



BIOLOGICAL INPUTS - SUSTAINABLE AGRICULTURAL DEVELOPMENT

ABIM 2011

Lucerne, Switzerland

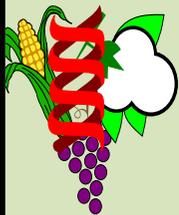
24 – 26 October 2011



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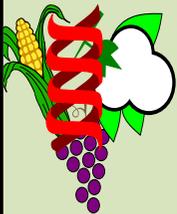
O Goddess Earth, O all-enduring wide expanses!
Salutation to thee.
Now I am going to begin cultivation.
Be pleased, O virtuous One.

- Ancient Sanskrit prayer



STRUCTURE OF PRESENTATION

- Food Production & Productivity
- Nutritional Inputs - Biological Vs. Conventional
- Seed Care – An Emerging Opportunity for Bio-Controls
- Food Security Challenges & Suggestions



AGRICULTURE BUZZWORDS THIS DECADE



BIO-CONTROLS

CARBON SEQUESTRATION

CARBON FOOTPRINT

CLIMATE CHANGE

BIO-FERTILISERS

I N M

WATER SECURITY

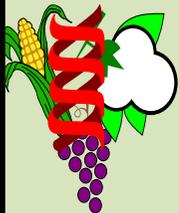
GM CROPS

SEED CARE

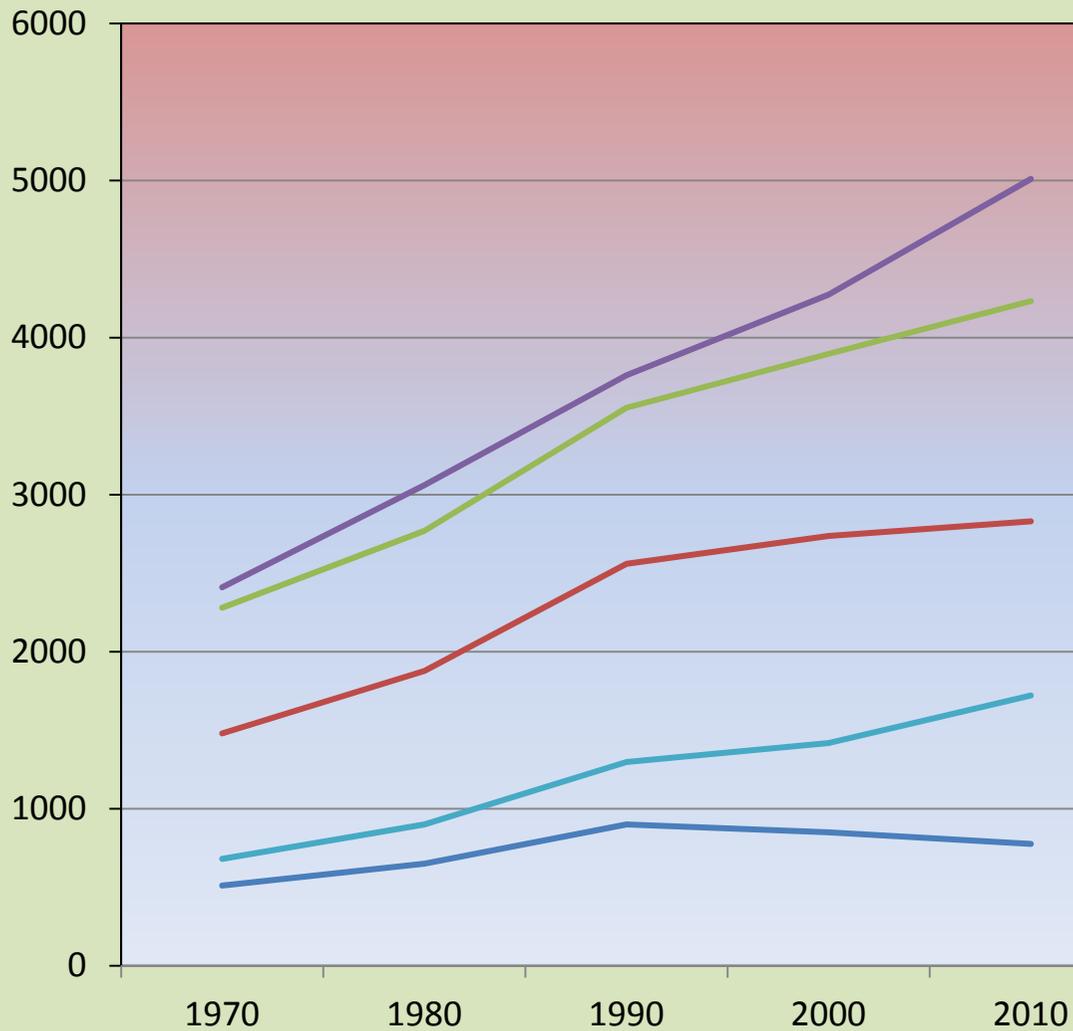
BIO-FUELS

FOOD SECURITY

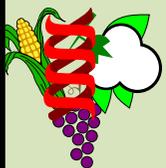
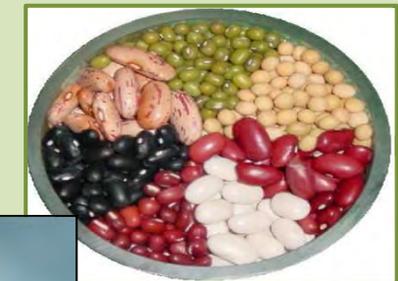
SOIL HEALTH



World Average Yields of Major Crops – Cereals, Pulses, Oilseeds



- World Avg. Pulses
- World Avg. Wheat
- World Avg. Paddy
- World Avg. Maize
- World Avg. 9 Oilseeds



The Challenge for Agro-Inputs Industry - 2030

Change in Consumption Patterns/ Diets in Developing Countries – (FAO estimate)

- Rice will Decrease
- Wheat will Increase
- Coarse Cereals No Change
- Pulses No Change
- Sugar will Increase
- Fruits will Increase
- Oilseeds/ Vegetable Oils will Increase Geometrically
- Meat will Increase Geometrically
- Dairy will Increase Geometrically

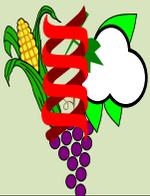
