

# Rhizoteka

## Liquid Rhizobium Biofertilizer



2020



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**Background:**

Biofertilizers can increase crop yield by 5 – 10 % and save chemical fertilizer up to 25%. All India Network project on Soil Biodiversity Biofertilizers, centre - CCS HAU, Hisar is producing biofertilizer to meet the farmers demand in Haryana, Punjab, Rajasthan, Himachal Pradesh and Jammu & Kashmir. One such product referred as “Rhizoteeka” is a rhizobium biofertilizer. The current technological bulletin highlights the significance of the product, production protocol, and impact on crops. The product is commercially produced and during 2015-20, a revenue of Rs 981130/- generated. The technology has been transferred to 2 industries and about 12000 farmers were benefitted.

**Rhizoteeka:**

- It contains nitrogen-fixing bacteria *Rhizobium* for different pulse and legume crops like moongbean, urdbean, pigeonpea, soybean, pea, chickpea, berseem and groundnut.
- Different species of *Rhizobium* exhibit host specificity so different fast and slow growing species of *Rhizobium* have been used for different legumes which were mainly isolated from semi-arid, arid and hyper-arid zones of Haryana and Rajasthan state.
- The liquid formulation of the rhizoteeka biofertilizers developed by the AINP SBB centre CCSHAU Hisar Haryana has self-life more than a year and carries high microbial load of  $10^{10}$  -  $10^{12}$  cfu/ml
- They are very easy to handle, store and transportation in the field for the application
- This rhizoteeka can be used for the seed treatment, root dip for the seedling in the transplanted crops and soil treatment
- It can add 15-20 kg/ha of nitrogen to soil and also increases the crop yield up to 10-35%

**Method of Application:**

Dissolve 50 g Sugar /Gur (Jaggery) or 10 % Gum arabic in 250 ml of hot water, which is used as sticky material for seeds. It also acts as a C-source for the bacteria. Add the solution to seeds and mix by rubbing with both hands. Add rhizobium biofertilizer as per the recommendation and mix thoroughly. Air dry the seeds on gunny bag. After complete drying, the seeds can be sown. Complete process of seed inoculation takes around 2 hrs. The seeds requiring treatment of pesticides or insecticide, should be done 12 hours prior to seed treatment with biofertilizers to maintain the viability of different biofertilizers.

Seedlings of vegetable and rice crops can be done by root dipping in liquid biofertilizers diluted with water (1:4 ratio). After half an hour of root dipping, the seedlings can be transplanted. The liquid biofertilizer can be poured in field during irrigation

**Protocol of preparation:**

1. Dissolve 50 g Sugar/Gur (Jaggery) or Gum arabic (10%) in 250 ml of hot water.
2. Add the jaggery solution to seed and mix thoroughly
3. Add biofertilizer to the sticky seeds
4. Air dry the seeds in shades on gunny bag
5. Sow the seeds as per recommendation

**Site characterization (specific to the area):** Arid, Semi-arid and Hyper-arid zones of the Haryana and Rajasthan State

**Precautions during biofertilizer application:**

- Store biofertilizers in cool and dry place, avoid direct sunlight.
- For long time storage of biofertilizers, use refrigerator.
- Use specific biofertilizer for the specific crop.
- See the label for manufacturing date and expiry date.

**Recommended doses:**

- 50 ml biofertilizer for 10 kg of seed.

**Benefits of the using biofertilizers:**

- Crop yield increase : 5 - 15 %
- Fertilizer saving: 20-25%.
- Biofertilizers provides different growth hormones and protects plants from pathogens.
- Germination is also increased by the use of bio fertilizers.
- In alkaline soils, use of phosphate solubilizers will increase the fertilizer use efficiency.

**Impact Analysis:**

Three rhizobial isolates viz. MR63, MB17a and MR54 referred as multi-trait mungbean rhizobia. Inoculation of these strains increased crop yield by 5-7 %, compared to RDF under rain-fed field conditions. These isolates also resulted in better nodule number and nodule fresh weight as compared to reference strain Mungbean rhizobia 1021.

