International Journal of Scientific Research in Science and Technology
Print ISSN: 2395-6011 | Online ISSN: 2395-602X (www.ijsrst.com)
doi : https://doi.org/10.32628/IJSRST

Effect of phosphate solubilizing fungus (*Aspergillus niger*) on development (Plant height and number of total branches) of mustard plant (*Brassica juncea*)

Krati Trivedi[1], Dr. Shyam Govind Singh[2]
Department of Botany, Agra College Agra, Uttar Pradesh, India

Article Info
Volume 9, Issue 3
Page Number : 826-829
Publication Issue
May-June-2022
Article History
Accepted : 05 May 2022
Published : 19 May 2022

ABSTRACT

The field experiment was conducted at agriculture farm of Bichpuri block District Agra, Uttar Pradesh, India in rabi season during 2021-22 to the effect of fertilizer P, phosphate solubilizing fungus (Aspergillus niger) inoculum alone and in combinations on development of mustard (Brassica juneca) plant. Ten treatment combinations consisting of fixed rate of phosphorus (30 kg P2O5 ha-1) and ten levels of microbial inoculum in gram per kg (no inoculums in treatment T1). Application of fungal formulation @8.5 g/kg on mustard seed and 30 kg P2O5/ha as chemical P increased the plant height and number of branches plant-1 as compared to their respective un-inoculated controls at maturity. Improved soil P availability due to fungal inoculation could explain the role of phosphate solubilizing fungus in soil P mobilization. The plant development was increased by the application of fungal based formulation with seeds.

Keywords : Phosphorus Fertilizer, Phosphate solubilizing fungus, Aspergillus niger, Mustard.

I. INTRODUCTION

Mustard is one of the important edible oil seed crop of India. In India mustard is predominantly cultivated in the states of Rajasthan, Uttar Pradesh, Hariyana, Madhya Pradesh and Gujarat. Rajasthan ranks first in area and production of rapeseed and mustard with 2.50 million ha area and 3.71 million tonnes production (Anonymous, 2017). Phosphorus is an important element for the development of the plant. It is a component of key molecules such as nucleic acids, phospholipids and ATP. It is necessary for maintain and transmission of energy, transfer of genetic characteristics and beneficial for root development, vigorous growth, better yield and quality and nodule formation in legume crops. Approximately 15-20 per cent of applied fertilizer phosphorus is utilized by the crops and rest of the gets fixed in the soil and becoming unavailable to crop plants (Toro, 2007). Thus, unavailability of phosphorus is the major problems in development of plants. There may be a number of factors responsible for low yield of mustard in India but poor soil fertility status and sub optimal use of fertilizer nutrients, particularly phosphorus appears to be most important (Premi and Kumar, 2004). Phosphorous plays a vital

role as a structural component of cell constituent and metabolically active compounds i.e. chloroplasts, mitochondria, phyton, nucleic acid, protein, flavin nucleotides and several enzymes. Phosphorus influences the vigour of plants and root development. It also encourages the development of nitrogen fixation, pod formation and hastens the maturity of pods (Tisdale et al., 1984).

For increasing phosphorus availability and reduction of P fertilizer, there are many microorganisms present in the soil capable of solubilization insoluble Phosphorus (P). Microorganisms are an integral component of the soil P cycle and are important for the transfer of P between different pools. Phosphate Solubilzing Microorganisms (PSMs) have various mechanisms of solubilization and mineralisation which are able to convert inorganic and organic soil P respectively (Khan et al. 2009) into the bioavailable form facilitating uptake by plant roots by the process of acidification, chelation and exchange reactions .These microorganism such as bacteria, yeast, fungi, actinomycetes. Phosphate solublilizing fungi (PSF) play an important role in increasing the bioavailability of phosphorus in soils for plant. Fungi are superior to bacteria for phosphorus solubilization both on precipitated agar and in liquid media (Kucey, 1983a; Banik and Dey, 1982; Singhal et al., 1994; Whitelaw et al., 1997; Sheshadri and Ignacimuthu, 2004) because fungal hyphae are able to reach greater distances in soil more easily then bacteria. Integrated phosphate solubilizing fungus with fixed amount of P fertilizer is the only viable strategy. Application of this helps to restore and sustain soil fertility, plant development and is economic also.

II. MATERIALS AND METHODS

The field experiment was conducted at agriculture farm of Bichpuri block, District Agra, Uttar Pradesh, India in rabi season at latitude: 27' N, longitude: 78' E and altitude of 170 m above mean sea level. The soil of the experimental fields was sandy loam texture with pH 8.3. The total rainfall during mustard cultivation was 19.80 mm. The mustard crop was sown on October 2021. Width of row was 45 cm for mustard crop. The seed rates for mustard (Agra local cultivar) was 4 kg/ha. For proper seed distribution along the rows, strip paper containing seeds were used. The fertilizer rate was 30 kg/ha for mustard. *Aspergillus niger* was obtained from riverain soil of Agra. The mustard (*Brassica juneca)* seeds were treated separately with the test fungus at ten different rates as per schedule given in Table 1. The rate of phosphorus was fixed (30 kg P_2O_5/ha in each treatment. The inoculated seeds were spread on a sheet (in to a flat layer) under shade, and allowed to dry for 2-3 h prior to sowing. At the time of crop harvesting, plant height, number of branches plant^{-1}, was measured given in the table -1.

