Website : www.ssdatmeerut.in
Progressive Research : An International Journal
Vol 16 (2) : 177-179 (July-2021), Print ISSN : 0973-6417, Online ISSN : 2454-6003
Society for Scientific Development in Agriculture and Technology, Meerut (U.P.) India

Potassium Solubilizing Bacteria Population in Field Crops Rhizosphere Soils of Yadgiri District

Yallappa M. and Mahadeva Swamy
Department of Agricultural Microbiology (UAS, Raichur) Bheemarayanagudi, Karnataka
Department of Agricultural Microbiology, UAS, Raichur, Karnataka
Email : ambyallappam@gmail.com

Abstract

A laboratory experiment on Potassium Solubilizing Bacteria (KSB) wascarried out at College of Agriculture Bheemarayaanagudi, UAS Raichur during 2020-21 for Isolation of KSB from Rhizosphere soils of different crops from Yadgiri district. Totally six KSB isolates were isolated from collected rhizosphere soils of field crops like Rice, Maize and Sorghum of yadgiri district. All KSB isolates have shown characters like Creamy white to White, raised circular colonies and gram positive and rod shaped. Based on the morphological characters all isolated KSB isolates were belongs to probable genus of *Bacillus*.The isolate ARKSB 1 (0.65 cm) shown highest Zone of solubilization in diameter (cm) was and lowest was recorded by HSKSB 2(0.45 cm) isolate after 75 hr of incubation. The highest amount of K^+released by KSB isolate ARKSB 1(47.92 µg/ml)and lowest was released by control (0.09 µg/ml) at 20 days after incubation (DAI).

Key words : *Potassium solubilizing bacteria, gogi tomato, B' Gudi chilly, tomato, chilly and cotton.*

Introduction

Potassium (K) is the third most important essential nutrient for plant growth after phophorus. Microorganisms play a key role in the natural K cycle. There is considerable population of K solubilizing bacteria in soil and rhizosphere (1). Silicate bacteria were found to dissolve potassium, silicon and aluminum from insoluble minerals (2). Balance dose of application is good for growth and development of field crops (3). Potassium solubilizing bacteria are capable of solubilizing rock K, mineral powder such as mica, illite and orthoclases through production and excretion of organic acids (4).

In the light of the above facts, an experiment involving, isolation and characterization of potassium solubilising bacteria (KSB) from different field crops (Rice, Maize and Sorghum) of yadgiri district at College of Agriculture Bheemarayaanagudi, UAS Raichur during 2020-21.

Materials and Methods

Collection of soil samples : The different field crops rhizosphere soils samples were collected in the different places of yadgiridistricts. The samples were brought in polythene bags for further work.

Isolation and purification of potassium soluiblizers : Potassium solubilizing bacteria were isolated from collected soil samples by serial dilution plate count method using Aleksandrov medium (5).

Identification and characterization of the bacterial isolates : All the KSB isolates were examined for the colony morphology, cell shape, gram reaction and ability to form spores as per the standard procedures given by (6,7).

Biochemical characterization : The biochemical characterization of the isolates was essentially carried out as per the procedures outlined by (8). The tests conducted are detailed below. Starch hydrolysis. The ability of the isolates to hydrolyse starch was examined by the procedure of (9). Casein hydrolysis procedure of (10). Acid and gas production (10). Catalase test (11). Hydrogen sulphide production done by following (12) method. Urease test done by use of (13). Gelatin liquefaction test conducted by (11) method. Denitrification test and Methyl red test was conducted by use of procedure given by (10). Voger Proskauer test was conducted by (10) process.

Screening of isolates for potassium solubilization : All the bacterial isolates were tested for their ability to solubilize the insoluble form of potassium on Aleksandrov agar plates. The isolates showing clear zone of solubilization around the colony on Aleksandrov agar for potassium solubilizing bacteria were taken as K-solubilizers.

Quantitative estimation of K released from insoluble K bearing mineral : The isolates showing zone of solubilziation on Aleksandrov agar were further examined for their ability to release K from broth media tested by use of method given by (5).

Received : July-2021 Revised : July-2021 Accepted : July-2021

Table-1 : Isolation of Potassium Solubilizing Bacteria (KSB) from rhizosphere soils of different crops.

Sl.No.	Places	Crops	Isolates
1	Attigudur	Rice	ARKSB 1
			ARKSB 2
2	Shakapura	Maize	SMKSB 1
			SMKSB 2
3	Haiyal	Soghum	HSKSB 1
			HSKSB 2

Note : KSB = Potassium Solubilizing Bacteria, AKKSB = Attigudur Rice KSB,SMKSB =Shakapura maize KSB and HSKSB = Haiyal Sorghum KSB.

