

Original Research Article

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## Influence of Different Hydration and Dehydration Techniques on Quality and Yield in fenugreek (*Trigonella foenumgraecum* L.)

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### ABSTRACT

In order to determine the influence of different seed hydration and dehydration techniques on growth, yield and seed quality parameters in fenugreek, an experiment was conducted in year 2019 at the Field Experimentation Centre and Post Graduate Laboratory, Department of Genetics and Plant Breeding, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj (U.P) in RBD (Randomized Block Design) and CRD (Completely Randomized Block Design) having three and four replications respectively. The results showed that the effect of seed treatments was significant on all quantitative and qualitative characters except field emergence and seedling dry weight at 5% level of significance. Mean comparison showed that treatment T<sub>7</sub> (CaCl<sub>2</sub>) (3%) were identified as a best treatment with maximum field emergence 93.04%, plant height (74.90 cm), number of branches per plant (2.10), early days to 50 percent flowering (34.91), number of pods per plant (15.20), number of seeds per pod (8.17), pod fresh weight (1.93 g), pod dry weight (0.91 g), seed yield per plant (93.04 g), biological yield (530.30 g) and harvest index (2.94 g) followed by T<sub>5</sub> (KNO<sub>3</sub>) (3%) when compared with control (T<sub>0</sub>). In qualitative parameters T<sub>7</sub> (CaCl<sub>2</sub>) (3%) showed better performance followed by T<sub>5</sub> (KNO<sub>3</sub>) (3%) when compared with control (T<sub>0</sub>).

#### Keywords

Hydration,  
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### Introduction

Fenugreek belongs to Leguminacea family; it was named, Trigonella, from Latin language that means “little triangle” due to its yellowish-white triangular flowers (Flammang *et al.*, 2004). Fenugreek (*Trigonella foenum-graecum* L.) is one of the oldest medicinal plants from Fabaceae family

originated in central Asia ~ 4000 BC (Altuntas *et al.*, 2005).

Its description and benefits had been reported in the Ebers Papyrus (one of the oldest maintained medicinal document) earlier in 1500BC in Egypt (Betty, 2008). It is being commercially grown in India, Pakistan, Afghanistan, Iran, Nepal, Egypt, France,

Spain, Turkey, Morocco, North Africa, Middle East and Argentina (Flammang *et al.*, 2004; Altuntas *et al.*, 2005).

The country produces more than two million tons of spices annually. India is the largest producer and exporter in the world. It is cultivated across the country though production is concentrated in Madhya Pradesh, Rajasthan and Gujarat. In India it is cultivated in an area of 149330 ha with 213340 tons production (Spice Board of India-2017-18).

It is an important short duration (90- 120 days) crop of high nutritive value having high nitrogen fixing ability and is grown during Rabi, kharif as well as summer seasons in arid and semi-arid regions of India. Fenugreek is cultivated mostly in India, Pakistan, USA, Italy, Morocco, Germany, and Spain (Punia *et al.*, 2009).

Fenugreek seeds contain substantial amount of fiber (Montgomery, 2009; Meghwal and Goswami, 2012), phospholipids, glycolipids, oleic acid, linolenic acid, linoleic acid (Suliman *et al.*, 2000; Chatterjee *et al.*, 2010), choline, vitamin A, B1, B2, C, nicotinic acid, niacin (Leela and Shafeekh, 2008), and many other functional elements. Despite of its exceptional nutritional and medicinal value, only a few studies have been done for its genetic enhancements and development of production agronomy.

Fenugreek is an annual legume, diploid ( $2n=16$ ) plant (Ahmad *et al.*, 1999) with no aneuploidy (Petropoulos, 2002; Trease and Evans, 2002; Flammang *et al.*, 2004). Morphologically, it is an erect, aromatic annual closely resembling large clover. The stem is long cylindrical (30 to 60 cm long) and pinkish in color; whereas its roots are massive finger like structures (Basu, 2006; Mehrafarin *et al.*, 2011; Moradikor and

Moradi, 2013). Fenugreek has pinnate, trifoliate, long stalked compound leaves having toothed, lanceolate, stipules triangular, obovate to obancelolate leaflets (Srinivasan, 2006; Basu, 2006). It blooms with white to yellowish white, axillary and sessile flowers that are hermaphrodite and insect pollinated. Flowers have 5 petals referred as banner, wing and keel. The ovary is deep green and glaucous while the pollen grains are oval to circular in shape (Basu, 2006; Montgomery *et al.*, 2009; Mehrafarin *et al.*, 2011). Fenugreek flower produces brownish to yellowish brown ~15 cm long 2-8 pods. Each pod contains 10-20 seeds per pod; seeds are small (~5 mm long), hard, smooth, dull yellow to brownish yellow in color (Altuntas, 2005; Moradikor and Moradi, 2013).