FAO estimates that in order for South Asia to avoid a Food Crisis:

Wheat Yields will have to increase by 28%

Rice Yields will have to increase by 23%

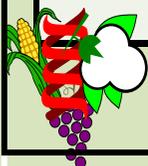
Pulses Yields will have to increase by 52%

Oilseeds Yields will have to increase by 48%



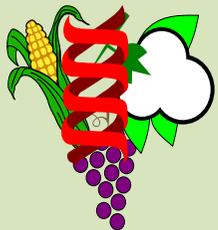
Comparing Chemical and Biological Fertilisers

CHEMICAL FERTILISERS	BIO-FERTILISERS
Definition: "Any of a large number of natural and synthetic materials, including manure and nitrogen, phosphorus, and potassium compounds, spread on or worked into soil to increase its capacity to support plant growth."	Definition: "Some microbes like Bacteria, Fungi and Algae are capable of Fixing Atmospheric Nitrogen, Solubilising Insoluble Soil Phosphates, or Mobilising Potash, making them available to plant roots. Materials carrying these microbes are Biofertilisers."
Only 30-40% of the applied Nitrogenous Fertiliser is available to the plant the balance is lost in the air after application.	Nitrogen Fixing Bio-Fertilisers can provide the plants with upto 50% of Nitrogen needed from the air itself.
Only 20-25% of the applied Phosphatic Fertiliser is available to the plant the balance is locked in the soil after application.	Phosphate Solubilising Bio-Fertilisers can increase the availability of Phosphorus by releasing upto 15% of the Phosphorus locked in the soil.
Only 15-25% of the applied Potash Fertiliser is available to the plant the balance is locked in the soil after application.	Potassium Mobilising Bio-Fertilisers can increase the availability of Potassium by releasing upto 20% of the Potassium locked in the soil.



