

Technical Bulletin Ref No.-AINPSBB/AP/ANGRAU/2021/01

RHIZOBIUM BIOFERTILIZERS FOR PULSES CULTIVATION IN ANDHRA PRADESH



Dr. R. Lakshmipathy,
Dr. N. Trimurtulu
Dr. P.R.K. Prasad
Dr. Santosh Ranjan Mohanty



**ICAR-All India Net Work Project on
Soil Biodiversity and Biofertilizers**
(ICAR Indian Institute of Soil Science, Bhopal)

Agricultural Research Station
Acharya NG Ranga Agricultural University, Amaravathi



CONTENTS

S.No.	PARTICULARS
1.	Introduction
2.	Isolation of Rhizobium
3.	Rhizobium Biofertilizers production process
4.	Use of Rhizobium for the cultivation of leguminous crops
5.	Response of leguminous crops to Rhizobium Biofertilizer
6.	Trainings/Dessiminationof information/recommendations (2015-2020)

INTRODUCTION

In Andhra Pradesh, legumes especially blackgram, redgram, bengalgram and groundnut are grown in vast area. These legumes are cultivated in 2.26Mha (Production-0.932MTs and Productivity-612kg/ha) while Cereals are cultivated in 2.56 MHa (Production-13.98 MTs, Productivity-4112kg/ha). Pluses are grown in less area compared to cereals and also production and productivity are far below the cereals. As per the 2016-17 data, pulses production in India was 17.01 with a deficit of 2.90 MTs to the pulses as against the demand of 19.91 MT. The production gap can be fulfilled by effective nutrient management, such as use of biofertilizers. Rhizobium biofertilizers not only increases productivity but also reduces the cost of cultivation and improve soil health. ICAR's All India Network Project on Soil Biodiversity Biofertilizers has developed efficient rhizobium biofertilizers at Agricultural Research Station, Amaravathi of Acharya NG Ranga Agricultural University. Rhizobium from various legumes viz. blackgram, redgram, bengalgram and groundnut grown in various places of Andhra Pradesh were isolated and screened. The isolates like RBG314& BLG 165, PPR704, BEG 1608 and GN 940 were found efficient for

blackgram, redgram, bengalgram and groundnut respectively. Both powder and liquid formulations of rhizobium biofertilizers are commercially being produced using automated fermenters. The products are being supplied to the farmers of Andhra Pradesh. The use of biofertilizers in the cultivation of legumes reduced the application of chemical fertilizers and enhanced the yields of legumes by 20-30 per cent. During 2015-2021 about 18159 kg powder and 24,976 litres liquid rhizobium biofertilizers were distributed to the farmers with a total revenue generation of Rs.81,56,524 and covered about 11,352 acres in the cultivation of various leguminous crops in Andhra Pradesh.

ISOLATION OF RHIZOBIUM

The nodules are surface sterilized with 0.1% mercuric chloride solution for 30 s, followed by 70% ethanol for another 30 s and rinsed thoroughly (5 times) with sterilized distilled water.

Surface sterilized nodules were kept in sterilized test tube and crushed to extract the Rhizobium from the nodules.



The suspension is streaked on yeast extract mannitol agar (YEMA) medium plates with Congo red following the spread plate technique. Rhizobium colonies formed after 24-48 h of incubation.



The plant infectivity tests are conducted to assess the efficiency of the isolates by Leonard Jar assembly and by pot culture study.

The efficient strains are used for mass multiplication/biofertilizer. In biofertilizer production process both powder and liquid formulations are produced. Further, the performance of carrier (powder) and liquid formulations of Rhizobium Biofertilizer are evaluated under pot and field experiments.



RHIZOBIUM BIOFERTILIZER PRODUCTION PROCESS

YEMA broth is prepared and loaded to fermenters of required size. After sterilization and cooling of the broth, the fermenter is inoculated with mother culture @ 0.1% v/v. The fermentation is carried out till the population reaches 10^9 CFU of Rhizobium/ml.



Then the fermented broth is mixed with sterilized lignite powder by rotary mixer in a ratio of 1:3 to 3.5 ratio. The entire process is done under aseptic conditions to avoid external contamination in a separate room meant for mixing, stabilization and packing.



The mixture is stabilized for 24 hours at 25°C and packaged. Before packing the sample are collected and assessed for their quality.

For the production of liquid Rhizobium Biofertilizer a separate medium is used with cell protectants. The liquid biofertilizer is bottled under aseptic conditions in 500ml bottles using bottling machine. After bottling, the bottles are capped and labelled with sticker containing all the necessary information of the biofertilizer, its storage and usage.



USE OF RHIZOBIUM FOR THE CULTIVATION OF LEGUMINOUS CROPS

The Rhizobium biofertilizers are applied to legumes in the form of seed treatment (10g/kg seeds). The seed treatment is done by preparing slurry by dissolving powder biofertilizer in water or in jaggery solution and the seeds are mixed with slurry to make a thin coating on the seeds. After seed

treatment seeds are dried under shade for 1 to 2 hours based on the season. The Rhizobium treated seeds are used for sowing. The liquid Rhizobium biofertilizer is treated with seeds by mixing 10ml of the biofertilizers per kg seed.

THE RHIZOBIUM BIOFERTILIZERS DISTRIBUTED AND ITS UTILIZATION FOR THE CULTIVATION OF VARIOUS PULSES

Year	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	Average
Production							
Powder(kg)	2778	6848	3878	4096	336	223	3027
Liquid (Litres)	1655	8169	6712	8068	187	185	4163
Usage in acres	6088	23186	17302	20232	710	593	11352



Training Programme on Biofertilizers



Distribution of Rhizobium Biofertilizers

Training Programme on Biofertilizers at Agricultural Research station, Amaravathi during 2014-15. There were 40 farmers participated in this programme.

