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AZOSPIRILLUM

BIOFERTILIZER TECHNOLOGY FOR DIFFERENT CROPS OF ANDHRA PRADESH

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INTRODUCTION

In Andhra Pradesh, recent statistical data shows that there is 10.1 million ha cultivated area, constituting 37% of states total geographical area. The important crops are rice, cotton, maize, sunflower, chilli and sorghum. With a cropping intensity of 122%, food grains production is 13.4 million tonnes, suggested interventions for natural resource management for agriculture in the state. Important resource management is nutrient management; such as use of biofertilizers. Among the biofertilizers, nitrogen fixers play an important role. Azospirillumbiofertilizer is a promising nitrogenous biofertilizers, which not only increases productivity but also reduces the cost of cultivation and improve soil health. Azospirillum is a Gram-negative, microaerophilic, non-fermentative and nitrogen-fixing bacterial genus from the family of Rhodospirillaceae. Azospirillum bacteria can promote plant growth through nitrogen fixation.

ICAR's All India Network Project on Soil Biodiversity Biofertilizers (AINP SBB) has developed efficient Azospirillumbiofertilizers at Agricultural Research Station, Amaravathi of Acharya NG Ranga Agricultural University. Azospirillum from roots and rhizosphere of various crops viz. cotton, maize, sorghum and chilli from different places of Andhra Pradesh were isolated and screened. There were 19 isolates obtained and the isolates S10, SCH18 and AZS303 were found efficient in enhancing growth and yield of different crops. Both powder and liquid formulations of Azospirillumbiofertilizers are commercially being produced using automated fermenters. The products were supplied to the farmers of Andhra Pradesh. The use of biofertilizers in the cultivation of various crops reduced the application of chemical fertilizers and enhanced the yields by 20-30 per cent. During 2015-2022 about 100171kg powder and 20562 litres liquid rhizobium biofertilizers were distributed to the farmers with a total revenue generation of Rs.404980and covered about 91748 Ha in the cultivation of various crops in Andhra Pradesh.

Isolation of *Azospirillum*

Azospirillum strains are isolated from the rhizosphere soils and root bits of cotton, maize, sorghum and chilli.

The roots 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 roots were inserted into semisolid N free Malate agar medium petri plates or in test tube.

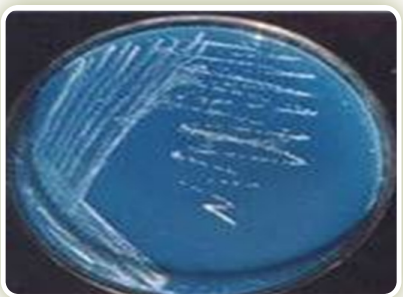
The rhizosphere soil suspension is spread on N free malate agar medium and incubated for 48 to 72 hours

The suspension is streaked on yeast extract N free malate agar medium plates following the spread plate technique. Azospirillum colonies formed after 24-48 h of incubation.

Gram reaction of the isolates istested by Gram staining (Arora 2003) and biochemical tests are performed on the isolates.

The efficient isolates were selected by bioassay with pot culture study.

The efficient strains thus assessed are used for mass multiplication/biofertilizer. In biofertilizer production process both powder and liquid formulations were produced. Further, the performance of powder and liquid formulations of Azospirillumbiofertilizer are evaluated under pot and field experiments.



Azospirillum Biofertilizer production process

The starter cultures were prepared using mother culture in conical flasks

N free malate broth was prepared and loaded to fermenters of required size. After sterilization and cooling the broth, the fermenter was inoculated with mother culture @ 0.1% v/v. The fermentation is carried out till the population reaches 109 CFU of Azospirillum/ml.

Then the fermented broth was mixed with sterilized lignite powder by a 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 mixuture is left for stabilization for 24 hours at 250C and are packaged. Before packing the sample are collected and assessed for quality.

The packet contains all the necessary information of the biofertilizer, its storage and usage.

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

Production of *Azospirillum*

Bottling of *Azospirillum*

***Azospirillum* formulations**

Use of *Azospirillum* for the cultivation of crops

The 500ml liquid or 2kg powder formulations *Azospirillum* biofertilizers were mixed with 200kg FYM was applied to the soil during transplanting and sowing of different crops.