BRIEF SUMMARY OF NUTRIENT ECONOMICS OF BIOFERTILISERS vs. CHEMICAL FERTILISERS

Quantity of Biofertiliser	Saving through Chemical Nutrients
1 Ton of Rhizobium inoculants	100 Tons of Nitrogen (min fixation 50 Kg N/ha)
1 Ton Azotobacter/ Azospirillum	40 Tons of Nitrogen (min fixation 50Kg N/ha)
1 Ton of Phosphate Solubiliser	24Tons of Phosphorous (min solubilisation 40Kg P/ha)
1 Ton of Potash Mobilisers	5 Tons of Potash (min mobilisation 25 to 35Kg K/ha)



WHY IS NITROGEN FIXATION NECESSARY ?

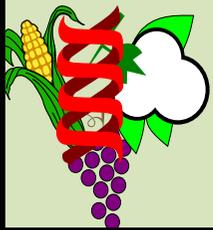
Nitrogen is an important macro-nutrient for the plant responsible for Vegetative growth. Of the Applied Nitrogen only 25% is utilised by plants. The balance 75% is lost to the atmosphere and leached out.

FIXATION:

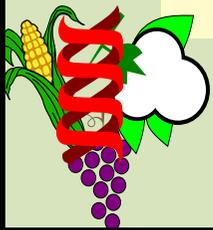
The chemical reaction by which the Atmospheric Nitrogen gets converted to Ammonia.

NITRIFICATION:

Conversion of Ammonia to Nitrates, which is then absorbed by Plant Roots



NITROGEN FIXATION GRAPHIC MODEL



WHY ARE PHOSPHATE SOLUBILISERS NECESSARY?

Phosphorous is an important macro-nutrient for the plant responsible for flowering and fruiting. Of the applied Phosphorous only 20% is utilised by plants.

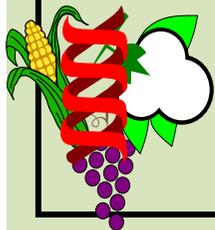
REVERSION:

The chemical reaction by which the applied phosphate gets fixed, which involves:

Fixation or Adsorption of applied 'P' onto active sites of oxides of Iron, Aluminum and Calcium forming stable compounds which are insoluble in water.

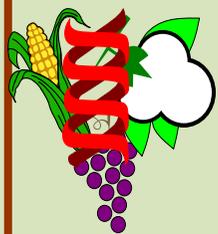
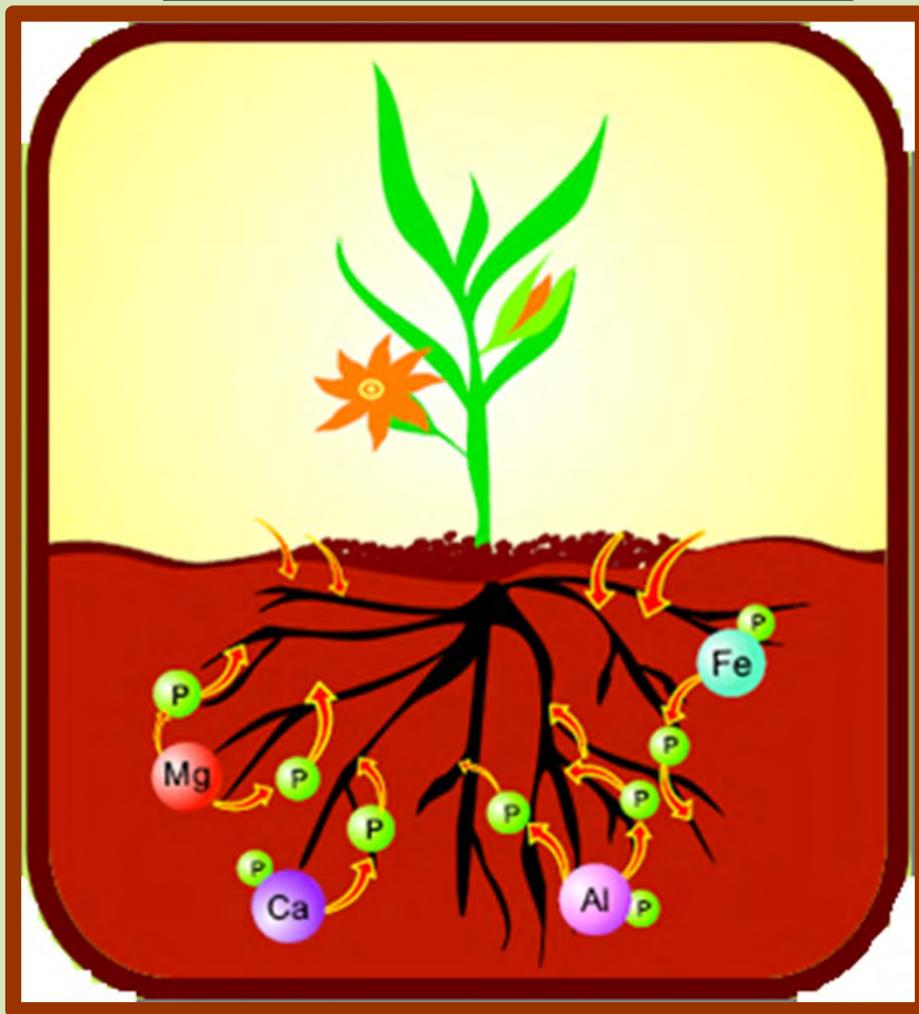
MODE OF ACTION:

