

An industry perspective on emerging agricultural technologies for productive agriculture, precision farming, precision nutrient deliveries, innovation and policy perspectives

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International Knowledge Sharing Workshop on Cross-border Innovation, Acceleration and Challenges in International Transfer of Technologies

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Our Businesses: Built around finding innovative solutions to Ag Challenges



SEED COMPANY (PVT) LIMITED
A subsidiary of Mahyco Limited

Seed business

- India
- Sub-Saharan Africa
- South-east Asia



Sevenstar Fruits
Horticulture genetics



Biologicals,
Digital Agri
Carbon farming

westrup



**Agri Processing &
Storage solutions**



Let's grow!

**Soybean &
Wheat Genetics**

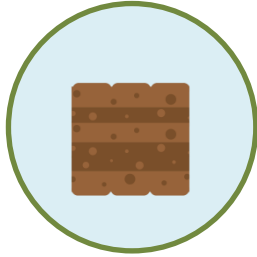


**Fytomax
Plant Proteins**

Ag practices of decades have resulted in significant environmental footprints



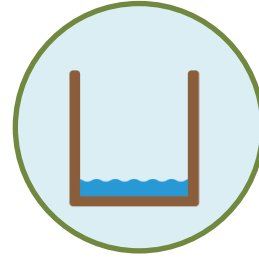
**WATER &
AIR POLLUTION**
due to chemicals



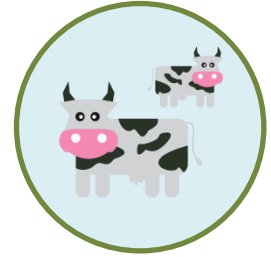
SOIL DEGRADATION
due to erosion
and salinity



DEFORESTATION
76%
So far due to agriculture



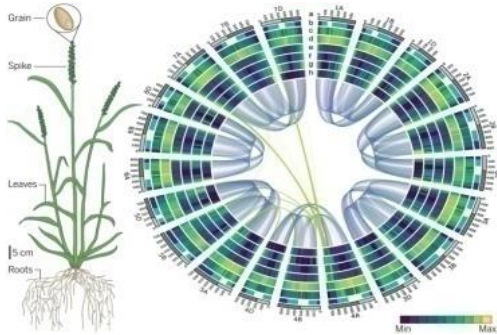
GROUND WATER DEPLETION
54%
of India's wells with
declining levels every year



METHANE EMISSION
due to livestock
farming

Opportunities for Innovation

Gene Editing : a revolutionary technology for Crop Improvement



SDN1 and SDN2 type genomic alterations can be used to improve various crop traits using **CRISPR-Cas**

- Precise, **Fast, Cheaper, Easy to use.**
- Knocking out genes by altering (short insertions or deletions) coding gene regions or regulatory elements
- Precisely alter the genome by base editing to delete or regulate gene expression
- Can insert or delete large strands of DNA including functional genes
- Can target multiple genes

Emerging Crop Breeding Technologies: Herbicide Tolerant Crops



Herbicide Tolerant Rice

- ~ 44 Mn Ha
- ~ 35 Mn farmers
- 200 trillion Ltrs saving
- Ground water recharged

(Source: PAU, Ludhiana study, CARJ, 2017)



Herbicide Tolerant Wheat

- ~29 Mn Ha
- ~10 Mn farmers
- Yield increase & cost reduction
- Ease of cultivation

