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Comparative Effects of Organic and Inorganic Priming on Seed Quality Parameters of Fenugreek (*Trigonella foenumgraecum* L.)

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A B S T R A C T

Fenugreek is one of the major and important spices grown in India. Application of commercial antioxidants and nutrients for seed enhancement is expensive and not easily accessible by the farmers. The hereby study was conducted in a completely randomized design with four replications in controlled conditions at Department of Genetics and Plant Breeding, SHUATS, Prayagraj (U.P) during 2018-2020, to assess the potential of botanicals for germination, seedling vigour and germination index in fenugreek. Inorganic and organic priming methods were adopted and treatments used are as T_0 (Control), T_1- Distilled water, T_2-KNO_3 (1%), T_3- (KNO_3 (3%), T_4- GA3 (100ppm), T_5-PEG (20%), T_6- $CaCl_2$ (1%,), T_7- $CaCl_2$ (3%), T_8- Aloevera leaf extract (5%), T_9- Moringa leaf extract (5%), T_{10}- Curry leaf extract (5%), T_{11}- Tulasi leaf extract (5%) & T_{12} -Ginger extract (5%). It was found that all the treatments showed significant effect on quality parameters. The highest germination percentage (%), speed of germination, seedling length (cm), seedling fresh weight (g), seedling dry weight (g), and vigour indices were observed in treatment T_{12}-Ginger extract (5%) priming for 12 hours. This study revealed that organic priming with botanicals can be effective in enhancing seed quality parameters in fenugreek, and are cost effective, economical, non-toxic and nature-friendly.

Introduction

India, the land of spices is the world's largest producer, consumer and exporter of wide range of spices, more than 60 spices are cultivated in India. The country produces more than two million tons of spices annually. Fenugreek (*Trigonella foenumgraecum* L.) commonly known as methi is an annual forage crop and a traditional spice and aromatic crop that has been grown for centuries. It is diploid (2n=16), belongs to the family leguminaceae and it is believed to be native to the Mediterranean region, but now it is widely cultivated in India and other parts of the world. It is a multipurpose crop grown

during winter season for seed, vegetable and condiment purposes in various parts of the country. Fenugreek is widely used as fodder crop because of its ability to provide high quality forage at all stages of growth. Fenugreek is mainly cultivated for its seeds, which are used as spice (Acharya *et al*., 2008) or dye.

Fenugreek is an annual quick growing herb, up to 30-90 cm in height with light to dark green trifoliate leaves with or without pink margins. It produces small white coloured flowers at base of each leaf. The flowers are hermaphrodite, papilionacious, in which fertilization occurs in unopened flowers. It is mainly grown in rabi season. It is native of South Eastern Europe and West Asia.

India is the largest producer and exporter in the world. It is cultivated across the country though production is concentrated in Madhya Pradesh, Rajasthan, Gujarat. In India it is cultivated in an area of 149330 ha with 213340 tons production. In India, Madhya Pradesh ranks top in Fenugreek production the state wise production includes, Madhya Pradesh (95850t), Rajasthan (81150t), Gujarat (13530t), Haryana (7470t), West Bengal (2750t), Uttaranchal (2610t). (Source: Spice Board of India-2017-18).

The medicinal properties of fenugreek were recorded by the Egyptians and Hippocrates (Lust, 1974), making it one of the oldest recoded plants used in medicine (Acharya *et al.*, 2008). The seeds have the good therapeutic properties (Fazil and Hardman, 1967), against digestive disorders (Sharma *et al.*, 1991), diabetes (Jain *et al.*, 1987)and diuretic actions too (Tanira *et al.*, 1989). The seeds compose ample amounts of soluble dietary fiber. Soaking them in water softens their outer coat and turns it slimy (mucilaginous). Carminative, tonic, aphrodisiac, emollient, anti-bacterial, used for nausea, fever, anorexia and colonitics. (Source: Spice Board of India)

