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MYCORRHIZAL BIOFERTILIZERS FOR AGRICULTURE AND HORTICULTURE CROPS OF ANDHRA PRADESH

Acharya N.G. Ranga Agricultural University
and
AINP on Soil Biodiversity and Bio Fertilizers

ANGRAU

మైకోరైజా వ్యామ్ (VAM) జీవన ఎరువు

ICAR

వ్యవసాయ పరిశోధనా స్థానం
అమరావతి - 522 020, గుంటూరు జిల్లా, ఆంధ్రప్రదేశ్
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INTRODUCTION

Arbuscular Mycorrhizal Fungi (AMF) constitute a group of root obligate organisms those exchange mutual benefits with about 80% of plants. AM fungi occur in the majority of natural habitats and they improve plant by enhancing nutrition, stress resistance and tolerance, soil structure and fertility. AM fungi also interact with most crop plants including cereals, vegetables, and fruit trees. Therefore, they receive increasing attention for their potential use in sustainable agriculture. In Andhra Pradesh, commercial crops especially chilly, cotton and turmeric are grown in vast area along with field crops, vegetable and fruit crops. However, to improve their productivity, mycorrhizae biofertilizers are developed by ICAR's All India Network Project on Soil Biodiversity Biofertilizers at Agricultural Research station, Amaravathi of Acharya NG Ranga Agricultural University. Efficient strains for each crop were selected through intensive screening. The host based production technology developed for the large scale production of VAM biofertilizer. Powder formulation of VAM biofertilizers are being supplied to the farmers of Andhra Pradesh. VAM biofertilizers enhanced the activity of other beneficial microorganisms, reduced the chemical fertilizers usages and improved the crop yield by 25-30 per cent. Field level Officers and workers of various organizations were trained on the VAM biofertilizers technology and its usage. During last seven years (2015-22) 1,00,322 kgs of VAM worth Rs. 45,77,590 biofertilizers were distributed to the farmers and covered about 20,064 acres in the cultivation of various crops in Andhra Pradesh.

VAM fungi Isolation and auxenic culture development

Rhizosphere soil samples from different crops viz., maize, cotton, paddy, chilly were collected to isolate VAM spores. The soil samples were stored under refrigerated conditions.

The VAM spores from the soil samples were collected by wet sieving and decantation method using test sieves following the method outlined by Gerdemann and Nicolson (1963).

The soil sample was suspended in water, stirred well. The suspension was passed through sieves of size 1mm, 400µ, 325µ, 250µ,105µ and 45µ. Jet splash of water was passed through the sieves. This process was repeated for 3-4 times.

The suspension collected was poured on to Whatman filter paper or on nylon mesh of size 25µm and observed under stereo Binocular microscope for VAM spores.

Based on spore morphology, the spores are categorized. Using these spores, pure culture is developed by single spore culture using Funnel Technique.

Funnel Technique

The live spores are surface sterilized with 2% Chloramin T and 200 PPM Streptomycin Sulphate. The surface sterilized spores are put into the sterile sand soil mix in a funnel. Surface sterilized seeds of sorghum are sown on the mix.

The funnel need to be kept in a test tube containing water to make soil mix wet. The whole set up is kept in glass house for 2 months.

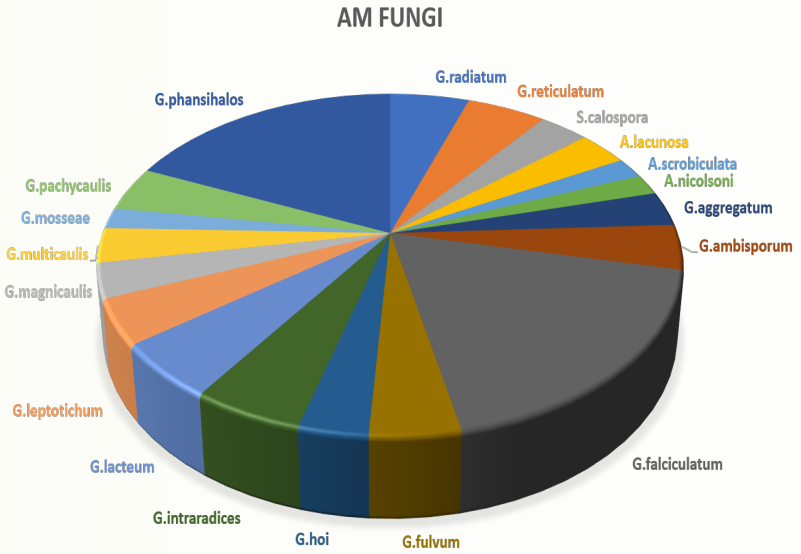
Then roots are tested for VAM colonization and soil is tested for VAM chlamydospores. The funnels where the roots are colonized by VAM fungi and soil with VAM chlamydospores are selected. The seedlings along with soil are transferred to a small surface sterilized pot containing sterilized sand soil mix. Further sorghum seeds are sown in pot and kept in glass house. After two months roots and soil will be tested for VAM colonization and chlamydospores.