Results and Discussion

The attempts were made to isolate potassium solubilizing bacteria from rhizosphere soil of different field cropsof yadgiri district. The KSB isolates were characterized and tentatively identified upto genus level based on morphological and biochemical properties.

Isolation and screening of potassium soluiblizing bacteria (KSB) : The rhizosphere soil samples of different field crops *viz.,* Rice, Maize andsorghum, were collected. The details of the place of soil samples collected and the crops from which the KSB were isolated are furnished in Table-1.

The results are in agreement with the findings of (14), where in, they isolated 5 efficient strains of KSB from soil samples of ceramic industries using mineral potassium as sole source of potassium. Similar results were observed by (15), who isolated 2-keto gluconic acid producing *Pseudomonas* strain capable of solubilizing many potassium minerals like quartz, silicates and phlogopite.

Morphological and biochemical characterization of KSB isolates : All the Six KSB isolates were tested for colony morphology, Gram reaction, cell shape and spore formation.the results are presented in Table-2. All 6 isolates were gram positive rods belong to genera *Bacillus*. Similler results optained by (14) wherein they observed morphological characterization revealing that all potassium solubilizing bacteria were gram positive short to long rods with spore production, but differed in their physiology and nutrition.

Potassium solubilization by the KS Bisolates : Qualitative analysis for K solubilization of the isolates is presented in Table-3. Among the isolates ARKSB 1 recorded maximum solubilization zone of 0.65 cm followed by ARKSB 2 with the solubilization zone of 0.62 cm after 72 hours after incubation.

The results also indicated great variation between the isolates to soluiblize the same or different source of insoluble potassium minerals (5).

Table-2 : Morphological and biochemical characteristics of the Potassium solubilizing bacterial isolates.

Sl. No.	Code No. of the Isolates	Morphological characters		Endospore formation	Biochemical test											Carbon source utilization				Probable genus
		Colony characters	Gram reaction andcell shape		1	2	3	4	5	6	7	8	9	10	11	12	a	b	c	d	
1	ARKSB 1	white, widely spread-ing, large size	+ve, rod	+	+	+	+	+	+	+	-	+	-	-	-	-	+	+	-	-	*Bacillus*
2	ARKSB 2	white, slimy growth large	+ve, rod	+	+	+	+	+	+	+	-	+	-	-	-	-	+	+	-	-	*Bacillus*
3	SMKSB 1	White, smeared growth	+ve, rod	+	+	+	+	+	+	+	-	+	-	-	-	-	+	+	-	-	*Bacillus*
4	SMKSB 2	Smeared and whitish	+ve, rod	+	+	+	+	+	+	+	-	+	-	-	-	-	+	+	-	-	*Bacillus*
5	HSKSB 1	White, raised growth	+ve, rod	+	+	+	+	+	+	+	-	+	-	-	-	-	+	+	-	-	*Bacillus*
6	HSKSB 2	White, raised growth	+ve, rod	+	+	+	+	+	+	+	-	+	-	-	-	-	+	+	-	-	*Bacillus*

1 = Starch hydrolysis, 2 = Casein hydrolysis, 3 = Urease test, 4 = Gelatin liquefaction, 5 = Catalase test, 6 = Acid production test,7 = Denitrification test, 8 = Methyl red test, 9 = Growth at 7% NaCl, 10 = H2S production, 11 = Gas production, 12 =VogesProskauer test, a= Mannitol, b = Sucrose, c = Maltose, d = citric acid. KSBPotassium Solubilizing Bacteria, AKKSB =Attigudur Rice KSB, SMKSB =Shakapura maize KSB and HSKSB = Haiyal sorghum KSB

Table-3 : Zone of solubilization by potassium solubilizing bacterial (KSB) isolates after 75 hr of incubation.

Sl. No.	Strain	Zone of solubilization in diameter (cm)
1.	ARKSB 1	0.65
2.	ARKSB 2	0.62
3.	SMKSB 1	0.60
4.	SMKSB 2	0.61
5.	HSKSB 1	0.50
6.	HSKSB 2	0.45

Note : KSB = Potassium Solubilizing Bacteria, AKKSB = Attigudur Rice KSB, SMKSB = Shakapura maize KSB and HSKSB = Haiyal sorghum KSB.