Fenugreek has high nutrition values. 100 g of seeds provide am 24.6 g or over 65% of dietary fiber. Nutritional value for 100 g. includes energy-323Kcal, carbohydrates - 58.35 g, protein- 23.00 g, total fat- 6.41 g, dietary fiber- 24.6 g, cholesterol 0 mg (USDA National Nutrient data base)

Seed is a biological entity and deterioration after harvest is inevitable. In spices seed quality may be deteriorated due to fluctuating temperatures and humidity during storage, various diseases (Meena *et al.*, 2013). These effected seeds show poor germination and low vigor. Quality seed is the pre requisite for any crop improvement program. It ensures good germination, rapid emergence, vigorous growth and increased yields. Quality seeds have the ability to use the inputs such as irrigation, fertilizers, and nutrients efficiently (Mirza Hasanuzzaman (2015). Seed quality can be maintained either by storing seed in controlled condition or by seed treatments.

Seed enhancements aim to improve seed germination and seedling growth, encompasses many techniques performed on seed after harvest and before sowing (Copeland and McDonald, 1995 and Taylor *et al.*, 1998). A simple, low-cost, low-risk technology called ‘on farm seed priming has been shown to improve emergence, seedling vigor and yield in a range of crops, including legumes (Harris *et al.*, 1999; Musa et al2001 and Kumar *et al.*, 2002). Seed priming is one of the invigoration treatment that involves controlled hydration of seed to a level that permits pre-germinative metabolic activity to proceed, but that prevents actual emergence of the radical (Vanangamudi *et al.*, 2010). Priming of seeds has shown to have beneficial effects on the germination and emergence of many species (Bradford, 1986). The direct

benefits of seed priming in crops include faster emergence, improved germination, uniformity, vigorous plants and higher yields. The indirect benefits are earlier sowing and harvest and decreased risk of crop failure (Harris *et al.,* 2001)

Materials and Methods

The Research study was conducted at Seed Testing Laboratory, Department of Genetics and Plant Breeding, Naini Agriculture Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj during *rabi-2019* to find out "Comparative effects of organic and inorganic priming on seed quality parameters of fenugreek (*Trigonella foenumgraecum* L.)". The data was collected on ten randomly selected healthy seedlings plants from each replication and different observations were recorded.

The treatments were represented as T_0 (Control), T_1- Distilled water, T_2-KNO_3 (1%), T_3-KNO_3 (3%), T_4- GA3(100ppm), T_5- PEG 6000 (20%), T_6- $CaCl_2$, (1%,), T_7- $CaCl_2$, (3%), and T_8- Aloevera leaf extract(5%), T_9- Moringa leaf extract (5%), T_{10}- Curry leaf extract (5%),T_{11}- Tulasi leaf extract (5%) & T_{12} -Ginger extract (5%).

Preparation of solutions

The solution of KNO_3 (1%&3%) was prepared by dissolving 1 gm & 3gm of KNO_3 in 100 ml of distilled water each in separate beakers. The solution of $CaCl_2$ (1% & 3%) was prepared by dissolving 1 gm & 3gm of $CaCl_2$ in 100 ml of distilled water each in separate beakers.

For the preparation of GA3 (100ppm), 100mg of GA3 is dissolved in 1000 ml of distilled water. For the preparation of botanical leaf extracts Moringa, Curry leaf, Tulasi leaves were collected from Horticulture Research fields, SHUATS.

These leaves were shade dried and made into fine powder.5g of each powder is dissolved in 100ml of distilled water to make 5% solution. Ginger extract is prepared by grinding 5 g of fresh ginger with 100ml of distilled water. Aloe vera leaf extract is prepared by grinding 5 g of aloe vera with 100ml of distilled water.

After preparation of solutions, seeds were soaked in for a duration of 12hr and shade dried.

These seeds were used for further laboratory studies to record observations.

