

Liquid Biofertilizer : Azo-Phosphoteka



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Background:

Biofertilizers are selected and optimized living strains of microorganisms that are beneficial to the growth and development of the plants. Biofertilizers are eco-friendly, non-toxic and non-hazardous in nature. They maintain soil health, minimize pollution of the environment by lowering the use of chemicals. Biofertilizers are used to treating seeds, plantlets, grown plants. Nitrogen and phosphorus are most important nutrients for growth in plants. Nitrogen fixing bacteria helps to fix the nitrogen from the environment and PSBs or Phosphate solubilizing bacteria helps in converting phosphorus into soluble forms by acidification by organic acids, inorganic acid etc.

Biofertilizers can increase crop yield by 5-10% and save chemical fertilizer up to 25%. Centre of Biofertilizer Production & Technology, Department of Microbiology, CCS HAU, Hisar is producing biofertilizers to meet the farmers demand in Haryana, Punjab, Rajasthan, Himachal Pradesh and Jammu & Kashmir. One such product referred as “Azo-Phosphoteeka” is an Azotobacter and PSB mixed biofertilizer. Strains were screened under ICAR’s All India Network Project on Soil Biodiversity Biofertilizers (AINP SBB). The current technological bulletin highlights the significance of the product, Application protocol, and impact on crops. The product is commercially produced and during 2015-20, a revenue of Rs. 8827870/- generated. The technology has been transferred to two industries and more than 10000 farmers were benefitted.

Azo-Phosphoteeka:

- It contains *Azotobacter spp.* and phosphorus-solubilizing bacteria (*Pseudomonas spp.*) which were mainly isolated from semi-arid, arid and hyper-arid zones of Haryana and Rajasthan state.
- Azo-Phosphoteeka are used for the cereals and non-legume crops like wheat, maize, pearl millet, sorghum, mustard, cotton, fruit and vegetables.
- The liquid formulation of the Azo-phosphoteeka biofertilizers developed by the Department of Microbiology, CCSHAU Hisar Haryana has self-life more than six months and carries high microbial load of 10^8 - 10^{10} cfu/ml.
- They are very easy to handle, store and transportation in the field for the application.
- This Azo-phosphoteeka 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 and phosphorus to soil and also increases the crop yield.

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 Azo-Phosphoteeka 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 or mix with cow dung (Gobar khad) and apply in the soil.

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 biofertilizers 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 and 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 biofertilizers.

Impact Analysis:

Three years data on field experiments on pearl millet under irrigated conditions at CCS HAU farm indicated that inoculation with mixed biofertilizers at 0, 75 and 100% RDF resulted in average increase in grain yield by 12.8, 18.1 and 16.7% respectively over uninoculated control and 11.6, 9.8 and 6.2 % average increase in grain yield respectively under rain fed field conditions for three consecutive *kharif* seasons (Table 1). Effect of mixed biofertilizer inoculation on mustard under rain fed conditions with different recommended doses of fertilizer (RDF) was studied during three consecutive *rabi* seasons at CCS HAU farm. The inoculation of mixed biofertilizer resulted in an average increase of seed yield by 4.5, 8.4 & 5.5% with 0, 75 and 100% RDF over the uninoculated control, respectively (Table1).

The inoculation of mixed biofertilizer on pearl millet was studied under Pearl millet-Wheat and Pearl millet-Mustard system during 3 consecutive *kharif* seasons at Regional Research Station, CCS HAU, Bawal. The variety used was HHB 67. The effect of inoculation of mixed biofertilizer on average increase in grain yield was much more in Pearl millet-Wheat system which is 10.7, 16.0 & 4.5 % as compared to Pearl

Table 1. Effect of inoculation of mixed biofertilizers on grain yield (q/ha) of pearl millet and mustard at different levels of N under irrigated and rain-fed conditions at CCS HAU farm, Hisar

Treatments	*Pearl millet under Irrigated conditions			*Pearl millet under Rain- fed conditions			**Mustard under Rain-fed conditions		
	Control	Inoculated	% Increase	Control	Inoculated	% Increase	Control	Inoculated	% Increase
Control (0 RDF)	29.67	33.49	12.8	9.64	10.76	11.6	17.34	18.12	4.5
75% RDF	28.39	33.52	18.1	14.17	15.56	9.8	19.68	21.34	8.4
100% RDF	30.31	35.38	16.7	11.14	11.83	6.2	21.82	23.02	5.5
125% RDF	35.65	-	-	-	-	-	-	-	-

*Average grain yield of 3 consecutive years of *kharif* season; ** Average grain yield of 3 consecutive years of *rabi* season.

millet-Mustard system, which showed an average increase of 8.3, 12.3 & 3.6 % at 0, 75 and 100% RDF respectively (Table 2).

