

## Schemes and *Adhoc* projects

### Schemes Currently Functioning

<b>Sr. No.</b>	<b>Name of Scheme</b>	<b>Funding agency</b>	<b>Year of commencement</b>
<b>01</b>	Establishment of methylotrophic and algal biofertilizer production and GHG emission with plant growth improvement of irrigated crops	RKVY	<b>2021-22</b>
<b>02</b>	Research on Organic Farming (Microbiology component) (Plan)	GOG	<b>2016-17</b>
<b>03</b>	Strengthening Department of Agricultural Microbiology (Plan)	GOG	<b>2012-13</b>
<b>04</b>	Research & Demonstrations of Biofertilizers in tribal areas of Gujarat (Plan)	GOG	<b>2002-03</b>
<b>05</b>	Research on eco-friendly Biofertilizers (Plan)	GOG	<b>1997-98</b>
<b>06</b>	NARP- Subcomponent Microbiology (Plan converted to Non-plan)	GOG	<b>1983-84</b>

### Projects successfully completed

<b>Sr. No.</b>	<b>Name of Project</b>	<b>Funding agency</b>	<b>Duration</b>
<b>01</b>	Native methanotrophic bacterial consortium for mitigation of methane flux from rice ecosystem	DBT-GOI	<b>2017-20</b>
<b>02</b>	Feasibility study for enrichment of hygienised dry sewage sludge with Plant Growth Promoting Bacterial consortium ( <i>Anubhav</i> Bio-NPK) and to assess its efficacy in potato, tomato and wheat	Ahmedabad Municipal Corporation, Ahmedabad	<b>2016-18</b>
<b>03</b>	Establishment of central laboratory of excellence for mapping and atlas preparation of agriculturally beneficial bacteria in Gujarat state	RKVY	<b>2012-14</b>
<b>04</b>	Establishment of Liquid Biofertilizer mass production unit (Biofertilizer plant)	RKVY	<b>2012-14</b>
<b>05</b>	Fortified formulations of PGPR consortium and PGPR metabolites with humic acid and micronutrients followed by efficacy on rice, wheat and bajra crops.	DBT, GOI	<b>2012-15</b>
<b>06</b>	Business planning and development Unit NAIP-I	NAIP-GOI	<b>2009-14</b>
<b>07</b>	Native endophytic PGPR consortium formulation and appraisal as biofertilizer cum biopesticide for sustainable crop productivity	DBT, GOI	<b>2009-12</b>
<b>08</b>	RKVY Project (Rastriya Krishi Vikash Yojna)	GOG	<b>2009-11</b>

	on Organic farming (Plan)		
09	Field efficacy testing of Agriland Biotech biofertilizer's formulations in wheat cv., GW 496	Agriland Biotech.Ltd., Samlaya, Vadodara	2009-10
10	Research on Kalisena and Josh as Biofertilizers against different horticultural crops	Agro Business, Cadila Pharmaceuticals Ltd., Ahmedabad	2006-08
11	Enrichment of FYM for sustainable soil productivity	Gosewa Aayog, Gandhinagar	2001-04
12	Development and testing of liquid biofertilizers	Biofertilizer, Kribhco, Khrbhconagar, Hazira	2000-02
13	Quality testing of biofertilizers	Growel Agrochemical, Porbandar	1993-94
14	Testing of microbial inoculants as per BIS Standards	G.S.F.C. Fertilizer Nagar, Vadodara	1990-91
15	Research on <i>Azolla</i> and Biofertilizers (Non-plan)	GOG	1985-11

### Patent & Patent Culture Deposits: 5

- Technology for Native Plant Growth Promoting Bacterial (PGPB) Consortium Formulations, Useful as Biofertilizer cum Biopesticide" Indian patent filed vide No 1060/DEL/2013 dtd. April 9, 2013 and published vide No.50/2014 dtd. 12/12/2014.