Hydration and dehydration in its traditional sense, soaking or drying of seeds in chemicals/water before sowing, has been the experience of farmers in India in an attempt to improve crop stand establishment but the practice was without the knowledge of the safe limit of soaking duration (Harris, 1996).

The advantage of seed hydration and dehydration in reducing the germination time and improving emergence uniformity is well established under laboratory conditions.

## **Materials and Methods**

The Research study was conducted at experimental research field, Department of Genetics and Plant Breeding, Naini Agriculture Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj during kharif-2019. The experiment was carried out at Field Experimentation Centre of the Department of Genetics and Plant Breeding, Sam Higginbottom University of Agriculture, Technology & Sciences, Prayagraj (UP) during Kharif-2019 to influence of different

hydration and dehydration techniques on quality and yield infenugreek (*Trigonella foenumgraecum* L.)

The experiment comprised of thirteen treatments in Randomized Block Design (RBD) with three replications for field experiment and Completely Randomized Design (CRD) with four replications for laboratory experiment. The data was collected on five randomly selected plants from each plot and measurement of different observations was recorded.

The treatments were represented as T0 (Control), T1 (Distilled water), T2 (KCl @ 1%), T3 (KCl @ 3%), T4 (KNO<sub>3</sub> @ 1%), T5 (KNO<sub>3</sub>@3%), T6 (CaCl<sub>2</sub> @ 1%), T7 (CaCl<sub>2</sub>@3%), T8 (NaCl @ 1%), T9 (NaCl @ 3%), T10 (Salicylic Acid (200 ppm), T11(Gibberellic Acid (GA3) (100 ppm), T12 (Indole Acetic Acid (IAA) (100 ppm).

## Results and Discussion

The treatment T<sub>7</sub>(CaCl<sub>2</sub>) (3%) showed better performance among all treatments in terms of field emergence 93.04%, plant height (74.90 cm), number of branches per plant (2.10), days to 50 percent flowering (34.91), number of pods per plant (15.20), number of seeds per pod (8.17), pod fresh weight (1.93 g), pod dry weight (0.91 g), seed yield per plant (93.04 g), biological yield (530.30 g) and harvest index (2.94 g). and it was followed by the treatment T<sub>5</sub> (KNO<sub>3</sub>) (3%) was second best after T<sub>7</sub>(CaCl<sub>2</sub>) (3%) among all treatments in terms of all parameters viz: field emergence 87.38 %, plant height (70.46 cm), number of branches per plant (2.00), days to 50 percent flowering (35.77), number of pods per plant (13.46), number of seeds per pod (7.60), pod fresh weight (1.92 g), pod dry weight (0.71 g), seed yield per plant (87.38 g), biological yield (486.86 g) and harvest index (2.40 g) (Table 1 and 2).

**Table.1** Mean performance of growth and yield parameters in fenugreek

Treatments	Field emergence	Plant height (cm)	Day to 50 % flowering	Number of primary branches / plant	Number of pod / plant	Number of seed / pod	Pod weight fresh (g)	Pod weight Dry (g)	Seed yield / plant (g)	Biological yield (g)	Harvest Index (g)	
T <sub>0</sub>	76.10	52.63	39.66	1.20	8.00	5.52	1.56	0.21	78.21	276.03	1.23	
T <sub>1</sub>	81.79	60.96	39.00	1.30	9.53	5.82	1.83	0.63	80.07	427.56	1.74	
T <sub>2</sub>	85.16	59.90	38.00	1.76	12.33	6.57	1.83	0.66	79.19	349.46	1.93	
T <sub>3</sub>	81.69	65.03	37.00	1.80	11.73	6.21	1.81	0.52	81.16	416.36	1.91	
T <sub>4</sub>	79.90	61.20	39.00	1.40	12.93	6.10	1.83	0.51	83.29	322.46	1.54	
T <sub>5</sub>	87.38	70.46	35.77	2.00	13.46	7.60	1.92	0.71	87.38	486.86	2.40	
T <sub>6</sub>	83.61	57.73	37.33	1.46	13.40	6.43	1.78	0.56	82.31	373.93	2.00	
T <sub>7</sub>	<b>93.04</b>	<b>74.90</b>	<b>34.91</b>	<b>2.10</b>	<b>15.20</b>	<b>8.17</b>	<b>1.93</b>	<b>0.91</b>	<b>93.04</b>	<b>530.30</b>	<b>2.94</b>	
T <sub>8</sub>	83.51	60.06	38.66	1.50	11.20	7.54	1.86	0.63	80.54	377.93	2.01	
T <sub>9</sub>	79.00	55.76	36.33	1.66	10.33	7.20	1.83	0.50	81.61	371.23	1.94	
T <sub>10</sub>	85.74	62.30	39.33	1.34	9.52	7.44	1.71	0.47	82.53	330.93	1.60	
T <sub>11</sub>	83.29	64.00	36.21	1.70	9.92	6.91	1.82	0.42	79.34	288.70	1.76	
T <sub>12</sub>	81.47	55.63	37.33	1.39	10.42	6.09	1.79	0.70	82.84	334.70	1.90	
Grand Mean	83.20	61.58	37.57	1.58	11.38	6.73	1.80	0.57	82.42	375.88	1.91	
SE	1.08	5.93	4.20	1.81	1.42	0.22	1.42	0.23	0.31	104.15	1.81	
CD 5%	NS	2.18	1.69	0.33	38.00	1.30	0.07	0.02	4.03	36.51	1.26	
CV	6.90	2.02	2.58	11.82	10.32	11.31	2.46	2.20	2.83	51.64	1.75	
Range	Max	93.04	74.9	39.66	2.1	15.2	8.17	1.93	0.91	93.04	530.3	2.94
	Min	76.1	52.63	34.91	1.2	8	5.52	1.56	0.21	78.21	276.03	1.23