Source: ir.arcadiabio.com



Herbicide Tolerant Soybean

- ~10 Mn Ha
- ~4.5 Mn Farmers
- Yield improvement
- Import minimisation

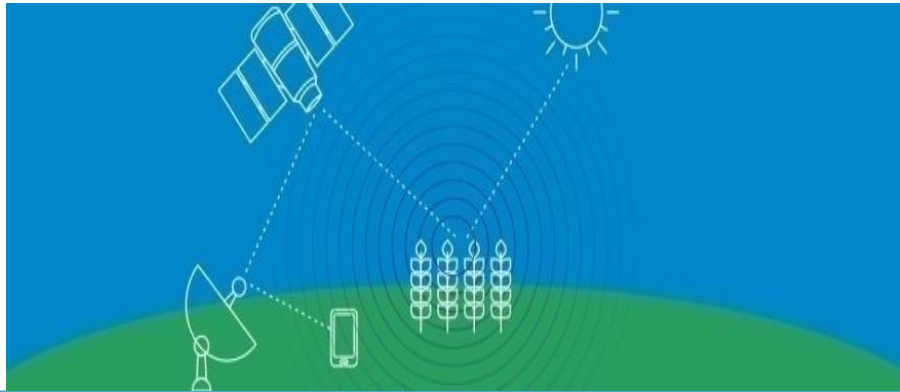
Source: ISAAA.ORG

+ Environmental Foot Print, Productivity Increase, Reduced Water & Air Pollution, + Farmers' Income by ~INR 20000 Crs and impact ~50 Million Farmers

Precision farming Technologies: Examples of Digital Tools

Remote Sensing applications

- Drought/ Heat Screen
- Pest and Disease Forecast, identification
- Moisture – Irrigation scheduling
- Soil variability – fertilizer application
- Organic matter, Soil Organic Carbon,
- Severity index -- spectral signatures



Other Digital technologies

- **Sensors** for Crop health & Soil health monitoring
- **AI** for quality standardization, Yield Est.
- **Robotics** for farm operations,
- **Drones** for Chemicals spraying , Crop monitoring, Land use& mapping



Precision Nutrient Delivery Innovation: Biological Fertilisers

- Nitrogen - most important plant nutrient
- Urea is the primary source of nitrogen for Agriculture
- Annual consumption in India : ~30 mmt
- Experimental data available show a potential of 50% replacement of chemical nitrogen by atmospheric nitrogen fixation through microbial applications

Potential Impact

50% ↓ in Soil degradation 50%; ↓ in N₂O (GHG) emission; ↓ in Ground water contamination; Annual saving of ~ Rs 32000 Cr

PLANT SCIENCE

Soybean photosynthesis and crop yield are improved by accelerating recovery from photoprotection

Amanda P. De Souza¹, Steven J. Burgess^{1,2}, Lynn Doran¹, Jeffrey Hansen¹, Lusya Manukyan¹, Nina Maryn³, Dhananjay Gotarkar², Lauriebeth Leonelli^{1,4}, Krishna K. Niyogi^{3,5}, Stephen P. Long^{1,6*}

Crop leaves in full sunlight dissipate damaging excess absorbed light energy as heat. This protective dissipation continues after the leaf transitions to shade, reducing crop photosynthesis. A bioengineered acceleration of this adjustment increased photosynthetic efficiency and biomass in tobacco in the field. But could that also translate to increased yield in a food crop? Here we bioengineered the same change into soybean. In replicated field trials, photosynthetic efficiency in fluctuating light was higher and seed yield in five independent transformation events increased by up to 33%. Despite increased seed quantity, seed protein and oil content were unaltered. This validates increasing photosynthetic efficiency as a much needed strategy toward sustainably increasing crop yield in support of future global food security.

Encouraging Technologies in Agriculture: An Enabling Policy Environment

Protection of IP Rights

- Transformative Technologies being resource and time intensive with high risk, critical to provide adequate protection for IP rights

Enabling Regulatory system

- Science based and predictable regulatory environment will help to inspire confidence in the investors & Innovators

Market based pricing approach

- Market based pricing helps to ensure fair competition unlike Administered pricing which would distort the market

Unified approach

- Need for alignment of approaches between Center and States, and between Policy makers with different ideologies

Communication

- Investment in education of general public through adequate communication needed for inspiring confidence & trust in innovations