(12) PATENT APPLICATION PUBLICATION		(21) Application No.1060/DEL/2013 A
(19) INDIA		
(22) Date of filing of Application :09/04/2013		(43) Publication Date : 12/12/2014
(54) Title of the invention : TECHNOLOGY FOR NATIVE PLANT GROWTH PROMOTING BACTERIAL (PGPB) CONSORTIUM FORMULATIONS, USEFUL AS BIOFERTILIZER CUM BIOPESTICIDE		
(51) International classification	:C05F	(71)Name of Applicant :
(31) Priority Document No	:NA	1)DEPARTMENT OF BIOTECHNOLOGY
(32) Priority Date	:NA	Address of Applicant :BLOCK-2, 7TH FLOOR, C.G.O.
(33) Name of priority country	:NA	COMPLEX, LIDI ROAD, NEW DELHI - 110003, INDIA Delhi
(86) International Application No	:NA	India
Filing Date	:NA	2)ANAND AGRICULTURAL UNIVERSITY
(87) International Publication No	: NA	(72)Name of Inventor :
(61) Patent of Addition to Application Number	:NA	1)VYAS, R.V.
Filing Date	:NA	2)SHELAT, H.N.
(62) Divisional to Application Number	:NA	
Filing Date	:NA	
(57) Abstract :		
The present invention relates to Plant Growth Promoting Bacteris (PGPB) Consortium Formulations capable of stimulating plant growth and development. The PGPB consortium or the composition of the present invention also capable of fixing atomospheric nitrogen, solubilize phosphate, produce growth hormones and antagonistic activity against soil borne pathogens and their concentrated secondary metabolites. The present invention also provides method of making the for a PGPB consortium or composition.		

- Deposition of biofertilizer cultures at IMTECH (GOI), Chandigarh for Indian Patent Right
  1. MTCC 5464 (*Azotobacter chroococcum*)
  2. MTCC 5465 (*Bacillus coagulans*)
  3. MTCC 6567 (*Azospirillum lipoferum*)
  4. MTCC 5483 (*Acetobacter diazotrophicus*)

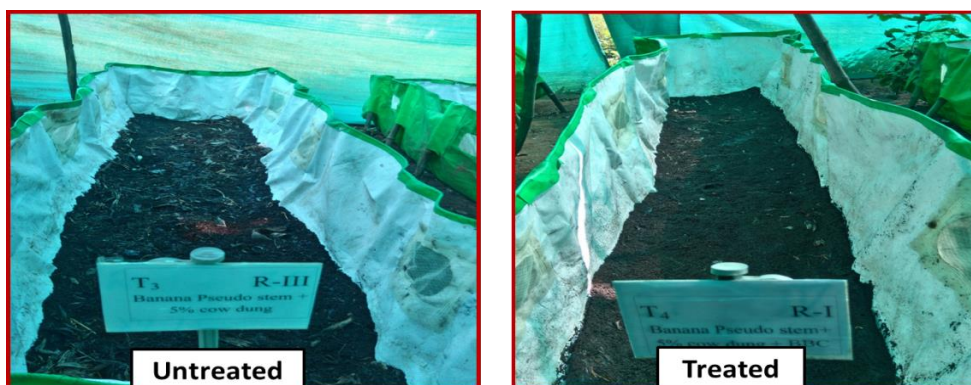
### Standard Strain Deposition

Deposited Methylophilic bacterial culture *Bacillus aerius* AAU M8 as type strain TSD 109 at ATCC, USA and available as methylophilic bacterial standard strain for scientific community.



