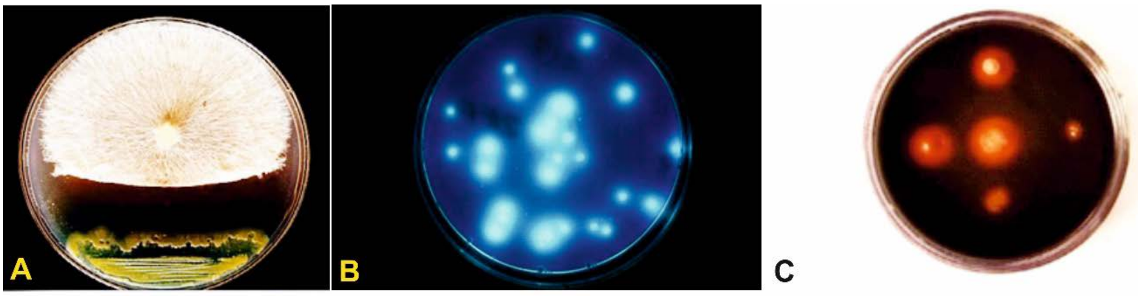
NutBoost: A PGPR Formulation Enhances Groundnut Growth and Yield

Situation:

Beneficial soil microorganisms play a very important role in sustainable crop production. These microbes are helpful in biogeochemical recycling of mineral nutrients as well as improving soil health and fertility. Groundnut, an important oilseed crop, is potentially benefitted by a formulation of beneficial rhizospheric bacteria 'NutBoost'.

NutBoost formulation

The consortium of Plant Growth Promoting Rhizobacteria (PGPRs) comprising of *Pseudomonas gessardii* BHU1 (PGPR1), *Pseudomonas putida* S1(6) (PGPR2) and *Pseudomonas aeruginosa* BM6 (PGPR4), was originally isolated at Junagadh from groundnut rhizosphere. These microorganisms are having multiple plant-growth promoting attributes like ACC deaminase (an indicator of plant growth promotion), phosphate solubilization, and production of siderophore, antifungal metabolites, hormones, and ammonification traits. Besides, these PGPR isolates also exhibited solubilization of Zn and potassium (K) and exhibited antifungal activities against major soil-borne fungal pathogens like *Sclerotium rolfsii* and *Aspergillus niger*.



Traits of PGPR of 'NutBoost' formulation: A= antifungal activity against *S. rolfsii*; B= production of fluorescent pigments; C= production of siderophore

Application and testing at multi-locations, FLDs

Application of these organisms have been found to enhance growth, yield, and nutrient uptake in groundnut at Junagadh, in farmers' fields, at multi-locations in India, tested through AICRP(G) centres for three years and demonstration through FLDs. Pooled results of 3 years in AICRP(G) showed that seed inoculations with either PGPR1, 2 or 4 or in combinations can enhance pod yields by 16.5 to 18.1 % over the un-inoculated control. These PGPR isolates have been recommended for irrigated and rainfed groundnut cultivation in India on the basis of the performance. The FLDs conducted in India with groundnut showed yield response of 18% with B:C ratio of 2.46 (ICBR: 6.4). Subsequently, a liquid formulation of PGPR1, PGPR2 and PGPR4 (compatible to each other) was developed and named "**NutBoost**" with a shelf-life of one year at room temperature. The formulation is compatible with seed treating chemicals like Bavistin (Carbendazime)/ Thiram**.** The "**NutBoost**" can also be applied after dilution through irrigation water or through FYM after multiplication in FYM.

Benefits that can be harnessed using NutBoost in groundnut:

- Consortium of multiple plant growth promoting PGPRs
- Improvement in soil health
- Improvement in nutrient mobilization and uptake like P, K, N, Fe, Zn, etc. (P, Zn, and K solubilizers)
- Produces plant growth promoting substances like IAA and iron chelating substances like siderophore

- Control of incidence of soil-borne fungal diseases in groundnut (stem and collar rot)
- Compatible with seed treating chemicals like Bavistin (Carbendazime)/Thiram
- Very fast growing and ease in large-scale multiplication
- Useful for both irrigated and rainfed conditions
- Strains of the consortium are compatible to each other and co-culturing is possible
- Liquid formulated "**NutBoost"** has a shelf-life of more than one year at room temperature
- Yield advantage of at least 10%
- Can also be applied through irrigation water or through FYM
- Can also be formulated in talcum powder and in charcoal/peat

Availability of the formulation:

The technology is ready for commercialization and the details are available with AgrInnovate India Limited.