The *Azosprillum* biofertilizers distributed and its utilization for the cultivation of various crops

Production

Year	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	Average
Powder(kg)	111860	38407	28617	12922	3180	2609	2576	100171
Liquid (Litres)	1572	8688	3523	4500	508	1378	663	20562
Uasge in acres	9074	36579	21354	15461	2606	4060	2614	91748

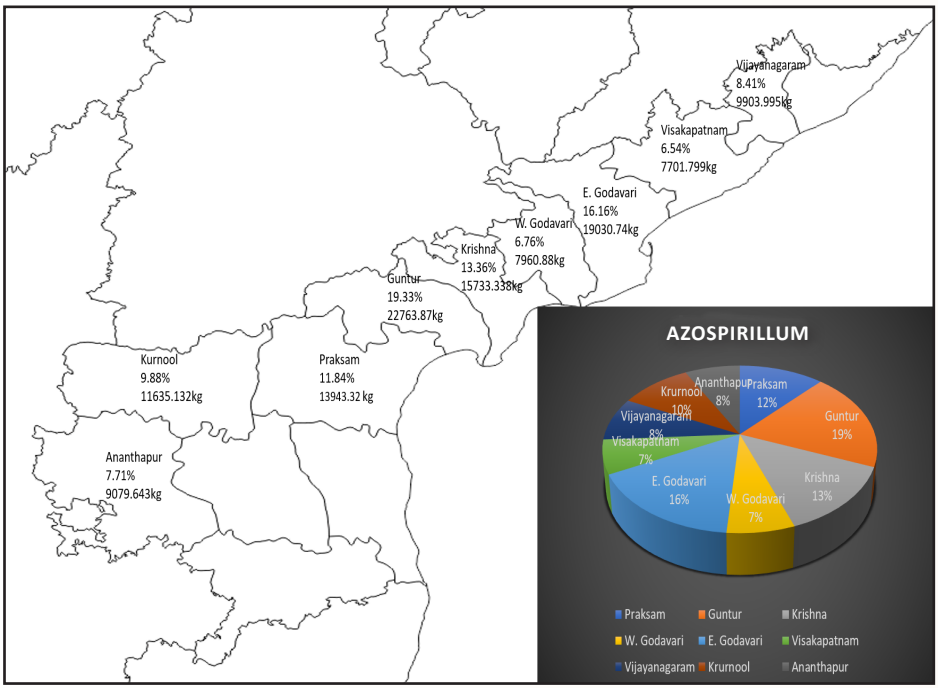


Fig. *Azospirillum* distribution pattern in different districts of Andhra Pradesh

Training farmers to use rhizobium biofertilizers

Response of different crops to *Azospirillum* biofertilizer

CHILLI

- Uninoculated control dry chilli yield: 2000kg/ha
- 100RDF dry chilli yield: 3300kg/ha
- 50%Azospirillum +PSB inoculation dry chilli yield: 3450kg/ha
- 100%Azospirillum +PSB inoculation dry chilli yield: 3900kg/ha

Effect of *Azospirillum* biofertilizer on Chilli

MAIZE

- Uninoculated control grain yield: 1500kg/ha
- 100% RDF grain yield: 4755kg/ha
- 75% RDF + Azospirillum inoculation grain yield: 4899kg/ha 100% RDF + Azospirillum inoculation grain yield: 5333kg/ha

Effect of Azospirillum biofertilizer on Maize

COTTON

- Uninoculated control Kapas yield: 1382kg/ha
- 100% RDF Kapas yield: 1903kg/ha
- 50% N +AzospirillumKapas yield: 1832kg/ha

Effect of Azospirillum biofertilizer on cottton

Trainings/Dessimination of information/recommendations

Farmers Benefitted

Year	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22
No. of farmers benefitted	125	175	295	310	325	270	315

About 1500 farmers, representatives from dfferent NGOs and officers of the Agriculture Depaertment from Andhra Pradesh were trained on usage of biofertilizers

Transfer of technology

Biofertilizer production Technology was transferred to the Biofertilizer Production Units of Agriculture Depaertment,Andhra Pradesh and their staff were trained at ARS, Amaravathi

GOVERNMENT OF ANDHRA PRADESH
DEPARTMENT OF AGRICULTURE

From
Sri D.Muralidhar Reddy, IAS,,
Special Commissioner of Agriculture,
Andhra Pradesh,
Chuttugunta, Guntur.

To
The Director of Research,
ANGRAU, Guntur,
Administrative Building,
Larmfarm Guntur.

Lr.No.Fert.(1)91/2014, Dt: - 07-2018

Sir,

Sub:- Bio-Fertilizer lab established at Samarlakota, East Godavari District – Technical training to be imparted to two Agricultural Officers - Requested – Reg.

Ref:- RC.No.A1/197/2018, dt.03.07.2018 of JDA, Kakinada, East Godavari.

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It is to inform you that a Bio-fertilizer laboratory has been newly established in the premises of SM & AR Farm, Samarlakota in East Godavari District under District Collector's innovation fund projects.

In this connection, JDA, East Godavari requested to arrange for imparting training to the following Agricultural Officers on production of various Bio-fertilizers.