Results and Discussion

It is evident from the present investigation that priming treatments has significant effect on quality parameters in fenugreek. In general, most of the treatments have increased germination and vigour parameters as compared to control (untreated seeds).

Germination percent (90.75%), speed of germination (213.11) were highest in seeds treated with T_{12} -Ginger extract (5%). Seedling parameters such as root length (7.67cm), shoot length (14.46cm), seedling length (22.13cm), seedling fresh weight (2.37g), seedling dry weight(0.11g), vigor index-I (2009.2) and vigor index-II (12.66) were recorded highest in seeds treated with T_{12} -Ginger extract (5%) followed by T_{11} - Tulasi leaf extract (5%) however, T_0-Control being the lowest.

Similar results were observed by Hasan *et al.,* (2005), Misrak Kebede *et al.,* (2015), Dileepkumar Masuthi *et al.,* (2015), Cupcupin *et al.,* Vinothni and Bhavyasree (2019) (Table 1).

Table.1 Mean performance of seed quality parameters due to various priming treatments in fenugreek

S.no	Treatments	Germination percentage	Speed of germination	Root length	Shoot length	Seedling length	Seedling fresh weight	Seedling Dry weight	Seedling Vigour Index-I	Seedling vigour Index-II
1	**T_0**	71.750	107.513	5.125	10.975	16.100	1.500	0.060	1,154.725	4.298
2	**T_1**	81.250	139.488	6.650	13.025	19.675	2.125	0.070	1,598.900	5.688
3	**T_2**	78.000	118.998	5.750	13.878	19.628	1.600	0.064	1,531.020	4.970
4	**T_3**	82.750	136.940	6.625	11.660	18.285	2.050	0.075	1,513.255	6.205
5	**T_4**	87.750	143.700	7.400	14.200	21.600	2.263	0.105	1,895.450	9.178
6	**T_5**	79.750	164.420	5.750	12.113	17.863	1.950	0.075	1,424.675	5.975
7	**T_6**	82.500	115.238	5.675	13.638	19.313	1.550	0.063	1,594.142	5.158
8	**T_7**	88.500	178.793	7.050	14.085	21.135	2.250	0.103	1,870.685	9.065
9	**T_8**	82.250	176.263	5.450	12.778	18.228	1.738	0.060	1,498.792	4.930
10	**T_9**	84.500	178.793	6.325	14.070	20.395	2.050	0.073	1,722.705	6.135
11	**T_{10}**	75.000	121.670	6.675	12.925	19.600	2.125	0.085	1,471.050	6.375
12	**T_{11}**	89.250	180.745	7.425	14.263	21.688	2.375	0.113	1,935.575	10.010
13	**T_{12}**	**90.750**	**213.115**	**7.675**	**14.463**	**22.138**	**2.550**	**0.140**	**2,009.025**	**12.668**
Grand mean		82.61	145.55	6.42	13.23	19.66	2.009	0.083	1632.32	6.97
C.D.		2.264	15.048	0.314	0.602	0.743	0.134	0.018	81.172	1.565
SE(m)		0.789	5.241	0.109	0.210	0.259	0.047	0.006	28.270	0.545
SE(d)		1.115	7.412	0.155	0.296	0.366	0.066	0.009	39.980	0.771
C.V.		1.909	7.201	3.399	3.167	2.633	4.655	14.840	3.464	15.628

From the present investigation it is concluded that the pre-sowing treatments with organic priming can be used for enhancement of germination and vigor of fenugreek. Organic priming with T_{12} (Ginger extract @ 5%) was found to be best in all the treatments followed by T_{11} (Tulasi extract @ 5%), T_4 (GA3@ 100ppm) and T_7 ($CaCl_2$ @ 3%) and control being the lowest. The experimental observations of increase in germination and quality parameters indicate the effect of botanicals on physiological processes of the seeds. Botanicals being cheap, nature friendly and easily available to farmers can be efficiently used for improving seed quality parameters.

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