Four pigeonpea rhizobial isolates (PPM37D, PPM33B, PPB25A and PPH10B) were found to be most efficient isolates, which resulted in 7.1, 5.9, 5.4 and 4.7% increase in seed yield, respectively as compared to RDF under rain-fed condition at CCS HAU, farm.

Six clusterbean rhizobial isolates (GB14c, GB32a, GB32c, GH1a, GH2b and GM16b,) showed significant increase in seed yield, which varied from 13.53-14.06 q ha<sup>-1</sup> compared to RDF (12.00 q ha<sup>-1</sup>) & commercial strain, GSS (12.92qha<sup>-1</sup>), with clusterbean variety HG 220 at recommended dose of fertilizer (RDF) under field conditions (Table 2). Most of these isolates showed significant increase in nodulation efficiency as compared to control and commercial strain.

Four chickpea rhizobial isolates (CK15, CH25, CS12 and CK 16) isolated from South–West Haryana performed better than control (RDF) and the commercial chickpea strain, 1233 in terms of nodule number per plant, nodule weight per plant and seed yield under field conditions. These isolates resulted in 7.99 to 11.73 % increase in chickpea seed yield, while the commercial strain, 1233 showed 6.78 % increase in seed yield as compared to RDF.



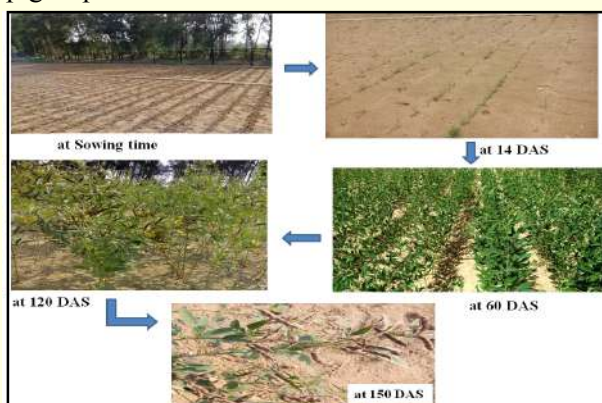
Effect of multi-trait Rhizobia on growth of mungbean crop at CCS HAU, Hisar farm.



**Effect of multi trait Rhizobia on seed and biological yield in mungbean crop (2016 to 2018)**

Treatments	Seed yield (kg/ha)			Mean Seed yield (kg/ ha)	Percent increase over control
	2016	2017	2018		
RDF (N & P)	1216	1235	1194	1215	-
75% RDF (N & P)	1042	1094	986	1041	-
75% RDF + 1021	1080	1135	1019	1078	3.55
<b>(Reference Strain)</b>					
75% RDF + PPB25A	1125	1181	ND	1153	10.76
75% RDF + PPH10B	1131	1196	ND	1164	11.82
75% RDF + PPM33B	1211	1209	1104	1175	12.87
75% RDF + PPM37D	1225	1223	1117	1188	14.12
C.D. at 5%	64	72	68		

RDF: Recommended dose of fertilizer; PPB25A, PPH10B, PPM33B & PPM37D are abiotic stress tolerant pigeonpea rhizobia.



Effect of abiotic stress tolerant rhizobia on growth of pigeonpea at CCS HAU, Hisar farm.



Effect of abiotic stress tolerant rhizobia on growth of clusterbean at RRS Bawal farm.

