Bulletin of Environment, Pharmacology and Life Sciences
Bull. Env. Pharmacol. Life Sci., Vol 11 [6] May2022 : 178-180

Online ISSN 2277-1808
Journal's URL:http://www.bepls.com
CODEN: BEPLAD

ORIGINAL ARTICLE **OPEN ACCESS**

The Effect of phosphate Solubilizing fungus *(Aspergillus niger)* on Mustard crop productivity

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ABSTRACT

The field experiment was conducted at agriculture farm of Bichpuri block District Agra, Uttar Pradesh, India in rabi season during 2021-22 to investigate the interactive effect of nine rates of seed inoculation with phosphate solubilizing fungus (Aspergillus niger) and rate (30 kg P_2O_5/ha) of chemical phosphorus (P) fertilizer on soil P availability and productivity in mustard (Brassica juneca) crop. Chemical phosphorus (P) distribution in same fractions was conducted. Application of fungal formulation @8.5 g/kg on mustard seeds and 30 kg P_2O_5/ha as chemical P increased the grain yield of mustard 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 crop productivity was increased by the application of fungal based formulation with seeds.

Key words: *Fertilizer, (Aspergillus niger), Phosphate solubilizing fungus, Mustard.*

Received 13.03.2022 Revised 16.04.2022 Accepted 07.05.2022

INTRODUCTION

The world's human population is increasing at high speed and expected to reach 9.1 billion by 2050. This is necessary to increase the food production by 70% [4]. Phosphorus (P) is necessary second essential nutrient for plant development and growth. It is second only to nitrogen among mineral nutrients most commonly limiting the growth of crops [1]. On an average, the phosphorus content of soil is about 0.05% (w/w); however, only 0.1% of this phosphorus is available for plant use [10]. Traditionally, the challenge of soil phosphorus deficiency is addressed by the application of phosphorus fertilizers. However, majority of the applied fertilizer phosphorus is not available to plants and the addition of inorganic fertilizers in excess of the amount that is commonly employed to overcome this effect can lead to environmental problems such as, groundwater contamination and waterway eutrophication [3]. It is therefore of great interest to investigate management strategies that can replace chemical fertilizer efficiency into the bio-fertilizer efficiency, increase crop yields and reduce environmental pollution caused by phosphorus loss from the soil. 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 [6] 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 [2, 5-9] because fungal hyphae are able to reach greater distances in soil more easily then bacteria. It is important to determine the actual mechanism of P solubilization by PSF for optimal utilization of these microorganisms in varied field conditions. Hence it is imperative to better understand the plant-soil-microbial P cycle with the aim of reducing reliance on chemical P fertilizers. This has led to increased interest in the harnessing of PSF to support P availability to the crop. However, information on distribution of P in same fractions induced by different rates of PSF *Aspergillus niger* inoculation under field condition is scarce. Thus, the present study was under taken with the objectives (i) Application of isolated phosphate solubilizing fungus *(Aspergillus niger)* on mustard crop production.

MATERIAL 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 is 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. Thefertilizer rate was 30 kg/ha for mustard.

The field was irrigated as andwhen required and weeding was done 30 days aftersowing. The crop was harvested in month of March. The threshing of harvested above ground crop biomass was done mechanically to get grain yield for eachtreatment. All the samples were sun dried prior to oven drying and weighed on electronic balance.

Aspergillus niger was obtained from riverain soil of Agra. The mustard (*Brassica juneca)* seeds were treated separately with the test fungus at nine 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, andallowed to dry for 2-3 h prior to sowing. At the time of crop harvesting the grain yield in kg/ha was calculated.

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) [8] to determine the level of significance at $P < 0.05\%$.

RESULT AND DISCUSSION

The Phosphorus is a vital element, for growth and development of the plant. Fungal *(Aspergillus niger)* inoculation can bring change in the value of productivity of mustard crop by increasing the quantity of Fungal inoculation. In mustard grown with treatments, PSF seeds inoculation @8.50 g/kg seeds and 30 Kg P/ha (T_{10}) is recorded higher value of grain yield up to 1898 kg/ha as compare to other treatments.

Table-1 Effect of phosphate solubilizing fungus (*Aspergillus niger*) on grain yield of mustard crop

Treatment	P rates (kg P2O5/ha)	Inoculum rate g/kg seed	Grain Yield (kg/ha)
T1	30	0.00	1638
T2	30	0.50	1645
T3	30	1.50	1654
T4	30	2.50	1682
T5	30	3.50	1715
T6	30	4.50	1758
T7	30	5.50	1816
T8	30	6.50	1881
T9	30	7.50	1888
T10	30	8.50	1898

CONCLUSION

In the present study, application of Fungus *(Aspergillus niger)* on the mustard seeds related in improving grain yield with fixed rate of phosphorus fertilizer. This study is significant from the point of view to increasing productivity of oil seeds crop which is the need of present time for our country.

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CITATION OF THIS ARTICLE

K Trivedi and S G Singh. The Effect of phosphate Solubilizing fungus *(Aspergillus niger)* on Mustard crop productivity. Bull. Env. Pharmacol. Life Sci., Vol 11[6]May 2022: 178-180