International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
www.chemijournal.com
IJCS 2020; 8(3): 2705-2707
© 2020 IJCS
Received: 21-03-2020
Accepted: 22-04-2020

SM Mulik
Department of Plant Pathology College of Agriculture, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth Dapoli, District, Ratnagiri, Maharashtra, India

MS Joshi
Department of Plant Pathology College of Agriculture, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth Dapoli, District, Ratnagiri, Maharashtra, India

AD Gadhave
Department of Plant Pathology College of Agriculture, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth Dapoli, District, Ratnagiri, Maharashtra, India

MB Dawale
Department of Plant Pathology College of Agriculture, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth Dapoli, District, Ratnagiri, Maharashtra, India

Corresponding Author:
SM Mulik
Department of Plant Pathology College of Agriculture, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth Dapoli, District, Ratnagiri, Maharashtra, India

Evaluation of different carrier material for survival *Aspergillus niger* a phosphate solubilizing organism

SM Mulik, MS Joshi, AD Gadhave and MB Dawale

DOI: https://doi.org/10.22271/chemi.2020.v8.i3am.9622

Abstract
Species of *Aspergillus viz. A. niger, A. flavus, A. terreus* were found to be effective phosphorous solubilizers, in order to utilize these species for large scale production of bioformulation, the basic studies on survival of the test organism in different carrier material was done. Out of six carrier materials tested for survival of *Aspergillus* spp. Lignite was found to be the most effective carrier material for all *Aspergillus* spp. with good colony growth up to 90 days.

Keywords: *Aspergillus* spp, carrier material, lignite, survival

Introduction
Optimum development of crops demands a high and often costly input of phosphate fertilizer. Current concept of sustainability involves application of alternative strategy based on the use of less expensive natural sources of plant nutrients like rock phosphate. In addition, chemical fertilizers are highly expensive and have adverse effect on soil.
A soil bacteria belong to genera pseudomonas and fungi belong to genera *Penecillium* and *Aspergillus* have ability to bring insoluble phosphate present in soil into soluble forms by secreating organic acid *viz.*, formic, acetic, propionic, lactic, IZglycolic, fumaric succinic acid etc. these acids lower the ph and bring about the dissolution of bound forms of phosphate. Phosphate solubilizing microorganisms have been reported to occur in different environmental niches and are abundant in rhizospher (Nautiyal *et.al.*2000 and Chen *et.al.*2002) [6, 4]. Fungi have been reported to possess greater ability to solubilize insoluble phosphate than bacteria (Nahas, 1996) [5].
Biofertilizers are microbial inoculants containing either living or latent cells of nitrogen fixing or phosphate solubilizing organisms. the technology of producing these inoculants consist of culturing efficient strains of microbes in suitable media under controlled condition and mixing the cultural broth with sterile carrier material by following the standard procedure. Among the phosphate solubilizing fungi *Aspergillus* and *penecillium* species are widely exploited for their biofertilizer production. Phosphate solubilizing *Aspergillus* spp. are *A. niger, A. flavus, A. terreus, A. sydowii, A. amstelodami, A. versicolor, Aspergilllus niger* is a versatile phosphate solubelizer and is abundantly present in different soil types (Gaur 1990). It solubilize eight insoluble metal compounds *viz*,. Al_2O_3, $Al_2(PO_4)^2$, $CaCO_3$, $Ca_3(PO_4)^2$, Mn (PO_4) ZnO and Zn3(PO4)2. *Aspergillus* lowers the soil ph and brings about dissolution of immobile forms of soil phosphate. Some organic acid produced by it may chelate calcium, aluminium, ferrous and magnesium further increasing phosphorus availability.

Material and Methods
Cultures- Fungal cultures which are found to be good phosphate solubilizer were obtained from Biofertilizer Production center, Department of plant pathology. These fungal spp. are *Aspergillus niger, A. vercicolor and A. sydowii.* Potato dextrose agar (PDA) was used for maintaining of the cultures during the course of investigation.

Effect of different carrier materials
The effect of carrier material was studied for 30, 60and 90 days. Different carrier material used as a lignite, lignite + soil, lignite + sawdust, sawdust, compost and talc.