PSB PRODUCES MILD ORGANIC ACIDS LIKE (TARTARIC, MALIC, FUMERIC, etc.) AND ENZYMES, WHICH HELPS IN SOLUBILISING PHOSPHOROUS, THIS SOLUBILISED PHOSPHOROUS IS EASILY TAKEN UP BY THE PLANTS FOR THEIR GROWTH.



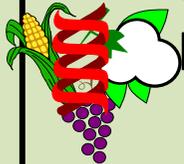
PHOSCO

(Phosphate Solubilising Bacteria)

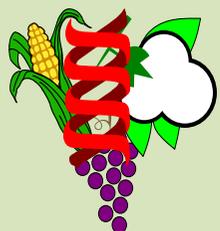
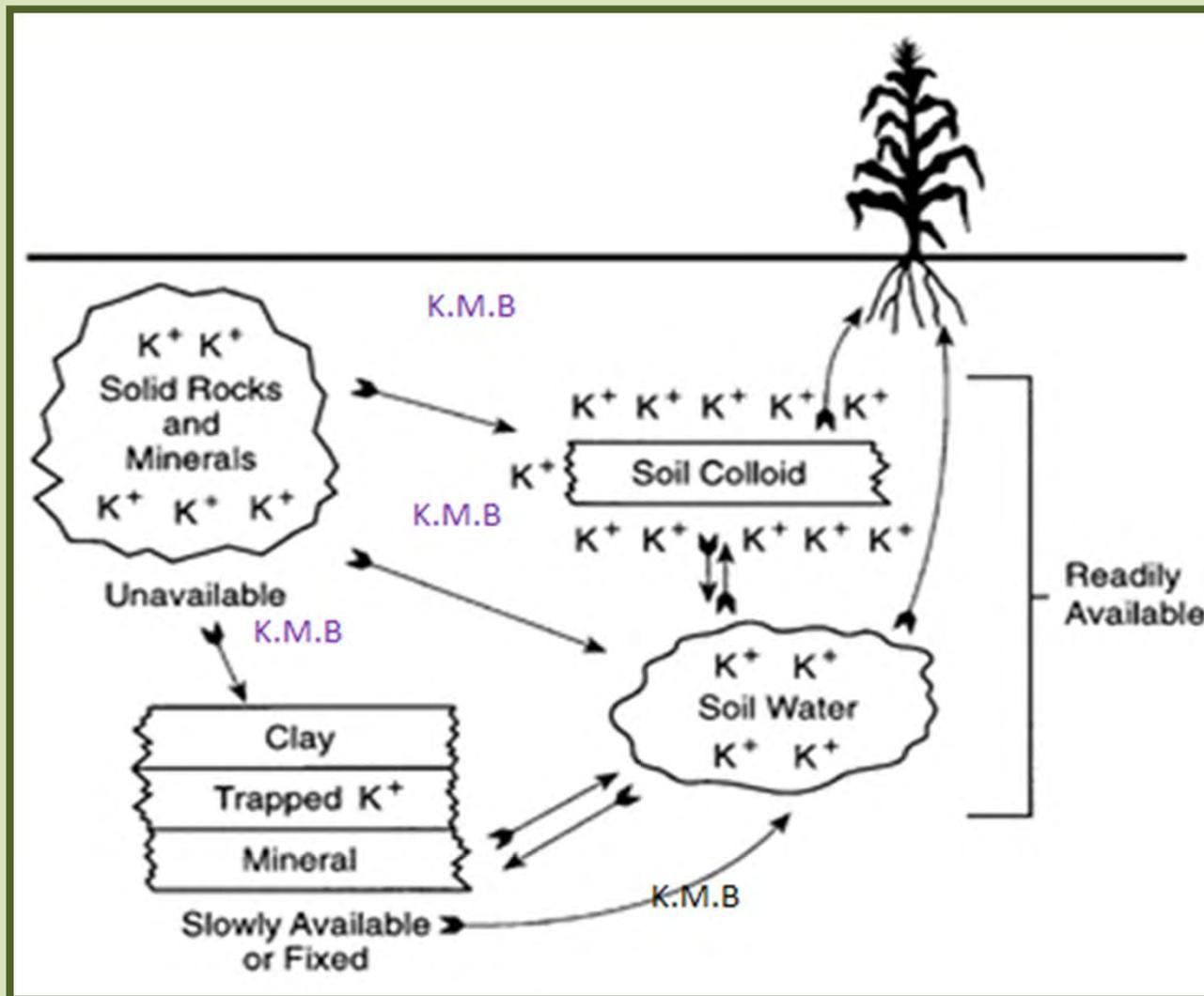


