Eco. Env. & Cons. 29 (May Suppl. Issue) : 2023; pp. (S341-S345)
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ISSN 0971–765X

DOI No.: http://doi.org/10.53550/EEC.2023.v29i03s.061

Analyzing the Response to Vermicompost and Biofertlizers on Germination and Quality Attributes of Fenugreek (*Trigonella foenum-graecum* L.) Seed

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(Received 13 December, 2022; Accepted 19 February, 2023)

ABSTRACT

A field experiment was conducted at College of Horticulture and Forestry, Jhalawar during *Rabi* season 2018-2019 to evaluate the effect of vermicompost and biofertilizers on quality attributes of seeds in fenugreek (*Trigonella foenum-graecum* L.). The experiment consisted of 15 treatments in combinations of different organic fertilizers, viz. vermicompost, *Rhizobium,* PSB and *Azospirrilium*. The results revealed that among the different combinations of vermicompost and biofertilizers, application of Vermicompost + *Rhizobium* + PSB + *Azospirrilium* significantly increased seedling length (13.90 cm), chlorophyll content of leaves (1.60 mg), Vigour Index I (1348.30), Vigour Index II (1250), root length (6.40 cm), shoot length (7.50 cm), test weight (16.46 g) and crude protein content of seed (21.88%) as compared to control and the EC (1.02 dS m^{-1}) was decreased with the application of vermicompost and biofertilizers in treatment T_{15} (V+R+A+PSB) as compared to highest in T_0. Thus, the seeds obtained from the application of biofertlizer and vermicompost mix were superior in quality than use in single form for obtaining high quality seeds.

Key words: *Vermicompost, Biofertilizer, Quality, Germination and Vigour*

Introduction

Fenugreek (*Trigonella foenum graecum* L.) popularly known by its common name "Methi" is an important seed condiment crop grown in northern India during Rabi season. Rajasthan, Madhya Pradesh, Gujarat, Uttar Pradesh, Maharashtra and Punjab are leading states of fenugreek production in India. It is on top amongst the seed spices grown in northern India. The major districts growing fenugreek in Rajasthan are Sikar, Chittorgarh, Jaipur, Pali, Nagaur, Jhalawar and Alwar. Fenugreek is a multipurpose crop whose every part is consumed in many forms. Its tender leaves and pods are eaten as fried vegetable being rich in iron, calcium, protein and vitamins. Its chopped green leaves are mixed in

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flour to prepare "parantha", the grains are used to form a concentrate feed for animals. Besides this, it has many medicinal utility like constipation, indigestion and stimulates the digestive process, dysentry, diarrhoea, rickets, carminative tonic and aphrodisiac diabeties. The important steroid saponins "iosgenin" content in seed varies from 0.62-2.20 per cent which is used in synthesis of sex hormones and oval contraceptives. Its seeds are bitter in taste due to presence of alkaloid "trigonellin" trigocoumarin, trimethylcoumarin and nicotinic acid. Being a legume, its roots are endowed with mini factory to synthesize nitrogenous food material for the plants.

Organic manures like vermicompost is a potential source of macro and micronutrients and it improves soil structure by providing binding effect to soil aggregates, increases water holding capacity, improves buffering capacity of soils, soil productivity and enzymatic activity of soils. It is well known fact that organic materials such as vermicompost accelerate the process of decomposition as well as ready energy source for microbial proliferation. Its other effects are reduced soil erosion deoclourification of obnoxious smell, destruction of pathogens and detoxification of soil pollutant (Manna and Biswal, 1996).

Biofertilizers also play an important role in the increasing availability of mineral nutrients. They increase the biological fixation of atmospheric nitrogen and also enhance phosphorus availability to the crop by solubilizing fixed phosphorus of soil. Therefore, introduction of efficient strain *of Rhizobium*, *Azosprillium* and PSB in the soil may be helpful in more nitrogen, phosphorus fixation and consequently boosting up productivity of crop and soil fertility. Inoculation of seed with these biofertilizers culture is a very low cost method of fertilization in legume and has been found beneficial (Gill *et al*., 1987). The mechanism of action of these micro-organisms involve secretion of organic acids which lower the pH and PSB in responsible for P solublization (Srivastava and Ahlawat, 1993). Therefore, the study was undertaken to evaluate the effect of different treatment combinations of vermicompost and biofertlizers on quality attributes of fenugreek.