All the carrier materials were sterilized for two times at 1210C in an autoclave. The bioinoculants in the form of sporulated broth culture of *Aspergillus niger*, *A. flavus* and *A. terreus* was mixed separately in 2:1 proportion and the poly bags (75 µ milky white) were filled with 250gm bio-inoculants.

Bags were closed with sealing machine and kept in room temperature for further observation. The bags from each carrier containing the test inoculants was opened after 30, 60 and 90 days for studying the survival of *Aspergillus* spp. The serial dilution method was followed for observing CFU load in carrier material by using PDA. The inoculated plates were incubated at 200C for 48hrs to record the number of colonies appearing in each petri plates. Three replications were maintained for each carrier and the *Aspegillus* spp.

Effect of carrier material

Table 1: CFU after 30days (in numbers)

Carrier material	*A. niger**	*A. flavus**	*A. terreeus**	Mean
Lignite	28.66	26.00	24.66	26.44
Lignite+soil(1:1)	24.66	24.66	24.00	24.44
Lignite+sawdust(1:1)	21.33	22.33	21.66	21.77
Sawdust	3.00	3.67	3.66	3.44
Compost	19.66	16.00	15.66	17.10
Talc	2.33	18.33	19.67	19.77
Mean	19.77	18.49	18.22	
	S.E.m±			C.D
Carrier material	0.25			0.95
Aspergillus spp	0.18			0.67
Carrier material x *Aspergillus* spp	0.43			1.65

*Means of three replications

Effect of carrier material on survival

It is revealed from table 1 that lignite was the best carrier material giving highest colony count (26.44) after 30 days of storage. It was followed by lignite + soil with 24.44 colony count Lignite + sawdust ranked third where colony count was 21.77. In talc colony count was 19.7 while lowest colony count (3.44) was obtained in sawdust.

Effect of *Aspergillus* spp

Table one shows that highest colony count was recorded by *A. niger* (19.77) followed by *A. flavus* and *A. terreus* where colony count was 18.49 and 18.22 respectively and was on at par with each other.

Effect of interaction of month and carrier material

Highest colony count was found in interaction between lignite and *A. niger* (28.66) and lowest colony count of *A. terreus* was found in sawdust (3.00).

Table 2: CFU after 60 days (in numbers)

Carrier material	*A. niger**	*A. flavus**	*A.terreus**	Mean
Lignite	24.66	24.00	22.66	23.77
Lignite + soil (1:1)	23.00	23.00	21.00	22.33
Lignite + sawdust (1:1)	20.33	21.00	19.33	20.22
Sawdust	3.00	3.67	3.33	3.66
Compost	14.33	14.33	15.66	14.77
Talc	16.66	17.00	17.66	16.91
Mean	16.99	17.16	16.06	
	S.E.m±			**C.D.**
Carrier material	0.21			0.80
Aspergillus spp.	0.15			0.56
Carrier material x *Aspergillus* spp.	0.36			1.38

*Mean of three replications

Effect of carrier material

It is clear from the table tow that highest colony count was obtained when lignite was used as carrier material irrespective of the *Aspergillus* spp. The colony count in this treatment was 23.77. It was followed by lignite + soil which recorded 22.33 colonies irrespective of *Aspergillus* spp. the colony count in lignite + sawdust was 20.22 irrespective of *Aspergillus* spp. Sawdust was found to be poor carrier material for *Aspergillus* spp. as it recorded least colony count (3.66).

Effect of *Aspergillus* spp

It was revealed that, *A. flavus* was superior in colony development as a maximum colonies (17.16) were obtained irrespective of nitrogen source used. It was followed by *A. niger* and *A. terreus* which are at par.

Interaction of *Aspergillus* spp and carrier material

The interaction effect of *A. niger* and carrier material depicted table two revealed that the interaction between *A. niger* and lignite was highly significant as it recorded the maximum colony count (24.66). It was followed by the interaction between *A. flavus* and lignite which recorded the colony count to the tune of (24.00). The interaction between *A. niger* and sawdust was highly undesirable as 3.00 colonies were observed.

