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# Isolation of Potassium Solubilizing Bacteria from Rhizosphere Soils of Different Crops of Yadgiri District

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## Abstract

A laborotaryexperiment was conducted for Isolation of KSB from Rhizosphere soils of different crops from yadgiri district at College of Agriculture Bheemarayaanagudi during 2018-19, UAS Raichur. Totally six KSB isolates were isolated from collected rhizosphere soils of tomato, chilly and cotton crops of yadgiri district. All KSB isolates have shown characters like Creamy white, smooth widely spreading, White, raised circular and all were gram positive and rod shaped. Based on the morphological characters all isolated KSB isolates were belongs to probable genus of *Bacillus.* The highest Zone of solubilization in diameter (cm) was shown by GTKSB-1 (0.70 cm) isolate and lowest was recorded by BCKSB-1 (0.42 cm) isolate after 75 hr of incubation.The highest amount of $K^+$released by KSB isolate GTKSB-1 (45.89 µg/ml) and lowest was released by control (0.07 µg/ml) at 20 days after incubation (DAI).

***Key words :*** *Potassium Solubilizing Bacteria (KSB), Gogitomato KSB (GTKSB), B'Gudi chilly KSB (BCKSB), Tomato, chilly and cotton, GTKSB-1 and BCKSB-1.*

## Introduction

Potassium is one of the essential macronutrient and the most abundantly absorbed cation in higher plants. It plays an important role in the growth and development of plants. Potassium deficiency leads plant to develop weak roots, grow slowly, lodge easily, produce small seeds and lower yields. Potassium is present in relatively large quantities in soils, ranging between 0.5 and 2.5 per cent. However, in most cases only a small fraction of it is available to plants being the most abundant element on earth's crust. Most of our Indian soils rated as medium to high in available K status. Karnataka recorded 17, 50 and 33 per cent low, medium and high K status, respectively (1).

## Materials and Methods

**Collection of soil samples :** Therhizosphere soils of different crops plants were collected in the areas of yadgiridistricts. The samples were brought in polythene bags.

**Isolation and purification of potassium soluiblizers :** Potassium solubilizing bacteria were isolated from collected soil samples by serial dilution plate count method using Aleksandrov medium (2).

**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 (3,4).

**Biochemical characterization :** The biochemical characterization of the isolates was essentially carried out. Hydrogen sulphide production done by following (5) method. Urease test done by use of (6). Gelatin liquefaction test conducted by (7) method.

**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. The diameter of the zone of solubilization was measured and expressed in centimeters.

**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 (2).

## Results and Discussion

Microorganisms play a key role in the field of agriculture by converting the unavailable form of nutrient to available farm thereby increasing its availability in soil and enhancing agricultural production. In this study attempts were made to isolate potassium solubilizing bacteria from rhizosphere soil of different crop plants around the yadgiri district. The isolates were examined for their ability to solubilize insoluble potassic mineral. The selected

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

| Sl.No. | Places | Crops | Isolates |
|---|---|---|---|
| 1. | Gogi | Tomato | GTKSB-1 |
| | | | GTKSB-2 |
| 2. | B'Gudi | Chilly | BCKSB-1 |
| | | | BCKSB-2 |
| 3. | Kollur | Cotton | KCKSB-1 |
| | | | KCKSB-2 |

**Note :** KSB-Potassium Solubilizing Bacteria, GKSB-Gogi Tomato KSB, BCKSB-B' Gudi chilly KSB and KCKSB-Kollur KSB.

solubilizing many minerals like quartz, silicates and phlogopite.

**Identification of KSB isolates :** AllKSB isolates were identified upto genus level based on their morphological and biochemical characters and the results are presented in Table-2. All 6 isolates were gram positive rods belong to genera *Bacillus*.

**Potassium soluiblization by the isolates :** Qualitative analysis of the isolates for K solubilization is presented in Table-3. Among the isolates GTKSB 1 recorded maximum

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

| Code No. of the Isolates | Morphological characters | | Endospore formation | Biochemical test | | | | | | | | | | | | Carbon source utilization | | | | Probable genus |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Colony characters | Gram reaction & cell shape | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | a | b | c | d | |
| GTKSB-1 | Creamy white, smooth widely spreading, large size | +ve, rod | + | + | + | + | + | + | + | - | + | - | - | - | - | + | + | - | - | *Bacillus* |
| GTKSB-2 | White, smooth, slimy large | +ve, rod | + | + | + | + | + | + | + | - | + | - | - | - | - | + | + | - | - | *Bacillus* |
| BCKSB-1 | White, smooth, slimy, widely, | +ve, rod | + | + | + | + | + | + | + | - | + | - | - | - | - | + | + | - | - | *Bacillus* |
| BCKSB-2 | Grayish white, smooth, widely | +ve, rod | + | + | + | + | + | + | + | - | + | - | - | - | - | + | + | - | - | *Bacillus* |
| KCKSB-1 | White, raised circular | +ve, rod | + | + | + | + | + | + | + | - | + | - | - | - | - | + | + | - | - | *Bacillus* |
| KCKSB-2 | White, smooth widely spreading | +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- Voges-Proskauer test a-Mannitol, b-Sucrose, c-Maltose, d-citric acid. KSB -of Potassium Solubilizing Bacteria, GKSB–Gogi Tomato KSB, BCKSB–B' Gudi chilly KSB and KCKSB-Kollur KSB.

isolates were characterized and tentatively identified upto genus level based on morphological and biochemical properties. The efficient K soluiblizers were further subjected for their ability to release K from potassic mineral, mechanisms involved in K solubilization.