**Effect of Rhizobium inoculation on seed yield of cluster bean (2016-18)**

Treatment	Seed yield (q/ha)			Mean Seed yield (q/ha)	Yield increase over control (q/ha)	% increase over control
	2016	2017	2018			
Control	12.5	11.69	12.08	12.09	-	-
RDF	13.39	13.43	13.41	13.41	1.32	10.92
75% RDF	12.84	12.29	12.55	12.56	0.47	3.89
75% RDF + GSS (Reference strain)	14.42	12.96	13.7	13.69	1.6	13.23
75% RDF + GB14c	14.93	14.02	14.76	14.57	2.48	20.51
75% RDF + GB32a	14.99	13.04	14.03	14.02	1.93	15.96
75% RDF + GB32c	13.19	13.45	13.3	13.31	1.22	10.09
75% RDF + GH1a	14.87	12.76	13.82	13.81	1.72	14.22
75% RDF + GH2b	15.37	12.84	14.15	14.12	2.03	16.79
75% RDF + GM16b	13.8	12.94	13.4	13.38	1.29	10.67
Mean	14.03	12.94	13.47			
CD (P=0.05)	1.14	0.98	1.08			

RDF: Recommended dose of fertilizer; GB14c, GB32a, GB32c, GH1a, GH2b & GM16b are abiotic stress tolerant clusterbean rhizobia.



Effect of abiotic stress tolerant rhizobia on growth of chickpea at CCS HAU, Hisar farm



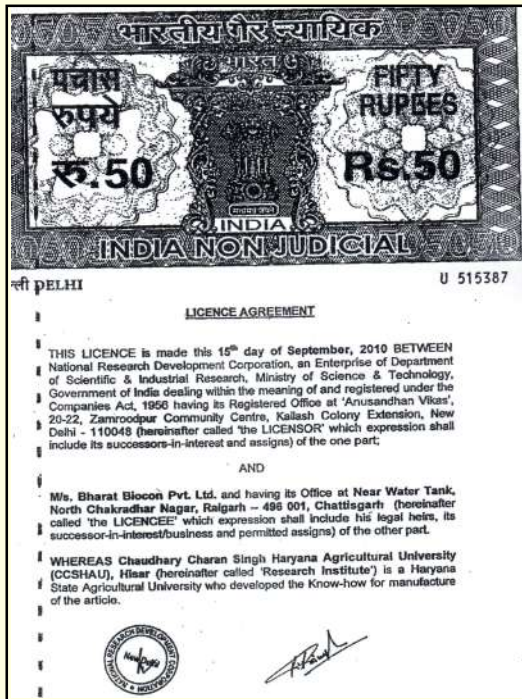
**Technology transfer:**

Liquid biofertilizer technology transferred to (1) M/S MicroBAC India West Bengal (Kolkatta); (2) Y.S. Sons Agrotech, Baddi, Himachal Pradesh and (3) M/S Bharat Biocon Ltd. Jhunagarh Lane, Chattisgarh for commercialization.

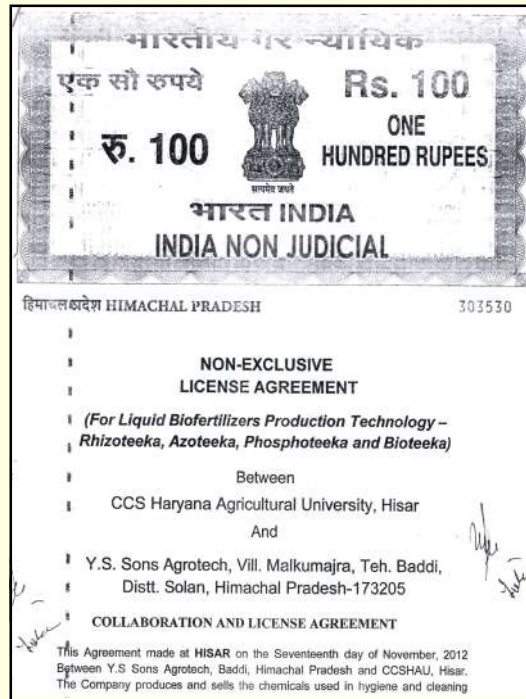
Commercial production in Public Private Partnership mode - FPO group M/s HABITAT Genome Improvement Primary Producers Company Pvt. Ltd. Village- Ramayan, Hisar, Haryana

Technology has been adopted by State agricultural department and recommendations published in Astral, 2<sup>nd</sup> edition.