Materials and Methods

The experiment was conducted at Vegetable farm of Department of Vegetable Science, College of Horticulture & Forestry, Jhalrapatan City, Jhalawar (Rajasthan) during Rabi season 2018-19. The field was divided into plots of size 3m x 1m and paths were also prepared according to the layout. A basal dose of 30 kg N, 20 kg P_2O_5 and 20 kg K_2O per ha, through Urea, DAP and MOP and were applied prior to sowing. Nitrogen was given into two split doses, first as basal dose and another was given after one month of sowing to each plot. Vermicompost was applied as per the treatment. Seeds were treated with biofertilizers (*Rhizobium*, PSB and *Azospirrilium*) before sowing. The culture for seed treatment was prepared by the standard method in which 10 per cent solution of jaggery was prepared. After cooling of this solution the biofertilizers were added in the jaggery solution according to the different treatments and treated seeds were dried in the shade for half an hour so that the culture was coated all around the seeds and then sowing done according to treatments. In the beginning of the experiment, seeds were dibbled at a row spacing of 30 cm and seed rate 25 kg/ha. All the recommended package of practices was uniformly followed in all treatments.

The observations on different quality attributes were recorded from randomly selected 10 plants and seed quality attributes were evaluated as per the guidelines of ISTA (2012) while, seed vigour-I and II were calculated as suggested by Abdul-Baki and Anderson (1973). Total leaf chlorophyll was measured as method suggested by Hiscox and Israelstam (1979) by using dimethyl sulfoxide (DMSO). Crude protein content (%) in seed was measured by colorimetric method as suggested by Snell and Snell (1939) using the Spectronic-20 (Model SL-177). Electrical conductivity was determined by electrical conductivity meter along with deionised water as a control (Dadlani and Agarwal, 1987). The data on quantity observations recorded were subjected to statistical analysis by adopting Randomized Block Design (RBD) with three replications.

Results and Discussion

Application of vermicompost and biofertilizers significantly influenced seed quality attributes in fenugreek (Table 2). The maximum value for quality attributes, i.e. seedling length (13.90 cm), shoot length (7.50 cm), root length (6.40 cm), vigour index

I (1348.30) and vigour index II (1250) were recorded under treatment T_{15} (V+R+A+PSB) and the minimum value for quality parameters, i.e. seedling length (11.10 cm), shoot length (6.00 cm), root length (5.10 cm), test weight (13.35 g), Vigour Index I (978.27) and Vigour Index II (839.93), were recorded under treatment T_0 (Control). Application of vermicompost along with biofertilizers inoculation enhances the accumulation of higher quantities of seed constituents like carbohydrates, proteins as enzymes which increased the seedling vigour index of bolder seeds that contain greater meatbolites for resumption of embryonic growth during germination (Yadav and Khurana, 2005). These results are in conformity with Naimuddin *et al*. (2014), Kumar and Sharma (2014) and Anitha *et al*. (2016) in fenugreek and Thangaraj *et al*. (2015) also presented similar findings. The results of seed quality (Table 2) showed that germination (%) was at par among the treatment combinations of vermicompost and biofertilizers.

It is evident from the results (Table 3) that the application of vermicompost and biofertilizers had significantly influenced test weight, chlorophyll content and crude protein content in seed as compared to control. Maximum test weight (16.46 g), chlorophyll content (1.60 mg) and crude protein content of seed (21.88%) was recorded in treatment T_{15} (V+R+A+PSB) and the minimum (13.35 g, 1.56 mg/100 g and 17.66 % respectively)) in control. This might be due to as the nitrogen is a basic constituent of protein and higher rate of nitrogen availability

Table 1. Details of experiment treatment combinations

S. No.	Symbol	Treatment combinations	S. No.	Symbol	Treatment combinations
1	T_0	Control	9	T_8	R+A
2	T_1	Vermicompost	10	T_9	R+PSB
3	T_2	*Rhizobium*	11	T_{10}	A+PSB
4	T_3	*Azospirillum*	12	T_{11}	V+R+A
5	T_4	PSB	13	T_{12}	V+R+PSB
6	T_5	V+R	14	T_{13}	V+A+PSB
7	T_6	V+A	15	T_{14}	R+A+PSB
8	T_7	V+PSB	16	T_{15}	V+R+A+PSB

PSB=Phosphorus Solublizing Bacteria, V=Vermicompost @3 tonnes/ha., A=*Azosprillium*, R=*Rhizobium,* Control = RDF.

