @ 10ppm (62.53%) and panchagavya @ 6% (56.06%) when compared to the KNO3 @ 1% (41.92%). The data the regarding the harvest index found best in panchagavya 4% among all the treatments. The similar results of harvest index was observed by Ghassemi-Golezani et al. [24], Hossain et al. [25].

4. CONCLUSION

The overall performance of pre-sowing seed treatments under study judged on the basis of positive results obtaining indicate that, Panchagavya @ 4% had shown superior performance with respect growth, yield under agro-climatic conditions of Prayagraj region, found to be vigorous among the 13 pre-sowing seed treatments with high seed vigour indices. Similarly the GA3 @ 10ppm performance of at par. Hence panchagavya and GA3 are the suitable pre-sowing seed treatments for lentil in Prayagraj region.

5. FURTHER RESEARCH

The further investigation needs to conduct for the confirmation of the promising pre-sowing seed treatments for prayagraj. The treatments panchagavya @ 4% and GA3 @ 10ppm where found most promising for commercial cultivation in prayagraj agro-climatic conditions

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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