

PSB Liquid Biofertilizer for Southern Rajasthan of India



- Dr. Devendra Jain • Dr. S. K. Sharma
- Dr. R. H. Meena • Dr. Bharati Kollah • Dr. S. R. Mohanty



**ICAR - All India Network Project on
Soil Biodiversity-Biofertilizers**

Department of Molecular Biology and Biotechnology
Maharana Pratap University of Agriculture and Technology
Udaipur-313001, Rajasthan, India



Background

Biofertilizers are selected and optimized living strains of microorganisms that are beneficial to the growth and development of the plants. Biofertilizers are eco-friendly, non-toxic and non-hazardous in nature. They maintain soil health, minimize pollution of the environment by lowering the use of chemicals. Biofertilizers are used to treating seeds, plantlets, grown plants. Phosphorus is the second most important nutrients for growth in plants. Phosphate solubilizing bacteria (PSB) helps in converting phosphorus into soluble forms by acidification by organic acids, inorganic acid etc.

Biofertilizers can increase crop yield by 5–10% and save chemical fertilizer up to 25%. All India Network Project-Soil Biodiversity & Biofertilizers, Department of MBBT, RCA, MPUAT, Udaipur is producing liquid biofertilizers to meet the farmers demand in Southern Rajasthan. One such product referred as Liquid PSB biofertilizer. The current technological bulletin highlights the significance of the product, Application protocol, and impact on crops. The product is commercially produced since 2020 and revenue of Rs. 459550/- generated. The technology has been transferred to one industry also. The features of Liquid PSB biofertilizer is as follows.

- It contains phosphorus-solubilizing bacteria (MPUAT strain PSB16 *Enterobacter cloacae*; Accession no. MW405830) which were mainly isolated from southern Rajasthan.
- Liquid PSB biofertilizer is used for all the crops like wheat, maize, vegetables etc.
- The liquid formulation has the self-life more than 1 year and carries high microbial load of 10^8 – 10^9 cfu/ml
- They are very easy to handle, store and transportation in the field for the application.
- It can add 15-20 kg/ha of phosphorus to soil and also increases the crop yield.

Production of Liquid PSB biofertilizer

Step I – Preparation of mother or starter cultures: Starter cultures of selected local strain obtained after ascertaining their performance in laboratory, pot culture experiments and at field levels. The pure culture of efficient strain of particular microorganism is grown on respective

PSB Liquid Biofertilizer for Southern Rajasthan of India

agar medium on slant and maintained in the laboratory. A loopful of inoculum from the slant is transferred to a 250 ml capacity conical flask containing liquid medium, keep the conical flask on rotary shaker for at 48-72 hrs depending on the strain whether they are fast growing or slow growing. The content of these flasks usually attain a microbial load of $>10^{10}$ cells per ml called mother culture or starter culture. This mother culture is used to inoculate the fermentor (100 L capacity).

Step II – Preparation of fermentor: A 100L fermentor was filled with the 80L capacity and the YEM broth media content was added to the fermentor and sterilized. The broth was allowed to cool down and further inoculated with the mother culture @ 2-5% (ml) aseptically. The agitation, temperature, dissolved O_2 and pH of fermentor was regulated during the fermentation process for 48-72 h until the viable count reaches to $>10^{10}$ cells per ml.

Step III – Preparation of liquid rhizobium biofertilizer with cell protectants: To prepare the liquid PSB biofertilizers from the above prepared broth, all the cell protectants required should be mixed thoroughly under mixing tank to avoid the contamination. In our studies we had observed that the formulation containing 1% Glycerol along with 2% Polyvinyl Pyrrolidone (PVP) has a shelf life of over 1 year with the cell count $>10^8$ per mL.

Step IV – Filling and packing of liquid biofertilizer: After preparation of liquid PSB biofertilizer as mentioned above the requisite quantity as per need should be filled in the sterile auto-lock high-density polyethylene (HDPE) plastic bottles with inner lid under laminar flow using semi automated bottle filling machine to avoid contamination.



Fermentor and Mixing Tank



Bottle filling Machine

PSB Liquid Biofertilizer for Southern Rajasthan of India

Strategies for application of Liquid PSB biofertilizers

Seed treatment: Mix 100 ml liquid Biofertilizer with 40-60 kg seeds by gentle mixing and dry the seeds in shade for 10 min. before sowing.