Table 2. Effect of vermicompost and biofertilizers on seed quality attributes of fenugreek

Treatment notation	Treatment combination	Germination %	Seedling length (cm)	Shoot length (cm)	Root length (cm)	Vigour Index I	Vigour Index II
T_0	Control	88.00	11.10	6.00	5.10	978.27	839.93
T_1	Vermicompost	91.00	12.30	6.80	5.50	1119.60	969.60
T_2	Rhizobium	91.00	11.60	6.40	5.20	1055.98	968.20
T_3	Azospirillum	90.00	11.40	6.20	5.20	1025.58	927.21
T_4	PSB	92.00	12.00	6.30	5.70	1104.07	948.10
T_5	V+R	92.00	12.90	7.20	5.70	1188.09	1109.20
T_6	V+A	91.00	12.50	6.90	5.60	1138.42	978.24
T_7	V+PSB	95.00	13.10	7.00	6.10	1244.04	992.31
T_8	R+A	91.00	11.90	6.60	5.30	1084.77	969.00
T_9	R+PSB	94.00	12.80	6.70	6.10	1203.37	987.00
T_{10}	A+PSB	91.00	12.10	6.30	5.80	1100.59	934.36
T_{11}	V+R+A	93.00	13.10	7.30	5.80	1219.97	1156.40
T_{12}	V+R+PSB	97.00	13.50	7.30	6.20	1309.50	1230.00
T_{13}	V+A+PSB	95.00	13.40	7.20	6.20	1274.06	1063.30
T_{14}	R+A+PSB	94.00	12.80	6.70	6.10	1203.16	1039.84
T_{15}	V+R+A+PSB	97.00	13.90	7.50	6.40	1348.30	1250.00
S.Em±		NS	0.27	0.22	0.11	37.97	33.21
CD at 5%		NS	0.78	0.65	0.33	109.67	95.91

Table 3. Effect of vermicompost and biofertilizers on chlorophyll, crude protein and Electrical Conductivity of seed in fenugreek

Treatment notation	Treatment combination	Test weight (g)	Chlorophyll (mg)	Protein (%)	EC (dSm^{-1})
T_0	Control	13.35	1.29	17.66	1.85
T_1	Vermicompost	14.35	1.42	19.06	1.15
T_2	*Rhizobium*	14.20	1.32	19.02	1.13
T_3	*Azospirillum*	13.60	1.31	18.02	1.57
T_4	PSB	13.90	1.32	18.07	1.06
T_5	V+R	15.48	1.50	20.30	1.12
T_6	V+A	15.35	1.50	20.22	1.13
T_7	V+PSB	15.02	1.48	20.04	1.23
T_8	R+A	14.50	1.43	19.23	1.28
T_9	R+PSB	14.80	1.44	19.31	1.35
T_{10}	A+PSB	14.16	1.35	18.18	1.16
T_{11}	V+R+A	16.01	1.58	21.41	1.10
T_{12}	V+R+PSB	16.40	1.60	21.38	1.03
T_{13}	V+A+PSB	15.85	1.56	21.38	1.09
T_{14}	R+A+PSB	15.80	1.52	20.48	1.15
T_{15}	V+R+A+PSB	16.46	1.60	21.88	1.02
S.Em±		0.30	0.02	0.39	0.02
CD at 5%		**0.88**	**0.07**	**1.14**	**0.07**

through microbial activity and vermicompost which resulted in increase of protein content in seed (Kumar and Sharma, 2014). Initial boost of nitrogen due to effect of vermicompost and biofertilizers which might have helped in higher chlorophyll formation and ultimately higher photosynthesis and phosphorus is also known to encourage cell division and hence contributed to taller plants (Beg and Singh, 2009). The results are corroborated with the finding of Birla, *et al.* (2018) in cowpea, Meena *et al*. (2018) in french bean and Das *et al*. (2013) in chickpea.

Fig. 1. A view of fenugreek seed germination in seed germinator

The results of seed quality contributing characters (Table 3) as influenced by application of vermicompost and biofertilizers showed that significant difference was recorded in EC of seeds over control. The lowest EC (1.02 dS m^{-1}) was noticed in treatment T_{15} (V+R+A+PSB) which shows good vigour of seeds as compared to control (1.85 dS m^{-1}). This might be due to these all components seed have good vigour, which don't allow minerals leach out from seed and decrease EC of seeds.

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