Table 3: CFU after 90 days (in numbers)

Carrier material	*A. niger**	*A. flavus**	*A. terreus**	Mean
Lignite	17.00	14.33	15.00	15.44
Lignite + soil	15.66	13	15.00	14.55
Lignite + sawdust	13.66	13.66	13.66	13.66
Sawdust	3.00	3.67	3.00	3.22
Compost	12.00	8.66	12.33	10.99
Talc	15.33	13.33	15.33	14.66
Mean	12.77	11.10	12.38	
	S.E.m±			**C.D.**
Carrier material	0.18			0.71
Aspergillus spp	0.13			0.50
Carrier material x *Aspergillus* spp	0.32			1.23

*Mean of three replications

Effect of carrier material

It is clear from the table three that highest colony count was obtained when lignite was used as a carrier material irrespective of the *Aspergillus* spp grown. The colony count in this treatment was 15.44.it was followed by lignite + soil which recorded 14.55 colonies irrespective of *Aspergillus* spp and on at par with talc. Colony count in lignite + sawdust was 13.66. Sawdust was found to be poor carrier material for development of *Asergillus* spp. as it recorded least colony count (3.22).

It is revealed that, *A. niger* was superior in colony development as a maximum colonies (12.77) were obtained irrespective of nitrogen source used. It was on par with *A. terreus.*

Interaction of *Aspergillus* spp and carrier material

The interaction effect of the *A. niger* and carrier material depicted in table three revealed that the interaction between and *A. niger* and lignite was highly significant as it is recorded the maximum colony count (17). It was followed by the interaction between lignite + soil and *A. niger* which recorded the colony count to the tune of 15.66. The interaction between *A. terreus*, *A. niger* and sawdust was highly undesirable as only 3.00 colonies were observed after 90 days.

Discussion

Effect of carrier material

Maximum colony count was obtained when lignite was used as a carrier material irrespective of the *Aspergillus* spp grown after 90 days. The colony count in this treatment was 15.44. It was followed by lignite + soil which recorded 14.55 colonies irrespective of *Aspergillus* spp. and on at par with the talc the colony count in the lignite + sawdust treatment was13.66. Sawdust was found to be poor carrier material for development of *Aspergillus* spp. as it recorded least colony count (3.22). The interaction between *A. niger* and lignite was highly significant as it recorded the maximum colony count (17.00). It was followed by the interaction between lignite + soil and *A. niger* which recorded the colony count to the tune of 15.66. The interaction between *A. terreus*, *A. niger* and sawdust was highly undesirable as 3.00 colonies were observed after 90 days these results were in accordance with those reported by Kandasmy and Prasad (1971) [2] who observed that lignite is a good source of carrier material for preparation of microbial inoculants. Similarly Menaka and Alagwadi (2007) [3] used 200 mesh lignite as a carrier material for phosphate solubilizing bacteria. Similar results were obtained by Heijen *et al*. (1993) also found lignite and talc are effective carriers for phosphate solubilizing *Aspergillus* spp.

Summary and conclusion

Lignite was found to be good carrier material for all *Aspergillus* spp. They showed good colony growth up to 90 days but colony number was reduced compared to 30 and 60 days. *A. niger* showed good response in lignite after 30, 60 and 90 days with colony count 28.66, 24.66 and 17.00 respectively. It was followed by lignite + soil with colony count 24.66, 23, and 15.66 after 30, 60 and 90 days respectively.

References

1. Abd Alla MH, Omar shurky Ahmed, Omar SA. phosphate solubilizing fungus *A. niger* on various carrier material from some agronomical wastes and their effect on nodulation and growth of faba bean and soyabean. Journal of plant nutrition. 2001; 24:261-272.
2. Kandasamy R, Prasad NN. Lignite as carrier of rhizobia. Current science. 1971; 40:496-497.
3. Menaka V, Alagawadi AR. Enhanced survival and performance of phosphate solubilizing bacteria in maize through carrier enrichment. Karnataka J Agric Sci. 2007; 20(1):170-172
4. Chen X, Tang J, Fang Z, Shuijin HU. Phosphate solubilizing microbes in rhizosphere soil of 19 weeds in south western china. J Zhejiang univ. sci. 2002; 3:355-361.
5. Nahas E. Factors determine rock phosphate solubilization by microorganism isolated from soil. World J. Microbiol. Biothechnol. 1996; 12:567-572.
6. Nautiyal CS, Bhadurias Kuma P, Lal H Vermal. Stress induced phosphate solubilization in bacteria isolated from alkaline soils. FEMS Microbial. Lett. 2000; 18:291-296