Soil application: For main field/nursery of 1 acre, mix 250ml of liquid biofertilizer with 100 kg organic manure and broadcast when the soil is just wet.

Precautions during biofertilizer application:

- Store biofertilizers in cool and dry place, avoid direct sunlight.
- For long time storage of biofertilizers, use refrigerator.
- Use specific biofertilizer for the specific crop.
- See the label for manufacturing date and expiry date.

Recommended doses

- 50 ml biofertilizer for 10 kg of seed.

Benefits of the using biofertilizers:

- Crop yield increase : 5 - 15 %
- Fertilizer saving: 20-25%.
- Biofertilizers provides different growth hormones and protects plants from pathogens.
- Germination is also increased by the use of biofertilizers.

Liquid PSB production and revenue generated (2020-2021) at Molecular Biology & Biotechnology Department, Rajasthan College of Agriculture

Year	2020	2021	Revenue generated
PSB	243350	216200	459550

No of trainings conducted on "Importance and Use of Biofertilizers in Agriculture"

Year	No. of Trainings	Type of beneficiaries	No. of beneficiaries
2014-15	5	Farmers	253
2015-16	6	Farmers	283
2016-17	10	Farmers	459
2017-18	7	Farmers	389
2018-19	4	Farmers	190

PSB Liquid Biofertilizer for Southern Rajasthan of India

Trainings / package of practices/recommendations

Farmers benefitted (2015-2020)	No of farmers benefitted 1574
Supply of Biofertilizer strains to Industries	1. NM India Biotech. LLP, Udaipur 2. Agriculture Department, Government of Rajasthan
Revenue Earned (2015-2020)	Rs. 459550 Revenue from Liquid PSB. Rs. 2007155.00 Revenue from all bio-fertilizers (This includes biofertilizer strains and biofertilizer of Azotobacter, Rhizobium and Phosphate solubilizing bacteria)
Package of practices	Package of practices developed and recommended to farmers of Rajasthan published by State agriculture department also included the use of Biofertilizers.

Evaluation of biofertilizer: Front line demonstration

Crop	Location	Area in ha.	No. of Demo.	Average Yield kg/ha		% increase
				Inoculated with PSB	Uninoculated	
Maize	Pratapgarh, Durgapur, Rajsamand, Udaipur	20	95	39.73	34.01	16.81%

Distribution of Liquid Biofertilizers at University adapted tribal village Chali on 12.04.2017 and farmers training programme at KVK, Bhilwara on 17.03.2017



PSB Liquid Biofertilizer for Southern Rajasthan of India



Published by: ICAR All India Network Project on Soil Biodiversity Biofertilizer (AINP-SBB), Directorate of Research, Maharana Pratap University of Agriculture and Technology, Udaipur-313001

Citation: Jain, D., Sharma, S.K., Meena, R. H., Kollah, B. and Mohanty S R, 2022. PSB Liquid and Carrier based Rhizobium biofertilizer for Southern Rajasthan of India, AINP-SBB technical bulletin No. 2, 1-7, MPUAT, Udaipur.

The information given in the document is based on the experiments carried out at the AINP centre- Department of Molecular Biology and Biotechnology, Maharana Pratap University of Agriculture and Technology, Udaipur-313001. For training, demonstration and other enquiries please contact, Director Research, MPUAT, Udaipur

Prepared by

Dr. Devendra Jain

Assistant Professor and PI (AINP-SBB)
Department of Molecular Biology and Biotechnology
MPUAT, Udaipur; devroshan@gmail.com

Dr. S. K. Sharma

Director Research, Maharana Pratap University
of Agriculture & Technology, Udaipur
dormpuat@gmail.com

Dr. R. H. Meena

Associate Professor, Department of Soil
Science & Agricultural Chemistry, RCA, MPUAT, Udaipur
ramharim@gmail.com

Dr. Bharati Kollah

Principal scientist, ICAR
Indian Institute of Soil Science, Bhopal
bharatik1@gmail.com

Dr. Santosh Ranjan Mohanty

Project Coordinator Principal scientist, ICAR
All India Network Project on Soil Biodiversity
Biofertilizer (AINP-SBB), Indian Institute of Soil
Science, Bhopal Santosh.mohanty@icar.gov.in,
mohantywisc@gmail.com



PSB Liquid Biofertilizer for Southern Rajasthan of India

PSB Liquid Biofertilizer for Southern Rajasthan of India