Field experiments were conducted at Regional Research Station, CCS HAU, Bawal to see the effect of inoculation with mixed biofertilizers on wheat var. WH 283 at different doses of N during 3 consecutive *rabi* seasons. Inoculation of mixed biofertilizers at 0, 50, 75 and 100% RDF of N resulted in an average increase of grain yield by 8.3, 9.8, 12.3 and 3.6 % respectively over uninoculated control (Table 2).

The seeds of mustard variety RH30 was inoculated with charcoal based mixed biofertilizer at 0, 50, 75 and 100% dose of N. The inoculation of mixed biofertilizer resulted in an average increase of seed yield by 17.7, 8.3, 9.4 and 9.5 % at RRS, Bawal with 0, 50, 75 and 100% RDF over the uninoculated control, respectively. The maximum average seed yield of 18.33 q/ha was observed with inoculation of mixed biofertilizer at 100% RDF (Table 2).

Table 2. Effect of inoculation of mixed biofertilizers on grain yield (q/ha) of pearl millet, wheat and mustard at different doses of fertilizers at RRS, Bawal

Treatments	*Pearl millet			*Wheat			**Pearl millet			**Mustard		
	Control	Inoculated	% Increase	Control	Inoculated	% Increase	Control	Inoculated	% Increase	Control	Inoculated	% Increase
Control (0 RDF)	11.75	13.01	10.7	8.1	8.78	8.3	13	13.8	6.2	6.73	7.92	17.7
50% RDF	16.24	18.11	11.5	23.41	25.7	9.8	17.5	19.09	9.1	13.33	14.44	8.3
75% RDF	19.39	22.5	16	28.67	32.21	12.3	20.53	22.72	10.7	14.73	16.12	9.4
100% RDF	23.38	24.44	4.5	34.96	36.21	3.6	23.49	25.54	8.7	16.74	18.33	9.5

*Average grain yield of 3 consecutive years of *kharif* and *rabi* seasons of pearl millet-wheat system.

** Average grain yield of 3 consecutive years of *kharif* and *rabi* seasons of pearl millet-mustard system.

Azo-Phosphoteeka 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 vials (2015-20)	Revenue generated (Rs)
Number of 50 ml vials produced and sold	149130	94023	89214	314074	236346	882787	8827870/-

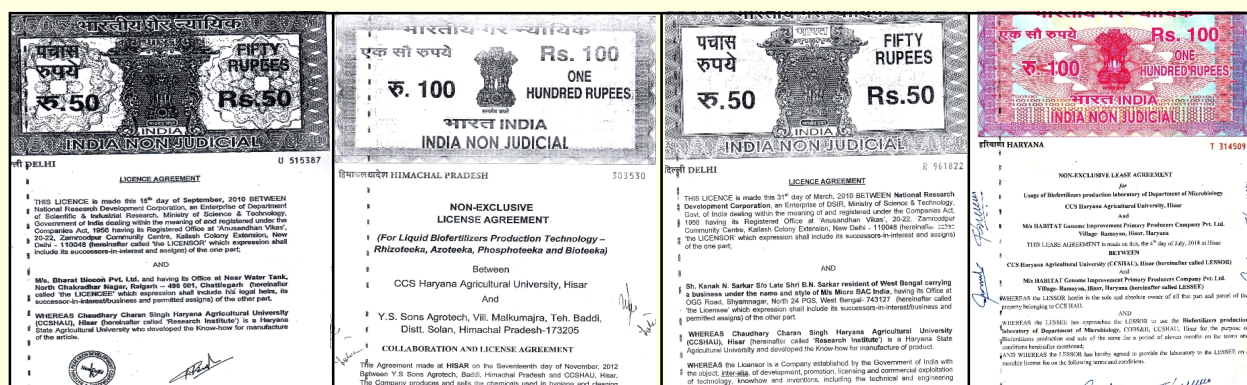
Technology transfer:

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, 2nd 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.



M/s. Bharat Biocon,
Chattisgarh.

M/s. Y S Sons Agrotech,
Himachal Pradesh.

M/s. MicroBac,
West Bengal.

M/s. Habitat Genome,
Hisar.

Stakeholders:

S. No.	Beneficiaries	Numbers
1	Farmers	>10000
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



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