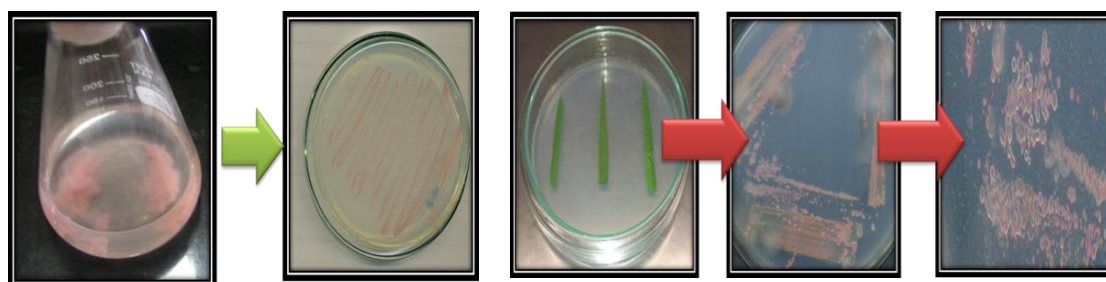
### New Frontiers

- **Bio decomposition of Agro waste using Anubhav Bio decomposer Bacterial Consortium (ABBC):**  
 Consortium of lignolytic and cellulolytic bacteria was prepared for effective decomposition of agro-waste bringing nutritionally rich compost
  - Production of high quality vermicompost from Banana pseudo stem or maize fodder using *Anubhav* Biodegradable Bacterial Consortium (ABBC) along with 5 % cow dung within short time (15 days earlier than normal vermicomposting method).
  - For making good quality compost from crops residues viz., banana pseudostem, pigeon pea stalk, cotton stalk and castor stalk, mix *Anubhav* Bacterial Biodecomposer Consortium (ABBC 1.0 L/t) and cow dung slurry at 200 kg/t with shredded crop residues to get finished compost within 40-45 days for banana pseudostem, 55-60 days for pigeon pea stalk, 70 days for cotton stalk and 80-85 days for castor stalk, which is 5-10 days earlier.

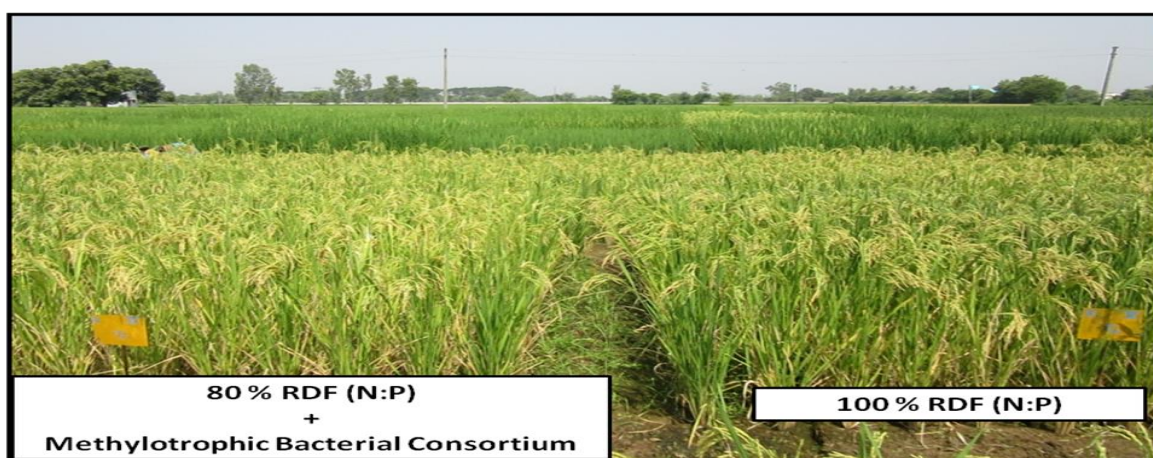


- **Methylo-trophic Bacterial Consortium Developed for Transplanted Paddy**

- A Methylo-trophic Bacterial Consortium comprising of three rhizospheric (*Bacillus aerius*, *Paenibacillus illinoisensis*, *B. megaterium*) and three phyllospheric (*Staphylococcus saprophyticus*, *B. subtilis* sp. spizizenii, *B. methylo-trophicus*) methylo-trophic bacterial isolates is developed for methane management of transplanted paddy fields.
- Application of methylo-trophic bacterial consortium in paddy field can save 20 % N and P chemical fertilizers along with 8-10 % reduction in methane emission.