Forms of Soil Potash and role of Potash Mobilising Bacteria

- **Unavailable K** is found in Minerals like Feldspars and Micas, unusable by plants, but released into the soil by weathering, which is very slow to supply plant needs.
- **Slowly Available K** is found trapped between layers of clay minerals and is Fixed and can be released when the clays become wet, but again gets fixed when the clays become dry. There is a continuous exchange between slowly available and readily available, wherein the clays act as a reservoir for the readily available K.
- **Readily Available K** is what is water soluble and found adsorbed onto the surface of soil colloids. This form of K is always available to the plants and helps in the desired plant growth.
- **Mobilising Potassium in the Soil:** Mobilising Potassium in the soil can be achieved by some forms of micro-organisms, which are able to release the K trapped in between layers of clay by means of physical processes and enhancing cation exchange capacities.

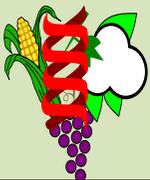


POTASSIUM MOBILISATION GRAPHIC MODEL



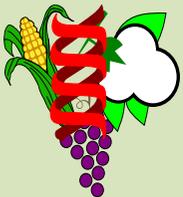
ADVANTAGES OF BIO-FERTILISERS OVER CHEMICAL FERTILISERS

- Aids Plant uptake of Macro Nutrients like Nitrogen, Phosphorus & Potassium.
- Increase the yield by 10-20% as compared to Chemical Fertilisers.
- Average Cost-Benefit Ratio for Cereals (Paddy/ Wheat) is 20.
- Economical to the farmer.
- Gives biological Nitrogen, Phosphorus and Potassium to the plant.
- Enhances Root Development, Vegetative Growth and Flowering, by release of auxins, vitamins & hormones.
- Improves soil health & productivity & survival of beneficial Soil microbes.
- Environmental friendly, Renewable source of Nutrients.
- Reduces Carbon Footprint.
- Major Earnings via Carbon Credits



Perception of Seeds – Then and Now

- *One for the rock, one for the crow,
One to die, and one to grow.*
- *English saying*
- *One for blackbird, one for the crow,
One for the cutworm, and one to grow.*
- *American saying*
- *I ask not for a larger garden,
but for finer seeds.*
- *Russell H. Conwell*



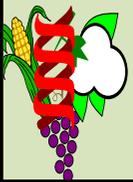
World Seed Treatment Scenario

Seed Treatment Market in 2001 = USD 900 Million.

Seed Treatment Market in 2010 = USD 2.8 Billion.

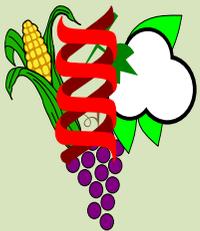
Trends:

- Crop Acreage is stagnating.
- High Seeding rate is being replaced by best available seed treatment.
- Seed Cost is increasing every year.
- GM Seeds every seed has a value.
- Cost-effective method – lesser a.i. per ha.
- Disease-Protection is most desired, followed by Insect- Protection.
- New Chemical/ Biological Products – Faster Development & Adoption.