Six VAM fungal isolates were collected across different agro-climatic zones of Andhra Pradesh and maintained at Agricultural Research Station, Amaravathi. The VAM genera recorded were *Glomus, Acaulospora, Gigaspora and Sclerocystis.*

Collection of different genera of VAM fungi by using single spore isolation technique

S. No.	Lab Code	VAM Genera
1	AM1	Glomus
2	AM2	Glomus
3	AM3	Gigaspora
4	AM4	Sclerocystis
5	AM5	Aculospora
6	AM6	Glomus

Distribution of VAM fungi in soils of Krishna district. The genera *Glomus* predominated followed by *Acaulospora* irrespective of soil samples. The dominant species were *Glomus fasciculatum and G.phansihalos.*



VAM BIOFERTILIZER PRODUCTION

Mycorrhizal spores, pieces of colonized crop roots and viable mycorrhizal hyphae function as active propagules of AM fungi that can be used as inoculum to colonize other plants.

AM fungi were multiplied in plant roots grown in soil-sand mixture (1:3). To initiate, pots are surface sterilized following standard method. Pots are filled with the sterile soil sand mixture. The axenic culture of AMF is added on the surface of soil at 1:10 ratio and mixed up to a depth of 1-1.5 inch.

The sorghum seeds (surface sterilized with sodium hypochlorite -1%/ 0.01% HgCl2) are sown on pots. These pots were maintained for 2 months and tested for root colonization and spore load. The colonization should be more than 65-70% and spore count should be 60-70 spores per 10g culture.(Hogland's nutrient solution without P should be given during watering once in 15 days for the proper growth of host plants)

After thorough quality heck, the shoot portion is removed and soil mixture along with roots are dried under shade. After drying the roots were cut into smaller pieces and thoroughly mixed into the soil.

This is further mixed with sterile lignite at a ratio of 1:3 and packed aseptically for distribution.