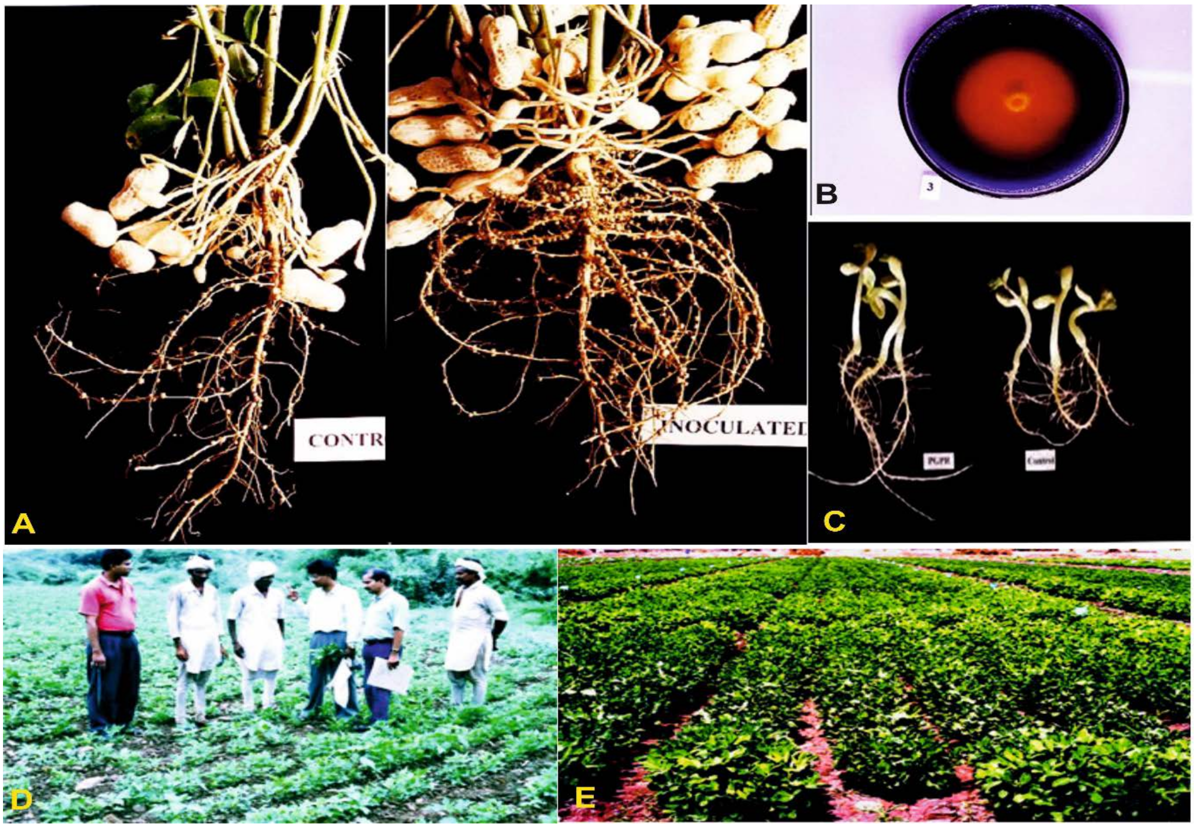
‘NutMagic’ Bacterial Formulation Augments Groundnut Growth and Yield

Situation:

Soil microorganisms play a very important role in sustaining crop production by nutrient recycling, mineralization and processes by which plants can thrive and agriculture can prosper. Some of the beneficial soil microbes also augment growth and yield of crop plants by exuding growth promoting hormones or by controlling the pathogenic microorganisms. Beneficial bacteria isolated from groundnut rhizosphere, have been characterized and tested and a combination of plant growth promoting bacteria, nitrogen fixers and phosphate solubilizing bacteria was found to be a good inoculant for improving growth and yield of groundnut, besides reducing incidences of soil-borne diseases.

‘NutMagic’, Application and Testing

As inoculation of a single strain of microorganism may not always be sustainable for providing all required benefits to plants, a mixed biofertilizer formulation would be best available option to provide a cascade of benefits to the plant by different organisms in a mixture.



Traits and effects of constituents of NutMagic formulation: A=enhanced nodulation, B= siderophore production, C=root growth on inoculation, D=demonstration in farmers’ field. E=station trails

The mixture would also provide an essential backup in case of failure of an organism. Thus, consortia were identified comprising mutually compatible and competent strains of phosphate solubilizing bacteria (PSBs), groundnut-rhizobia, and plant growth promoting rhizobacteria (PGPR) after pair-wise testing for compatibility.

ICAR-DGR developed consortium called "NutMagic" comprising of PGPR ((*Pseudomonas gessardii* BHU1, *Pseudomonas putida* S1(6)); PSB (*Enterobacter cloacae* BM8; *Bacillus polymyxa*), and rhizobia (*Sinorhizobium americanum* NRCG4 and *Rhizobium* sp. NRCG9). The consortium can take care of plant growth promotion by ACC deaminase activity, siderophore production, ammonification, suppression of pathogens, and solubilization of Zn and K; better phosphate solubilisation by PSBs; and improved biological nitrogen fixation by rhizobia. The consortium has been recommended after testing at Junagadh and at multilocations through AICRP(G). The consortium has been formulated as talcum based powder and also in liquid and recommended for seed treatment for both irrigated and rain-fed situations. These bacteria of the consortium are also compatible with seed treating chemicals. The benefits of consortia have been demonstrated through FLDs and on farm trials at different parts of the country.

Benefits that can be harnessed using "NutMagic" in groundnut:

- Consortium of PSB, PGPR and rhizobia
- Improvement in soil health
- Improvement in nutrient mobilization and uptake like P, K, N, Fe, Zn, etc. (P, K, and Zn solubilizers)
- Enhancement in biological nitrogen fixation
- Produces plant growth promoting substances like IAA and iron chetating substances like siderophore
- Compatible with seed treating chemicals like Bavistin (Carbendazime)/Thiram
- Dependence on nitrogenous fertilizer can be reduced
- Strains of the consortium are compatible to each other
- Very fast growing and ease in large- scale multiplication
- Can be used both for rain-fed and irrigated groundnut
- Yield advantage can be upto 20%
- Strains of the consortium are compatible to each other
- Easy to apply
- Eco-friendly
- Nominal in cost
- Can also be applied through irrigation water or through FYM
- Can also be formulated in talcum powder and in charcoal/peat
- Shelf-life of more than one year at room temperature of liquid formulation

Availability of the formulation:

The technology is ready for commercialization and the details are available with Agrinnovate India Limited.