The information given in the document is based on the experiments carried out at the AINP centre- Microbiology division, Hisar Agricultural University, HAU, Hisar. Haryana. For training, demonstration and other enquiries please contact the department.



Technology Transfer to M/s Bharat Biocon, Chattisgarh.

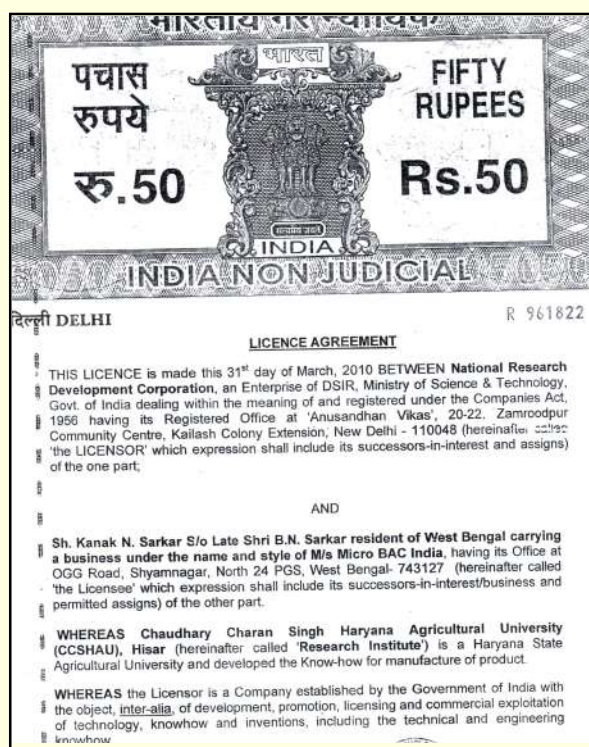


Technology Transfer to M/s Y S Sons Agrotech, Himachal Pradesh.



**Rhizoteeka production and revenue generated (2015-2020) at Centre of Biofertilizer Production & Technology, CCS HAU, Hisar**

Year	2015-16	2016-17	2017-18	2018-19	2019-20	Total (2015-20)	Revenue generated
Number of 50 ml vials produced	23634	10002	14048	16728	33701	98,113	Rs 981130/-



Technology transfer to M/s MicroBac, West Bengal.



Technology Transfer to M/s Habitat Genome, Hisar.

**Stakeholders:**

S. No.	Beneficiaries	Numbers
1.	Farmers	12000
2.	KVKs	1. Coordinator, Krishi Vigyan Kendra, Bawal, CCS HAU, Hisar, Haryana 2. Sr. Coordinator, Krishi Vigyan Kendra, Mahendergarh, CCS HAU, Hisar Haryana 3. Sr. Coordinator, Krishi Vigyan Kendra, Sonipat, CCS HAU, Hisar Haryana 4. Sr. Coordinator, Krishi Vigyan Kendra, Jhajjar, CCS HAU, Hisar, Haryana 5. Sr. Coordinator, Krishi Vigyan Kendra, Kaithal, CCS HAU, Hisar Haryana 6. Sr. Coordinator, Krishi Vigyan Kendra, Ambala, CCS HAU, Hisar Haryana 7. Sr. Coordinator, Krishi Vigyan Kendra, Jind, CCS HAU, Hisar Haryana 8. Coordinator, Krishi Vigyan Kendra, Fatehabad, CCS HAU, Hisar Haryana 9. Coordinator, Krishi Vigyan Kendra, Sirsa, CCS HAU, Hisar Haryana 10. Coordinator, Krishi Vigyan Kendra, Sadalpur, CCS HAU, Hisar Haryana



**Processing Unit**



**Demonstration of biofertilizers application to the farmers**





**Centre of Bio-fertilizer Production and Technology  
(Department of Microbiology)  
CCS HAU, Hisar-125 004 (India)**