VAM Production in green house

Host based VAM production in pots

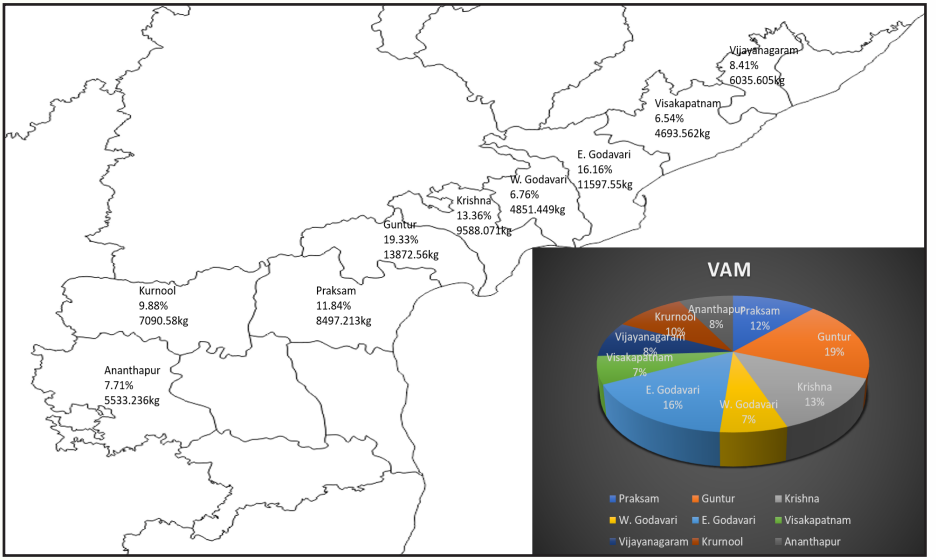
VAM biofertilizer packet

USE OF VAM FOR THE CROP PRODUCTION

The VAM biofertilizers are applied to different crops in the form of soil application (5kg/kg seeds). The 5kg VAM biofertilizer is mixed in 200kg FYM/Compost, broadcast it in the field and mix in soil. For nursery based crops VAM biofertilizers is applied to the nursery beds @ 1kg per Sq.Mt. and no need of applying in the main field during transplanting. For plantation crops 10g per seedling is applied below the seedling while planting.

The VAM biofertilizers distributed and its utilization for the cultivation of various field and commercial crops

Year	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	Average
Production (Kgs)	9,307	13,326	11,110	11,099	20,561	11,223	23,696	14,332
Usage in acres	1,861	2,665	2,222	2,220	4,112	2,245	2,866	4,739



Distribution of VAM bioferilizers to farmer

Application of VAM biofertilizer in the field

Response of different crops to vam biofertilizer

Cotton

In un-inoculated control plant dry matter production was 42.0g/plant and kappas yield was 6.45g/plant.

In inoculated plants, plant dry matter production was 117.6g/plant and kappas yield was 24.25g/plant

Maize

In uninoculated control-plant height, plant fresh weight and plant dry matter production were 84.8cm, 83.8g/plant and 36.5g/plant

respectively.

In uninoculated control-plant height, plant fresh weight and plant dry matter production were 128.1 cm, 142.8 g/plant and 75.5 g/plant respectively.

Commercialization

Yearwise VAM biofertilizer commercialization

Year	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22
Amount(Rs.)	3,25,745	4,66,410	3,88,850	3,88,465	7,19,635	3,92,805	18,95,680

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	105	95	110	125	100	250

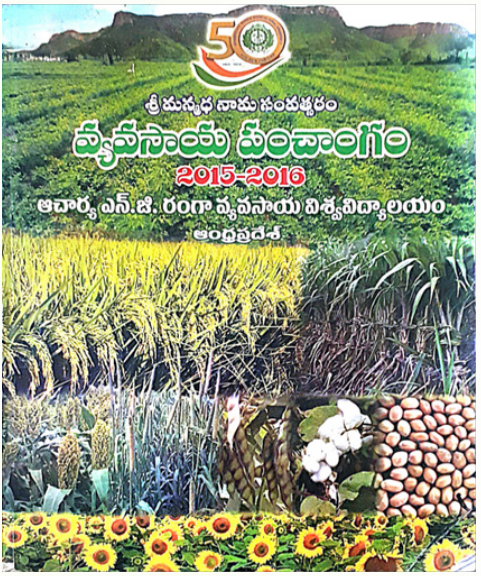
About 910 farmers, representatives from dfferent NGOs and officers of the Agriculture Depaertment from Andhra Pradesh were trained on usage of VAM biofertilizers

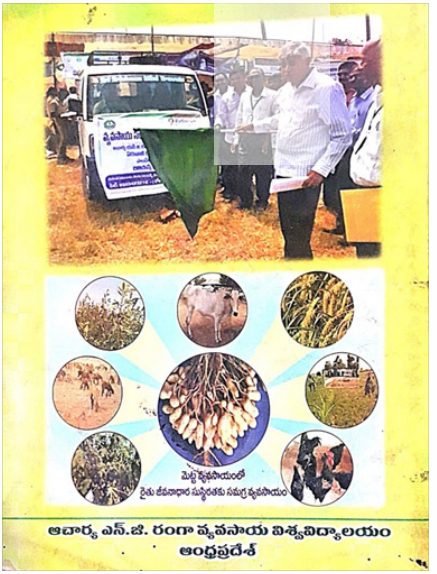
Transfer of technology

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

Package of practices

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





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