1. Title:

Project Title: “IMPROVEMENT OF SOIL HEALTH AND PRODUCTIVITY FOR YIELD MAXIMIZATION THROUGH INTEGRATED CROP MANAGEMENT PRACTICES AND CLIMATE RESILIENT AGRICULTURE”

Sub project Title:

“Development and popularization of liquid plant growth promoting microbial inoculants for the major crops of coastal, hilly and southern transitional zone of Karnataka”.

2. Category: Agriculture

3. Challenge

Now a days, biological means for production of agricultural commodities is gaining lot of importance, among biological means; microorganisms being an integral component of soil ecosystem play a prestigious role by making the soil truly living. These organisms have evolved many mechanisms such as antibiosis, competition, parasitism, resistance induction in plants etc., to provide effective disease suppression, nutrient availability and plant growth promotion. The significance of plant growth promotion, rhizosphere competence and the suppression of diseases and pests on the plants is much considered research theme in present days. Hence there is need to Popularization and dissemination of effective local liquid plant growth promoting rhizomicrobial consortial usage among the farmers for the higher yield of the major crops of the region by farmers participatory approach.

3 a) Why Liquid Biofertilizers

In the carrier based (solid) biofertilizers, the microorganisms have a shelf life of only six months. They are not tolerant to UV rays and temperatures more than 30 degrees. The population density of these microbes is only $10^8$ cfu/ml at the time of production. This count reduces day by day. In the fourth month it reduces to $10^6$ cfu/ml and at the end of 6 months the count is almost nil. That is why the carrier based microbial inoculants were not effective and did not become popular among the farmers. These defects are rectified and fulfilled in the case of liquid microbial inoculants. The shelf life of the microbes in these
liquid microbial inoculants is two years. They are tolerant to high temperatures (55 degrees) and ultraviolet radiations. The count is as high as $10^9\text{cfu/ml}$, which is maintained constant up to two years.

a) **Specific objectives.**

- Collection, Characterization and Screening of beneficial plant growth promoting rhizomicroorganisms from coastal, hilly and southern transitional zones of Karnataka.
- Development and comparative evaluation of the liquid plant growth promoting rhizomicrobial consortia with standard plant growth promoting rhizomicrobial consortia on major crops of the region.
- Production and supply of quality liquid plant growth promoting rhizomicrobial isolates, biocontrol agents and organic matter degrading cultures comprising of *Rhizobium, Azotobacter, Azospirillum* and Phosphate Solubilizing Microorganisms (PSM), *Trichoderma, Pseudomonas, Bacillus thuringiensis, Metarhizium, Beauveria, Verticillium* etc., to the farmers of the region.
- Development and large scale multi location evaluation of the liquid plant growth promoting rhizomicrobial consortia in the farmers fields for sustainable crop production on major crops of the region.
- Universalization and dissemination of liquid plant growth promoting rhizomicrobial consortial usage among the farmers by appropriate extension methods in the region.

b) **Gap existing that required that specific intervention?**

The different microbial inoculants used in agriculture are not been produced in large scale throughout the seven districts of the coastal, hilly and transitional zone of Karnataka, Hence the farmers are not much aware about these microbial inoculants. Hence, there is a need to develop and popularize microbial inoculants at coastal hilly and transitional zone of Karnataka under RKVY Programme at College of Agriculture, Shimoga of UAS, Shimoga to cater the needs of farmers of this region to produce quality crops and helps in increasing the potential of export market and even reduces the cost of production of the crops.

c) **Physical Targets**

- Initially important districts of Costal, Hilly and Transitional zone of Karnataka like Shimoga, Chithradurga, and Udupi will be selected for the large scale demonstration of the liquid plant growth promoting microbial inoculants.
- The capacity building activities will also be carried out by selecting the progressive small, medium and large scale farmers for training programme on liquid biofertilizers and also rapid
composting methods using organic matter decomposing microbial inoculants in all selected districts. (Training =5 in each district)

- The extension methodologies like group discussion, method demonstrations, farmers – scientist interactions and different farmers participator approaches etc., will also be done in each selected districts.

d) Out come

The outcome of the proposed programme has helped to popularize locally developed efficient liquid PGPR microbial consortia among farmers of the region.

1. This also helps to achieve cost-effective and stabilized crop yields in the region
2. This may also pave the way to create awareness about liquid PGPR microbial consortial usage among farmers of the region which results transfer of scientific technology from lab to land.