3) Smt G. Vani, PA to ADA, Korukonda
4) Sri A. Bhimaraju, AO, STL Samarlakota.

I, therefore, request you to issue necessary instructions to the Micro-biologists of the University to impart training to the above Agricultural Officers at the convenient dates of your Microbiologists.

I further request that a convenient time schedule may please be communicated. So, our Agricultural Officers will attend the said training.

Yours faithfully,
Special Commissioner of Agriculture

Signature valid
Digitally signed by D. Muralidhar Reddy
Date: 2018.07.28 [illegible]:45:59 IST
Reason: Approved

ANGRAU
ACHARYA N.G. RANGA AGRICULTURAL UNIVERSITY
ADMINISTRATIVE OFFICE: LAM, GUNTUR–522 034, A.P.

Lr.No:24846/Res.II(1)/2018 **Dated:05.12.2019**

From
Dr.A.S.RAO
Director of Research,
ANGRAU.

To
Smt.Y.Sailaxmiewari, M.Sc (Ag.),
Additional Director of Agriculture,
O/o Commissioner & Director of
Agriculture, Andhra Pradesh,
Guntur – 522 004.

Madam,

Sub: ANGRAU - Bio Fertilizer Laboratory established at Samarlakota, East Godavari district – Training on Production of Biofertilizers for AOs- at Bio Fertilizer Laboratory, ARS, Amaravati - Intimation of training dates - Regarding.

Ref: Lr.No.AGCO2-13021(35)5/2019-Fert Sec, dated: 20.11.2019 of the Additional Director of Agriculture, O/o Commissioner & Director of Agriculture, A.P.

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With reference to the letter cited, it is to inform that training on production of Biofertilizers for Agricultural Officers at Biofertilizer Laboratory, Agricultural Research Station, Amaravati will be conducted from 10.12.2019 to 13.12.2019 to facilitate the production work at the newly established Bio Fertilizer Laboratory at Samarlakota, East Godavari district.

Therefore, it is requested to depute the following two Agricultural officers on the above mentioned dates to impart intended training on Bio Fertilizer Production at ARS, Amaravati.

1. Sri.Ch.Srinivasu,
   Agricultural Officer, Bio Fertilizer Laboratory at Samarlakota
2. Sri.J.N.V.M.Manohar Krishna,
   Agricultural Officer, Bio Fertilizer Laboratory at Samarlakota

Yours faithfully,
Sd/-A.S.RAO
Director of Research

Cc to the Principal Scientist (SS& AC) & Head, ARS, Amaravati
Cc to the Associate Director of Research, RARS, Lam
Cc to Sf/Sc

// f.b.o //

S. L. Prafanna
Superintendent 5/12/19

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

Memo.No.19752/Res.II(I)/2019 **Dated: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.

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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. Azotobactor chrococcum/vinelandi
2. Rhizobium sps (Cowpea/Balckgram)
3. Azospirillum lipoferum
4. Bacillus megaterium
5. Frateuria aurantia
6. Pseudomonas fluorescens

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 Sf/Sc

// f.b.o //

S. L. Prafanna
Superintendent 13/11/2020
13/11/2020

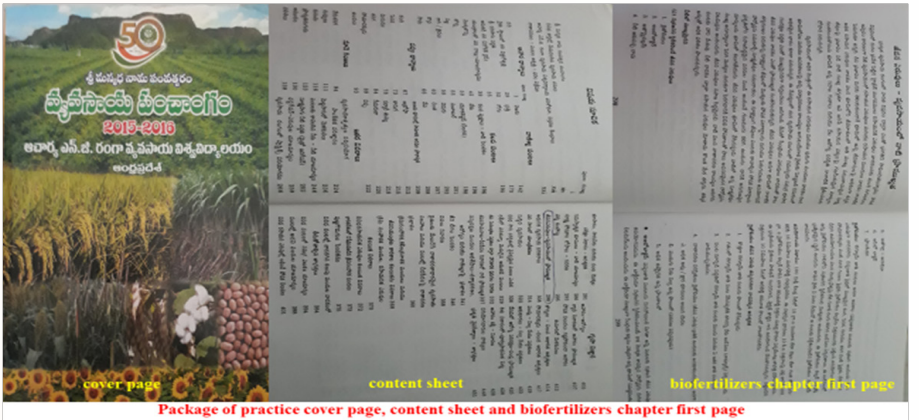
Revenue generated

Yearwise biofertilizer (solid, liquid) commercialization

Year	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22
Amount(Rs.)	5,98,560	39,89,052	20,56,900	18,15,192	2,66,880	5,07,324	4,04,980

Package of practices

The package of practice regarding the usage of biofertilizers is included in "Vyavasaya Panchangam" of ANGRAU.



Package of practice cover page, content sheet and biofertilizers chapter first page

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