Thank You

New apple rootstocks –a game changer

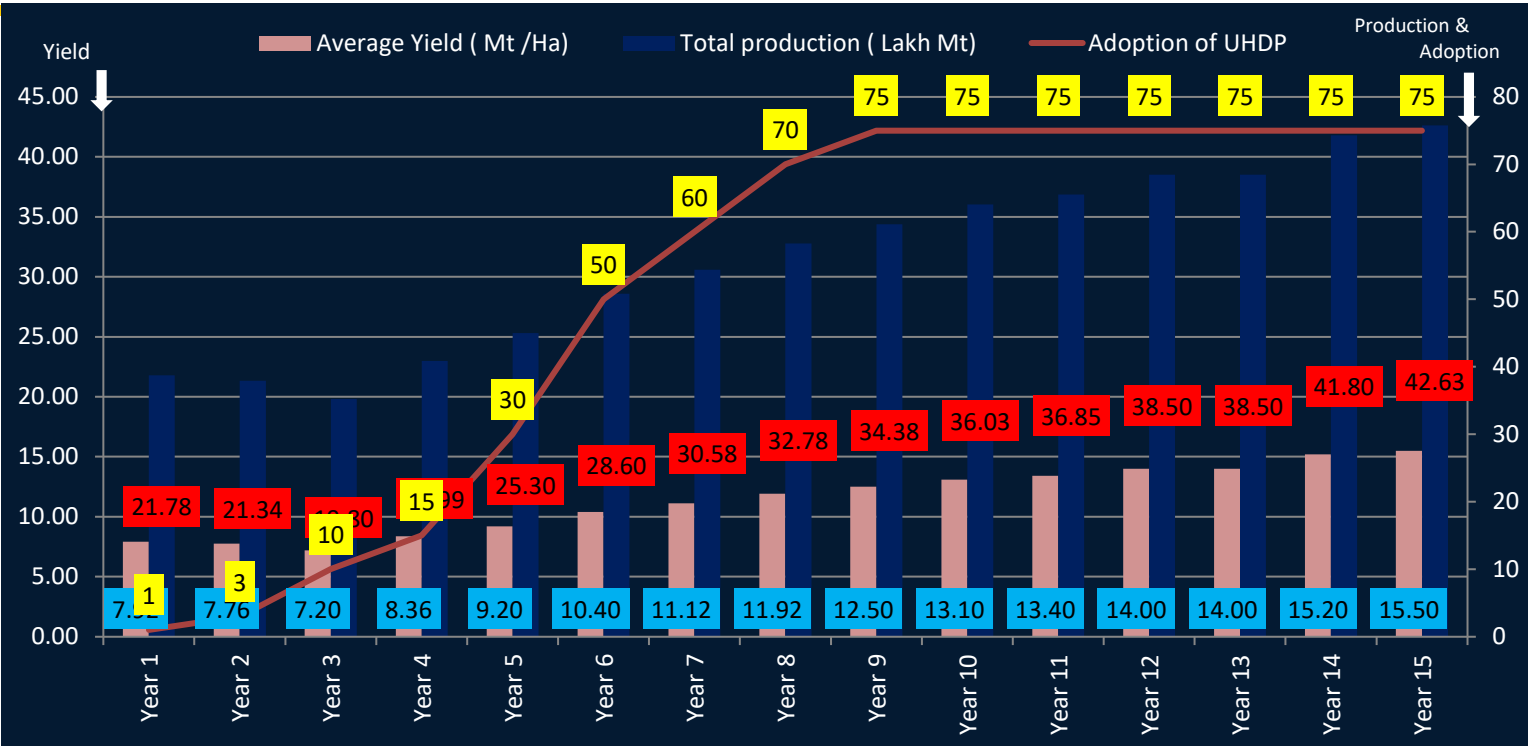


High Density apple orchards in USA with productivity 39.6 Tonnes / Ha



Typical Orchard in HP, India; Average India Yield 7.4 Tonnes / Ha at maturity (Picture Prof. Win Cowgill)

High Density planting of Apple



Dwarfing root stock; Pruning of orchards; regulating growth

More Plants; Efficient utilization of sunlight; Higher yield

**Additional Income of ~ Rs 12000 Cr
~2 lac farmers**

2X Yield ↑

2X Production ↑

**Import substitution
Rs 14000 Crs**