4. Initiative

a) Area covered: Southern transitional zone of Karnataka (Shimoga, Sikaripura, Honnalli etc.,)

b) Crops covered: Maize, Arecanut, Pepper, Paddy, Ginger, Banana etc.,

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Physical progress</th>
<th>Quantity (No.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Soil Samples collected from coastal and hilly zones</td>
<td>150</td>
</tr>
<tr>
<td>2</td>
<td>PGPR isolates isolated and characterized</td>
<td>125</td>
</tr>
<tr>
<td>3</td>
<td>Training on Liquid PGPR usage</td>
<td>15</td>
</tr>
<tr>
<td>4</td>
<td>Leaflets on liquid PGPR and biofertilizers</td>
<td>5</td>
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<tr>
<td>5</td>
<td>Liquid PGPR formulation developed (Individual organisms like (efficient Azotobacter, Azospirillum, Pseudomonas fluorescence, PSB and KSB were developed)</td>
<td>7</td>
</tr>
<tr>
<td>6</td>
<td>Liquid microbial consortia developed</td>
<td>3 (PSB +KSB, Azotobacter + Azospirillum and PSB + KSB + Azotobacter)</td>
</tr>
<tr>
<td>7</td>
<td>Development of cheaper material for mass production liquid PGPR</td>
<td>✓</td>
</tr>
<tr>
<td>8</td>
<td>Maize rind and sorghum seeds were identified for mass production of fungal PGPR</td>
<td>✓</td>
</tr>
<tr>
<td>9</td>
<td>Compatibility evaluation among different PGPR isolates</td>
<td>✓</td>
</tr>
<tr>
<td>10</td>
<td>Renovation of liquid PGPR laboratory</td>
<td>✓</td>
</tr>
<tr>
<td>11</td>
<td>Equipments for liquid PGPR lab (Laminar air flow, deep freezer, rotary shaker, steam sterilizer, Electronic balance, High loop eclectic sterilizer, vacuum cleaner, etc.,)</td>
<td>✓</td>
</tr>
<tr>
<td>12</td>
<td>Chemical and glasswares purchase</td>
<td>✓</td>
</tr>
<tr>
<td>13</td>
<td>Field large scale demonstration against Ginger soft rot</td>
<td>2</td>
</tr>
<tr>
<td>14</td>
<td>Method demonstration of liquid PGPR usage to different crops</td>
<td>3</td>
</tr>
</tbody>
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**Infrastructural Developments:**

Renovation of the mushroom laboratory to install the Horizontal autoclave and Microbiology Laboratory is developed with additional sophisticated equipments, chemicals and Glasswares.

5. Key result/insight/interesting fact

- The Native and efficient PGPR isolates have been identified.
- Cheaper material for mass production of liquid PGPR have been developed:
  - (Rice porridge (Ganjii) formulation has been developed for mass production of liquid PGPR *viz.*, *Azotobacter*, *Azospirillum*, *Pseudomonas fluorescence*, PSB and KSB isolates)
- Popularization of liquid PGPR usage through trainings and large scale demonstration at framers fields in paddy and ginger.
- 7 individual liquid formulation is developed in the brand name of “Sahyadri”
- 2 liquid microbial formulation has been developed: 1) PSB +KSB  2) *Azotobacter* + *Azospirillum* 3)PSB + KSB + *Azotobacter*

6. Impact:

The farmers of the region are adopting the plant growth promoting rhizomicrobial consortia for growing different crops like maize, ginger, and arecanut.

7. Lessons Learned

1. What did you learn in this process? What was difficult or challenging?
   
   Adoption of liquid PGPR in crop production and the difficulty is to convince the farmers to use the microbial agents over the chemical fertilizers.

2. How did you overcome the challenges faced?
   
   By doing training and demonstrations in the farmers filed.

3. If you were to do it all over again, what would you do differently?
   
   The same work can be further fine-tuned to adopt the liquid Plant growth promoting microorganisms in the region by making the small groups in the village, taluk and district levels and also providing all the inputs to conduct the large scale demonstration at village levels to further convenience the farmers of the region.
8. Additional information

Please provide additional relevant information, such as:

1. List of all project partners and/or donors who supported the work: RKVY

2. Links to supporting materials, such as news items, photos on Flicker and presentations on Slide Share: State department of Agriculture

3. Contact person for this story:
   a) Name: Dr. Nandish, M.S.
   b) Assistant Professor
   c) nandimicrobe@gmail.com

4. Other information you want to add – Nil

Liquid Plant Growth Promoting Rhizomicroorganisms developed in the brand name of “SAHYADRI”
Gel formulations of the PGPR is formulated for increased survivability of the microorganism
Training programmes and Liquid PGPR distribution to farmers