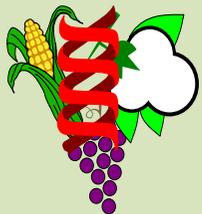
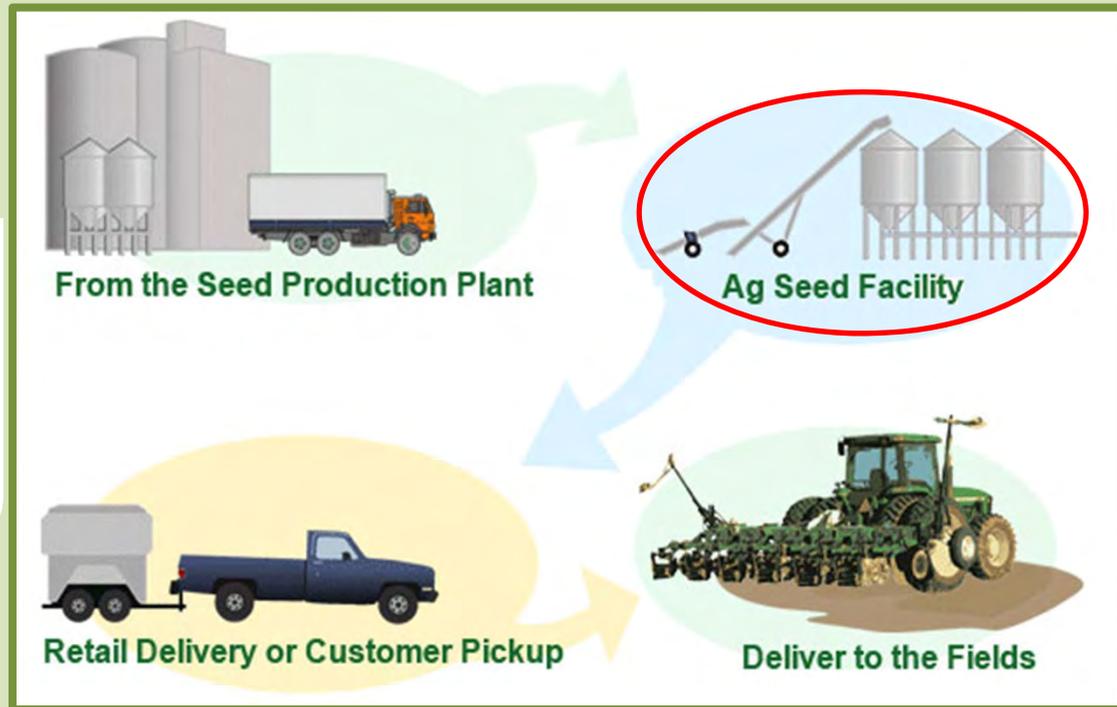
Seed Treatment Innovations :

- Most GM seeds in USA/ Canada have min 4 coats
 - 1) Disease Protection.
 - 2) Bio-Inoculums.
 - 3) Insect Protection.
 - 4) Micro-Nutrients.
- Polymer Coatings (Poly vinyls) being replaced by Renewables like Soybean/ Corn.



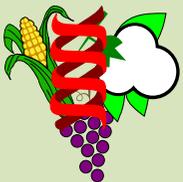
New Ag Service Industry – Seed Care

Dedicated Facilities- Low Dose of a.i.s, Highly Mechanized, Knowledge and Capital Intensive, Long Gestation Period,



Status of Seed treatment in India

- Presently, about 70% seed requirement is the farmer's own stock, sown without treatment.
- Only Commercial Hybrid Seeds are 100% Treated at Processing Plant level.
- Govt. estimates an average 80% of seeds sown in India are Un-treated compared to 100% seed treatment practice in developed countries.
- State seed agencies supply treatment chemical in a small pouch – All may not be using it ?
- Only 10-15% of Self pollinated crops seeds are treated.
- Seed treatment estimated to enhance productivity by 8-10%.



Indian Govt. Initiatives for Seed Care.

Kheti Ki Nai Takneek

An essential information for the benefits of the farmers



TREAT the SEED & SOW
let the healthy crop grow.