**Pink Pigmented Methylo-trophic Bacteria from Rhizosphere and Phyllosphere of Paddy**



**Saving of 20 % N and P fertilizers in Rice cv. Gurjari by Application of Methylo-trophic Bacterial Consortium**

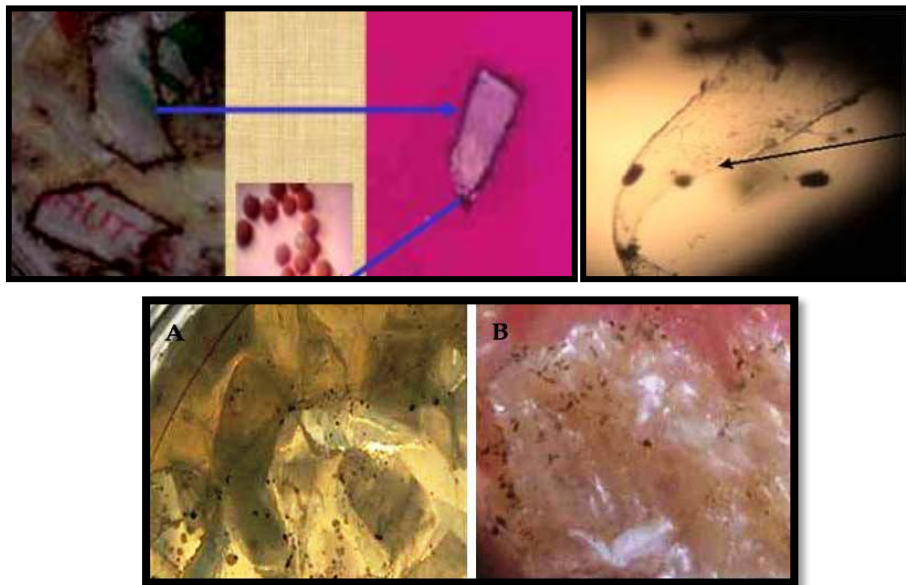




**Methane Gas collection from Field**

- **Biodegradation of plastic:**

*Emericella nidulans*, *Aspergillus wentii*, *Pseudomonas* etc. having thermoplastic and biodegradable plastic adoring capacity showed possibility to degrade plastic fast.



**Development of fungal biofilm on plastic**

- **Heavy metal bioremediation of contaminated soil by microorganisms**

Isolates predominantly gram +ve *Bacillus* spp., *Micrococcus* sp. and gram –ve *Pseudomonas* sp. were detected in polluted soil samples and studied tolerating heavy metals (Pb, Ni, Cd, Cr, Co, Fe, Zn and Cu) under laboratory conditions, selected cultures are further under investigation for their possible bio-remediation potential.



- **Agriculturally Beneficial Fungi proved as myco-phosphate solubilizer and myco-potash mobilizer**

Mycopesticides, *Paecilomyces lilacinus*-A, *Trichoderma viride*-A, *Trichoderma harzianum*-M found to give good P solubilization zones on PKVK agar medium. In broth, ThM showed highest P solubilizing ability (309.33  $\mu\text{g}/\text{ml}$ ). HPLC analysis showed production of pyruvic acid, formic acid, orotic acid, citric acid and butyric acid by mycopesticides. Quantitative analysis for IAA production found highest in ThM (12.60  $\mu\text{g}/\text{ml}$ ). Mycopesticide, *Trichoderma viride* and biodegrader fungus, *Aspergillus wentii* are found K solubilizer on mica agar plates and confirmed as myco-potash cultures.