Table-4 : The amount of K+ released from muscovite mica in a brothby the isolates at 7, 15, 20 days after incubation (DAI).

Sl. No.	Isolates	7 DAI (mg/ml)	15DAI (µg/ml)	20DAI (µg/ml)
1.	Control	0.08	0.08	0.09
2.	ARKSB 1	25.50	46.60	47.92
3.	ARKSB 2	22.36	32.52	36.30
4.	SMKSB 1	23.42	32.25	35.40
5.	SMKSB 2	21.56	31.43	34.62
6.	HSKSB 1	23.35	36.30	37.27
7.	HSKSB 2	21.35	29.25	32.23
S. Em ±		0.22	0.35	0.42
CD@ 1%		0.68	1.05	1.62

Note : KSB = Potassium Solubilizing Bacteria, AKKSB = Attigudur Rice KSB, SMKSB = Shakapura Maize KSB and HSKSB = Haiyal Sorghum KSB.

Quantitative estimation of K solubilizing ability of the isolates : The amount of K released from potassium mineral (muscovite mica) in broth by the isolates wasindicated in Table-4. Among the isolates ARKSB 1 released maximum amount of K from muscovite mica (47.92 g ml^{-1}) followed by HSKSB 1 (37.27 g ml^{-1}), ARKSB 2 (36.30 g ml^{-1}) and lowest released by HSKSB 2 (32.23 g ml^{-1}).

Similar results were obtained by (15) who reported that rhizosphere bacteria were capable of solubilizing mica in appreciable amounts. Similar studies conducted by (5) reported that *Bacillus megatherium* and *B. mucilaginosus* were capable of solubilizing both rock phosphate and potassium.

References

1. Sperber J.I. (1958a). Release of phosphate from soil minerals by hydrogen sulphide.
2. Aleksandrov V.G., Blagodyr R.N. and Live I.P. (1967). Liberation of phosphoric acid from apatite by silicate bacteria. *Mikrobiyolzh*, 29: 111-114.
3. Manjarekar R.G. and G.D. Shirke (2020). Effect of fertilizer levels on flowering behavior and yield of fruits in mango cv. Alphonso. *Progressive Research–An International Journal,* 15(1): 34-38.
4. Friedrich S.N.P., Platonova G.I., Karavaiko E., Stichel and Glombitza F. (1991). Chemical and microbiological solubilization of silicates. *Acta. Biotech*, 11: 187-196.
5. Hu X.F., Chen J. and Guo J.F. (2006). Two phosphate and potassium solubilizing bacteria isolated from Tiannumountain, Zhejiang, China. *World J. Micro. Biotech.,* 22: 983-990.
6. Anonymous (1957). Manual of microbiological method. *McGraw Hill Book Company Inc.,* New York, p.127.
7. Barthalomew J.W. and Mittewer J. (1950). A simplified bacterial strain. *Stain Tech.,* 25: 153.
8. Cappuccino J.G. and Sherman N. (1996). In: Microbiology : A laboratory manual. *The Benjamin/Cummings Publishing Company Inc.* (4th Ed.), Melopark, California, pp. 186.
9. Eckford M.D. (1927). Thermophillic bacteria in milk. *American J. Hyg*., 7: 200-201.
10. Seeley H.W. and Vandemark P.S. (1981). Microbes in action–A laboratory manual for microbiology, *Freeman and Compan*y, San Francisco, USA, p. 388.
11. Blazevic D.J. and Ederer G.M. (1975). Principles of biochemical tests in diagnostic microbiology, *Wiley and Company,* New York, pp. 13-45.
12. Cowan S.T. and Steel K.J. (1970). Manual for the identification of medical bacterial. Lowe and Brydon, London, p.30.
13. James G.C. and Natalie Sherman (1992). Microbiology and laboratory manual, rockland community college, suffern, New York, Third Edition. *The Benjamin/Cummings publishing Co. Inc.,* Redwood, City, California.
14. Prajapati K.B. and Modi H.A. (2012). Isolation and characterization of potassium solubilizing bacteria from ceramic industry soil. *J. Microbio.*, 1(2-3): 8-14.
15. Duff R.B., Webley D.M. and Sott R.O. (1963). Solubilization of minerals and related materials by 2 ketogluconic acid producing bacteria. *Soil Sci.*, 5: 105-114.
15. Parmar P. and Sindhu S.S. (2013). Potassium solubilization by rhizosphere bacteria: Influence of nutritional and environmental conditions. *J. Micro. Res.*, 3(1): 25-31.