About 1500 farmers, representatives from different NGOs and officers of the Agriculture Department from Andhra Pradesh were trained on usage of biofertilizers.

TRANSFER OF TECHNOLOGY

- ◆ Biofertilizer production Technology is transferred to the Biofertilizer Production Units of Agriculture Department, Andhra Pradesh and their staff were trained at ARS, Amaravathi
- ◆ Mother culture supplied to FIB Sol Life technologies Pvt Ltd, Bioincubator, IIT Chennai.

ACHARYA N.G. RANGA AGRICULTURAL UNIVERSITY
Administrative Office: LAM, Guntur-522 034, A.P

Memo.No.12752/Res.HH/2012

Date:13.11.2020

Sub: ANGRAU - Research - Purchase of mother cultures of Agriculturally important bacteria from ANGRAU - Remarks called for - Regarding.

Ref: Email, dt.2.11.2020 of the Chief Operating Officer, FIB-SOL Life Technologies Pvt.Ltd., IIT Madras Bio-incubator, Chennai.

As per the reference letter cited, the FIB-SOL Life Technologies Pvt.Ltd., IIT Madras Bio-incubator, Chennai has requested the University to provide the mother culture slants for the bacteria mentioned below on cost basis.

1. Azotobacter chroococcum/vinelandi
2. Rhizobium sps (Cowpea/Dalchigram)
3. Azospirillum lipoferum
4. Bacillus megaterium
5. Fructaria aurantia
6. Pseudomonas fluorescent

In this context, the Principal Scientist & Head, ARS, Amaravati is requested to furnish the remarks for possibility of supplying mother cultures on cost basis.

T. Giridhara Krishna
Director of Research

To
The Principal Scientist & Head, ARS, Amaravati (w.e)
Cc to SD/Sa

// Cho //

S. L. Prabhakar
Superintendent 12/11/2020
13/11/2020

BLACKGRAM

Uninoculated control grain yield: 845kg/ha

Rhizobium inoculation grain yield: 1510kg/ha

Rhizobium +PSB inoculation grain yield: 1640kg/ha



Effect of Rhizobium biofertilizer on Blackgram

BENGALGRAM

Uninoculated control grain yield: 1025kg/ha

Rhizobium inoculation grain yield: 1205kg/ha

Rhizobium +PSB inoculation grain yield: 1285kg/ha



Effect of Rhizobium biofertilizer on Chickpea

REDGRAM

Uninoculated control grain yield: 1150kg/ha

100% RDF grain yield: 1453kg/ha

50% RDF +Rhizobium +PSB inoculation grain yield:
1776kg/ha



Effect of Rhizobium biofertilizer on Redgram

GROUNDNUT

Uninoculated control the dry pod yield:1030kg/ha

Rhizobium inoculation the dry pod yield:1300 kg/ha

Rhizobium+PSB+100%RDF,
the dry pod yield:1300 kg/ha



Effect of Rhizobium biofertilizer on Groundnut

TRAININGS/DESSIMINATION OF INFORMATION/ RECOMMENDATIONS(2015-2021)

FARMERS BENEFITTED

Year	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21
No. of farmers benefitted	125	175	295	310	325	270

REVENUE GENERATED

Rs.82.98 Lakhs was generated with sale of biofertilizers

TABLE - YEARWISE BIOFERTILIZER (SOLID, LIQUID) COMMERCIALIZATION

Year	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21
Powder	1,00,008	2,46,528	1,39,608	1,47,456	12,096	8,028
Liquid	4,96,500	24,50,700	20,13,600	24,20,400	56,100	55,500
Total(Rs.)	5,96,508	26,97,228	21,53,208	25,67,856	68,196	63,528

PACKAGE OF PRACTICES

The package of practice regarding the usage of biofertilizers is included in "Vyavasaya Panchangam" of ANGRAU, Govt of Andhra Pradesh. Page.298-307



CONTRIBUTED BY:

Dr. R. Lakshmiopathy
Senior Scientist(Microbiology)
AINP on soil Biology and Biofertilizers
Agricultural Research Station
Amaravathi-522020, Andhra Pradesh.
rlakshmiopathy@gmail.com

Dr. N. Trimurtulu
Director of Research
Acharya NG Ranga Agricultural University
Administrative Office
Lam, Guntur-522034, Andhra Pradesh.
nunna_trim@yahoo.co.in

Dr. P.R.K. Prasad
Principal Scientist and Head
Agricultural Research Station
Amaravathi-522020, Andhra Pradesh.
ars.amaravati@angrau.ac.in

Dr. Santosh Ranjan Mohanty
Principal Scientist and Project Co-ordinator
ICAR-AINP on Soil Biodiversity and Biofertilizers
Indian Institute of Soil Science
Bhopal, Madhya Pradesh 462038
mohantywisc@gmail.com
santosh.mohanty@icar.gov.in

Citation :

Lakshmiopathy R., Trimurtulu N., Prasad P.R.K., and Mohanty S.R. 2021. *Rhizobium* Biofertilizers for Pulses Cultivation in Andhra Pradesh. AINP on SBB Technical Bulletin, **AINPSBB/AP/ANGRAU/2021/01**, 1-9, ANGRAU, Andhra Pradesh