Statistical Analysis: The experiment was carried out in completely randomized design with three replications. For statistical analysis of data, windows 7 was used and graphs were plotted using micro soft excel. The grain yield was statistically analyzed by analysis of variance (ANOVA) (Steel & Torie, 1984) to determine the level of significance at $P < 0.05\%$.

III. RESULT AND DISCUSSION

The Phosphorus is a vital element, for growth and development of the plant. Fungal *(Aspergillus niger)* inoculation with fixed rate of phosphorus fertilizer enhance the plant height, number of branches plant^{-1}, were measured. In mustard grown with treatments, PSF inoculation @8.50 g/kg seeds and 30 Kg P/ha (T_{10}) is recorded higher value of plant height and number of total branches per plant was 175.18 cm and 27.22 as compare to other treatments.

Table-1. Effect of phosphate solubilizing fungus (Aspergillus niger) on Plant height and number of total branches per plant of mustard plant (Brassica juncea)

Treatment	P rates (kg P2O5/ha)	Inoculum rate g/kg seed	Plant height (cm)	Number of total branches per plant
T1	30	0.00	156.14	18.16
T2	30	0.50	159.25	19.12
T3	30	1.50	161.36	20.35
T4	30	2.50	163.47	21.36
T5	30	3.50	165.18	22.14
T6	30	4.50	166.16	24.16
T7	30	5.50	169.11	25.25
T8	30	6.50	171.65	26.24
T9	30	7.50	173.14	27.42
T10	30	8.50	175.18	27.22
Mean			166.064	23.142
SD			6.22	3.383
CV (%)			3.746	14.617
SEm ±			0.062	0.034

IV. CONCLUSION

In the present study, application of Fungus (Aspergillus niger) on the mustard seeds related in improving plant development with fixed rate of phosphorus fertilizer. Application of this helps to restore and sustain soil fertility, plant development and is economic also. This study is significant from the point of view to increasing development of oil seeds plant which is the need of present time for our country.

V. REFERENCES

[1]. Anonymous. Agriculture statistics at a glance. Directorate of Economics & Statistics, DAC & FW (2017).

[2]. Toro M. Phosphate solubilizing microorganisms in the rhizosphere of native plants from tropical savannas: An adaptive strategy to acid soils. In: Velaquez C, Rodriguez-Barrueco, E (eds). Developments in Plant and Soil Science. Springer. Netherlands; 249-252, (2007).

[3]. Premi, O. P. and Kumar, M. Response of Indian mustard (Brassica juncea) to different levels of nitrogen and phosphorus under irrigated condition. Indian J. Agriculture Research, 38 (2): 151 – 153, (2004).

[4]. S. L. Tisdale, W.L. Nelson, J.D. Beaten. Zinc in Soil Fertility and Fertilizers (Fourth ed.), Macmillan Publishing Company, New York pp. 382–391, (1984).

[5]. Ahmad Ali Khan , Ghulam Jilani, Mohammad Saleem Akhtar , Syed Muhammad Saqlan Naqvi, Mohammad Rasheed Phosphorus Solubilizing Bacteria: Occurrence, Mechanisms and their Role in Crop Production J. Agric. Biol. Sci 1 (1); 48-58, (2009).

[6]. Kucey, RMN. Effect of Penicillium bilaji on the solubility and uptake of phosphorus and micronutrients from soil by wheat. Can. J. Soil Science, (68); 261-270, (1983).

[7]. Banik, S. and Dey, R. K. Available phosphate content of an alluvial soil as influenced by inoculation of some phosphate solubilizing microorganisms. Plant Soil, (69); 53-364, (1982).

[8]. Singhal, R., Gupta, R. and Saxena, R. K. Rock phosphate solubilization under alkaline conditions by Aspergillus foetidus and A. japonicas. Folia Microbiology, (39); 33-36 (1994).

[9]. Whitelaw, M.A., Hardenand, T.A. and Bender G.L. Plant growth promotion of wheat inoculated with Penicillium radicum sp. J. Soil Res., (35); 291-300, (1997).

[10]. Sheshadri, S. and Ignacimuthu, S. Effect of nitrogen and carbon sources on the inorganic phosphate solubilization by different Aspergillus niger strains. Chemistry Eng. Comm, (191); 1043-1052, (2004).

[11]. Steel RGD, Torie JH. Principles and procedures of statistics: McGra Hill Book C, Inc. Singapore, (21); 172-177, (1984).

Cite this article as :

Krati Trivedi, Dr. Shyam Govind Singh, "Effect of phosphate solubilizing fungus (Aspergillus niger) on development (Plant height and number of total branches) of mustard plant (Brassica juncea)", International Journal of Scientific Research in Science and Technology (IJSRST), Online ISSN : 2395-602X, Print ISSN : 2395-6011, Volume 9 Issue 3, pp. 826-829, May-June 2022.
Journal URL : https://ijsrst.com/IJSRST229479