- **Microbial Degradation of Pesticides**

Department of Agricultural Microbiology, BACA, AAU, Anand is intensively working on microbial degradation of pesticides since last decade. As an outcome, different species of native microorganisms such as *Pseudomonas* spp. and *Pinathrobacter* sp. capable to degrade pesticides such as chlorpyrifos, profenofos and atrazine have been successfully isolated and identified from different samples (Fig. 1). Additionally, these microorganisms possess superlative plant growth promotion traits in the presence of chemical pesticides (Fig. 2). Research is currently underway to develop formulations from these native microorganisms that can be used towards sustainable farming.

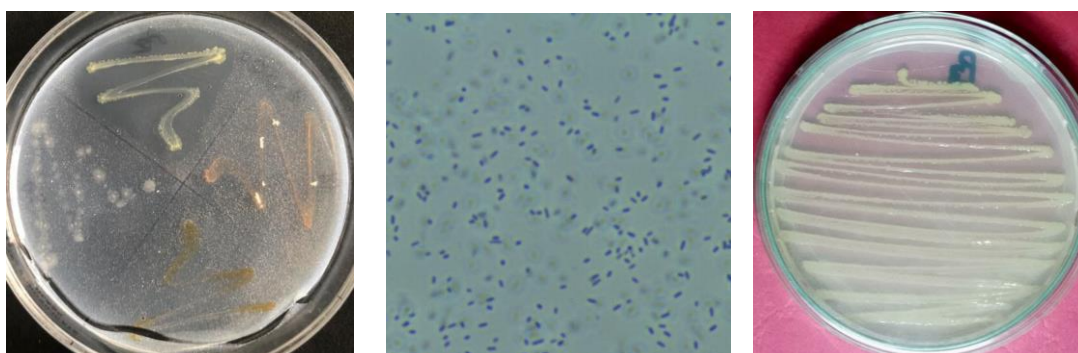


Figure 1: Pesticide degrading native microorganisms

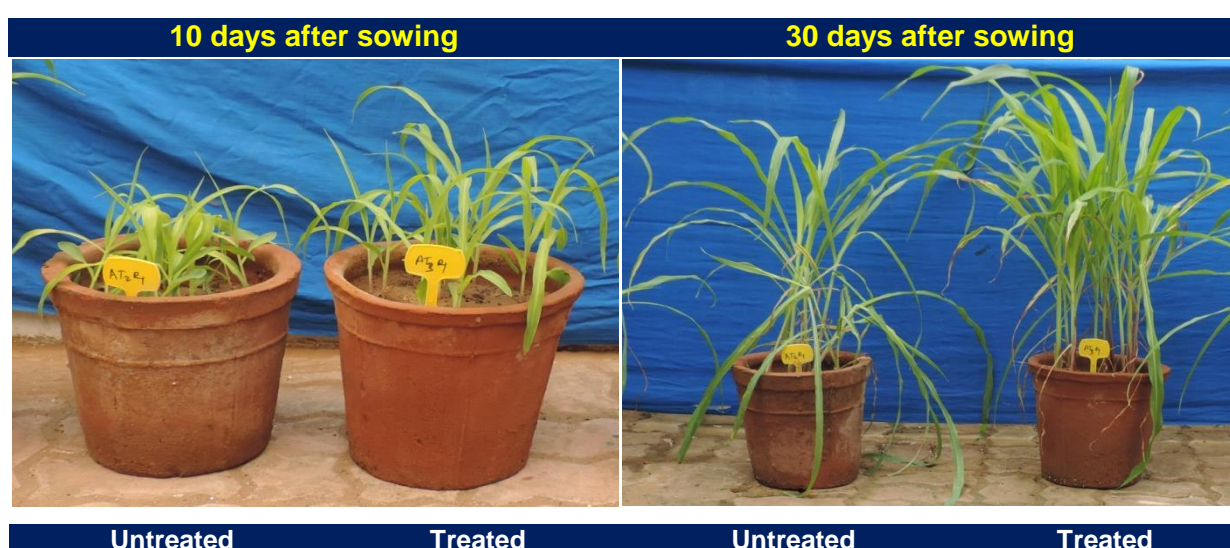


Figure 2: Plant Growth Promotion effect of pesticide degrading native microorganisms in presence of chemical pesticide (Atrazine)