**Table.2** Mean performance of seed quality parameters in fenugreek

Treatments	Germination (%)	Root length (cm)	Shoot length (cm)	Seedling length (cm)	Seedling fresh weight (gm)	Seedling dry weight (gm)	Vigour index I	Vigour index II	
T <sub>0</sub>	57.12	1.1	2.12	3.24	1.001	0.001	188.92	0.057	
T <sub>1</sub>	57.14	1.41	2.41	3.82	1.009	0.009	218.19	0.51	
T <sub>2</sub>	58.13	1.13	2.25	3.25	1.011	0.011	230.84	0.63	
T <sub>3</sub>	65.15	1.22	2.5	4.02	1.001	0.001	218.67	0.06	
T <sub>4</sub>	63.26	1.52	2.14	3.24	1.002	0.002	204.99	0.12	
T <sub>5</sub>	65.76	1.52	2.52	4.04	1.018	0.018	261.9	1.17	
T <sub>6</sub>	62.11	1.13	2.21	3.34	1.001	0.001	207.44	0.06	
T <sub>7</sub>	<b>68.76</b>	<b>1.74</b>	<b>2.73</b>	<b>4.47</b>	<b>1.07</b>	<b>0.07</b>	<b>307.35</b>	<b>4.81</b>	
T <sub>8</sub>	63.17	1.31	2.35	3.66	1.017	0.017	231.2	1.07	
T <sub>9</sub>	63.02	1.12	2.12	3.47	1.009	0.009	213.06	0.59	
T <sub>10</sub>	62.38	1.32	2.13	3.63	1.011	0.011	226.43	0.68	
T <sub>11</sub>	60.12	1.42	2.42	3.84	1.013	0.013	230.86	0.78	
T <sub>12</sub>	62.14	1.21	2.25	3.46	1.014	0.014	215	0.86	
Grand Mean	62.17	1.31	2.31	3.65	1.01	0.01	227.29	0.87	
S E	1.88	1.52	5.82	0.76	0.81	1.42	0.12	0.02	
CD 5%	0.65	0.52	2.01	0.26	0.28	NS	0.04	1.34	
CV	1.40	13.29	4.91	4.68	4.48	4.09	9.32	3.97	
Range	<b>Max</b>	68.76	1.74	2.73	4.47	1.07	0.07	307.35	4.81
	<b>Min</b>	57.12	1.1	2.12	3.24	1.001	0.001	188.92	0.057

The treatment T<sub>0</sub> control showed lowest values among all treatments in terms of field emergence 76.10%, plant height (52.63 cm), number of branches per plant (1.20), days to 50 percent flowering (39.66), number of pods per plant (8.00), number of seeds per pod (5.52), pod fresh weight (1.56 g), pod dry weight (0.21 g), seed yield per plant (78.21 g), biological yield (276.03 g) and harvest index (1.23 g).

Similar results was reported by Sarika *et al.*, (2013), reported that chemo priming improved the seed quality and showed improved seedling length, seedling dry weight which in turn improved higher seedling vigour index, germination speed and mean germination time. Seed vigour index length parameter depends on germination percentage, shoot length and root length.

The result from the experiment could be concluded that among all the treatments effect of hydration and dehydration with (CaCl<sub>2</sub>) (3%) was found to be superior in terms of all quantitative and qualitative parameters.

The present study suggests that hydration and dehydration with CaCl<sub>2</sub> and secondly KNO<sub>3</sub> treatments may improve rapid and uniform seedling germination-emergence and plant development.

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