Paddy, Wheat & Chickpea
be pest free
making you wealthy.

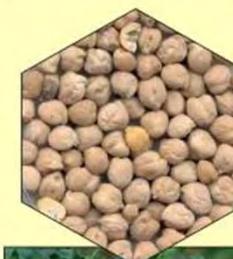
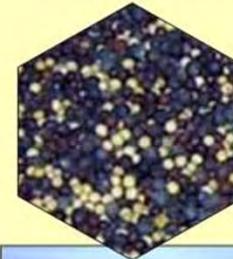
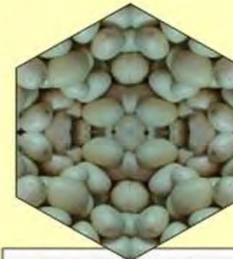


PROTECT every SEED
through
seed treatment

The way you protect
every child through
POLIO vaccination



Provide vaccination to Wheat, Mustard and Gram seed



Seed Treatment: Essential base for Healthy crop

Rabi crops like Wheat, Mustard, Gram, Pulses and Groundnut crops are attacked by different Seed and Soil borne diseases during different growth stages which reduces germination, heavy reduction in yield resulted in great losses to the crops and thus farmers profitability get reduced. Seed treatment is essential to overcome from these problems.



Treated Seed

Method of Seed Treatment:

Seed treatment should be done by seed treating drum. Weigh the seed and pour into the drum and after that recommended quantity of seed treating material should be sprayed on to the seeds and agitate the drum till all the seeds coated with chemicals.



Seed treating Drum



Ministry of Agriculture, Govt. of India, New Delhi

For more detail, Please contact:

Nearest Agricultural Center of state or Central Govt. / Regional Agriculture Center /
Office of Agriculture Department or farmer Call Center, Phone No.: 1551

www.agricoop.nic.in

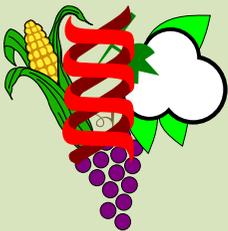
SEED CARE CHEMICAL CONTROL Vrs. BIOLOGICAL CONTROL

Crop	Disease	Conventional Control	Biological Control
Wheat	Loose Smut/ False Smut	Tebuconazole/ Carbendazim	Trichoderma
Barley	Loose Smut/ False Smut	Carboxin/ Thiram	Trichoderma/ Pseudomonas
Maize/Millet	Charcoal Rot/ Root Rot	Carbendazim/ Thiram	Trichoderma
Rice	Root Rot/Sheath Blight	Carbendazim/ Kitazin	Trichoderma/ Pseudomonas
Chillies	Damping-off/Wilt	Carbendazim/ Captan	Trichoderma/ Pseudomonas
Potato	Blight/	Mancozeb/ Carbendazim	Trichoderma
Tomato	Damping-off/Wilt	Carbendazim/ Captan/ Thiram	Trichoderma/ Pseudomonas
Onion	Purple Blotch	Mancozeb	Trichoderma/ Pseudomonas
Sunflower	Root Rot/ Seedling Rot	Carbendazim/ Captan/ Thiram	Trichoderma
Mustard	Stem Rot	Carbendazim	Trichoderma/ Pseudomonas
Soybean	Root Rot/ Seedling Rot	Carbendazim/ Thiram	Trichoderma
Cruciferous vegetables	Damping-off/Wilt	Carbendazim/ Captan	Trichoderma/ Pseudomonas
Chickpea	Wilt/ Damping off	Carbendazim/ Thiram	Trichoderma
Groundnut	Root Rot/ Collar Rot/ Aflatoxins	Carbendazim/Mancozeb/ Thiram	Trichoderma



How to: Suggestions

- India has 13.42 million Ha of Cultivable Waste Lands as of 2006-07.
- Improve Soil Health/ Productivity of these Lands – Use City Compost.
- Supplement use of Chemical Fertilizers with Biological Fertilizers.
- Provide Quality GM Seeds with Desirable Traits like Drought Tolerance, Disease Resistance, Nitrogen Fixation,
- World-class Seed Care using Bio-Controls.
- Use Bio-Technology to provide effective Low A.I. Dose Products.



Thank You

ECOSENSE



KETAN MEHTA

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