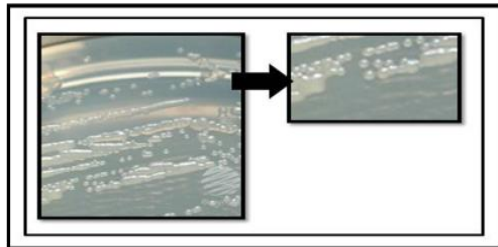
- **Microbiology of Ancient products**

Cow based products

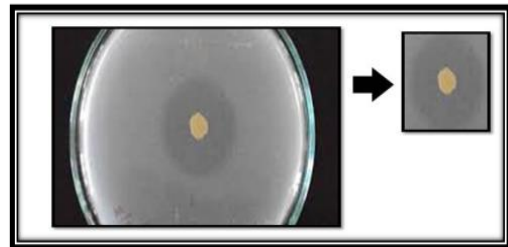
*Panchgavya*,

*Bijamrut*, *Jivamrut*

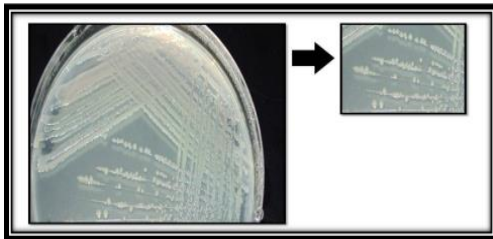
Key isolates from products: *Pseudomonas* spp., *Bacillus* spp., *Acinetobacter* spp., *Rhodococcus* spp. etc.



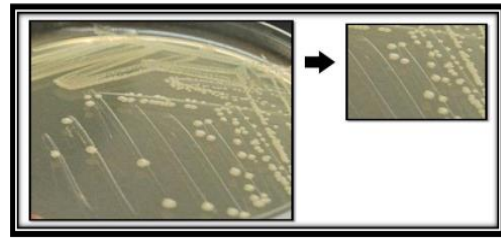
Colony characteristics of isolated bacteria V1PG on King's B medium



Colony characteristics of isolated bacteria V3PG on Sperber medium



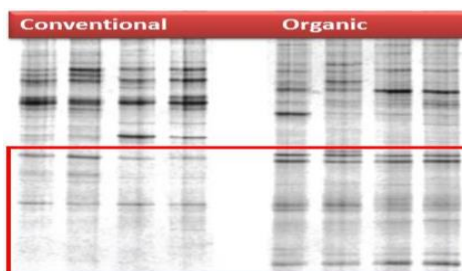
Colony characteristics of isolated bacteria V9MPG on TSA medium



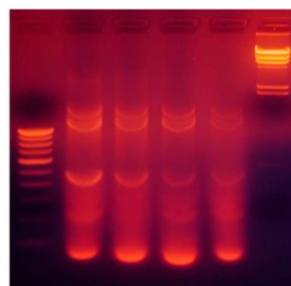
Colony characteristics of isolated bacteria V10MPG on TSA medium

- **Molecular characterization of native agriculturally beneficial microorganisms**

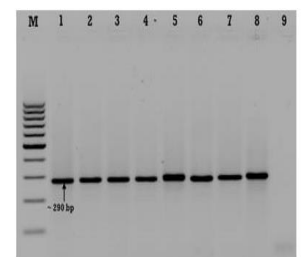
Molecular studies of agriculturally beneficial microorganisms through detection of *nif* H gene, *cry* gene etc. and community dynamics studies of soil micro flora through RAPD/RFLP/DGGE analysis



Microbial community dynamics study of organic and conventional farm soil



16S rDNA characterization of native *Xenorhabdus* isolates



*Cry* gene detection from *Bacillus thuringiensis*