**Isolation of potassium soluiblizing bacteria (KSB) from rhizosphere soils of different crops of Yadgiri district :** The rhizosphere soil samples of different crops were collected and used for the isolation of KSB. The details of the place of rhizospheresoil sample collected and the crops furnished in Table-1. Totally 6 KSB isolates were isolated from collect rhizosphere soils samples. The similarly results were found by (8) who also isolated two strains of *Bacillus* sp. and *Pseudomonas* from rhizosphere soil of various crop plants as mineral potassium solubilizers.

The results were same as (9,10) also isolated 2-keto gluconic acid producing *Pseudomonas* strain capable of soluiblization zone (0.70 cm diameter) followed by KCKSB-1 (0.64 cm). However, the isolate BCKSB-1 showed the least solubilization zone of 0.42 cmdiameter. The results also indicated great variation between the isolates tosoluiblize the same or different source of insoluble potassium minerals (2, 11).

**Quantitative estimation of Ksolubilizing activity of the isolates :** The amount of K released from muscovite mica in a broth by the isolates was studied at 7, 15, 20 days after incubation (DAI). The results K release indicated in Table-4. Among the KSB isolates GTKSB-1 released maximum amount of K from mica 45.89 µg/ml followed by KCKSB-1 38.20 µg/ml. The findings are in agreement with the findings of (2) who reported that *Bacillus megaterium* was capable of solubilizing mica in appreciable amounts. The results compare well with the observations of (12,13).

**Quantitative estimation of Ksolubilizing activity of the isolates :** The amount of K released from muscovite mica

**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. | GTKSB-1 | 0.70 |
| 2. | GTKSB-2 | 0.56 |
| 3. | BCKSB-1 | 0.42 |
| 4. | BCKSB-2 | 0.60 |
| 5. | KCKSB-1 | 0.64 |
| 6. | KCKSB-2 | 0.62 |

**Note :** KSB-of Potassium Solubilizing Bacteria, GKSB–Gogi Tomato KSB, BCKSB–B'Gudi chilly KSBand KCKSB-Kollur KSB.

**Table-4 : The amount of K+ released from muscovite mica in a broth by 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 | 0.06 | 0.06 | 0.07 |
| 2 | GTKSB-1 | 24.75 | 44.80 | 45.89 |
| 3 | GTKSB-2 | 19.54 | 30.42 | 33.61 |
| 4 | BCKSB-1 | 22.24 | 35.20 | 36.50 |
| 5 | BCKSB-2 | 20.52 | 32.65 | 36.25 |
| 6 | KCKSB-1 | 21.52 | 36.50 | 38.20 |
| 7 | KCKSB-2 | 20.50 | 33.20 | 37.36 |
| S. Em ± | | 0.27 | 0.39 | 0.46 |
| CD @ 1% | | 0.86 | 1.25 | 1.42 |

**Note :** KSB-Potassium Solubilizing Bacteria, GKSB-Gogi Tomato KSB, BCKSB–B'Gudi chilly KS Band KCKSB-Kollur KSB.

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The production of organic acids like oxalic acid, tartaric acid, citric acid, acetate by potassium solubilizing bacteria have been reported earlier by various workers (11,14).

## References


1. Motsari M.R. (2002). Available NPK status of Indian soils as depicted by soil fertility maps. *Fert. News,* 47(8): 15-21.
2. Hu X. and Boyer G.L. (1996). Siderophore mediated aluminium uptake by *Bacillus megatherium*ATCC 19213. *Appl. Environ. Microbiol.,* 62: 4044-4048.
3. Anonymous (1957). Manual of microbiological method. *McGraw Hill Book Company Inc.*, New York, p.127.
4. Barthalomew J.W. and Mittewer J. (1950). A simplified bacterial strain.*Stain Tech.,* 25: 153. Cappuccino, J.G. and Sherman, N., 1992, Microbiology : A laboratory manual. *The Benjamin/Comings Publishing Company, Inc.,* California.
5. Cowan S.T. and Steel K.J. (1970). Manual for the identification of medical bacterial. *Lowe and Brydon,* London, p. 30.
6. 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.
7. Blazevic D.J. and Ederer G.M. (1975). Principles of biochemical tests in diagnostic microbiology, *Wiley and Company,* New York, pp. 13-45.
8. Norkina S.P. and Pumpyansakya L.V. (1956). Certain properties of silicate bacteria dokl. *Crop Sci., Soc. Japan,* 28: 35-40.
9. Gaur A.C., Madan M. and Ostwal K.P. (1973). Solubilization of phosphatic compounds by native microflora of rock phosphates.*Indian J. Exp. Biol.,* 11: 427-429.
10. Duff R.B., Webley D.M. and Scott R.O. (1963). Solubilization of minerals and related materials by 2 ketogluconic acid producing bacteria. *Soil Sci.,* 5: 105-114.
11. Liu W., Xu X., Wu S., Yang Q., Luo Y. and Christie P. (2006). Decomposition of silicate minerals by *Bacillus mucilaginosus* in liquid culture. *Environ. Geochem. Health,* 28: 133-140.
12. Badr, M.A. (2006). Efficiency of K-feldspar combined with organic materials and silicate dissolving bacteria on tomato yield. *J. App. Sci. Res.,* 2(12): 1191-1198.
13. Yakhontova L.K., Andreev P.I., Ivanova M.Y. and Nesterovich L.G. (1987). Bacterial decomposition of smectite minerals. *Doklady Akademii Nauk, SSSR,* 296: 203-206.
14. Ullman W.J., Kirchman D.L. and Welch W.A. (1996). Laboratory evidence by microbioally mediated silicate mineral dissolution in nature. *Chem. Geol.,* 132: 11-17.