

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

Rajendra Barwale

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

14<sup>th</sup> Nov. 2022, New Delhi

# 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**

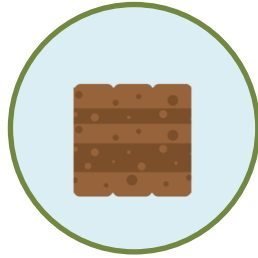


**Fytomax  
Plant Proteins**

# Ag practices of decades have resulted in significant environmental footprints



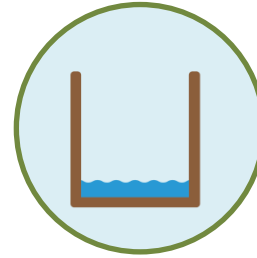
**WATER &  
AIR POLLUTION**  
due to chemicals



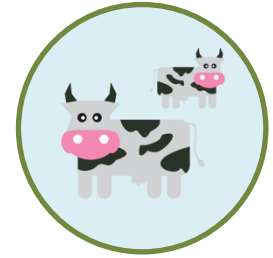
**SOIL DEGRADATION**  
due to erosion  
and salinity



**DEFORESTATION**  
**76%**  
So far due to agriculture



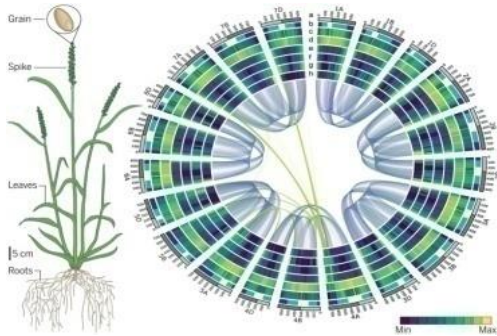
**GROUND WATER DEPLETION**  
**54%**  
of India's wells with  
declining levels every year



**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](http://ir.arcadiabio.com)



## Herbicide Tolerant Soybean

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

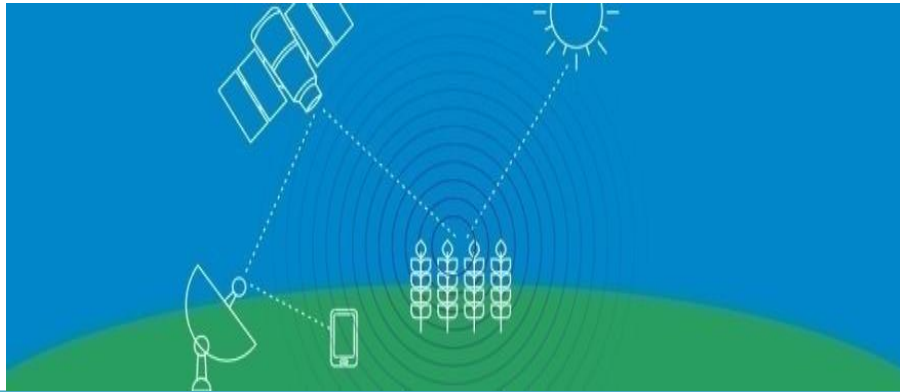
Source: ISAAA.ORG

**+ 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 N<sub>2</sub>O ( 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 Souza<sup>1</sup>, Steven J. Burgess<sup>1,2</sup>, Lynn Doran<sup>1</sup>, Jeffrey Hansen<sup>1</sup>, Lusya Manukyan<sup>1</sup>, Nina Maryn<sup>3</sup>, Dhananjay Gotarkar<sup>2</sup>, Lauriebeth Leonelli<sup>1,4</sup>, Krishna K. Niyogi<sup>3,5</sup>, Stephen P. Long<sup>1,6\*</sup>

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

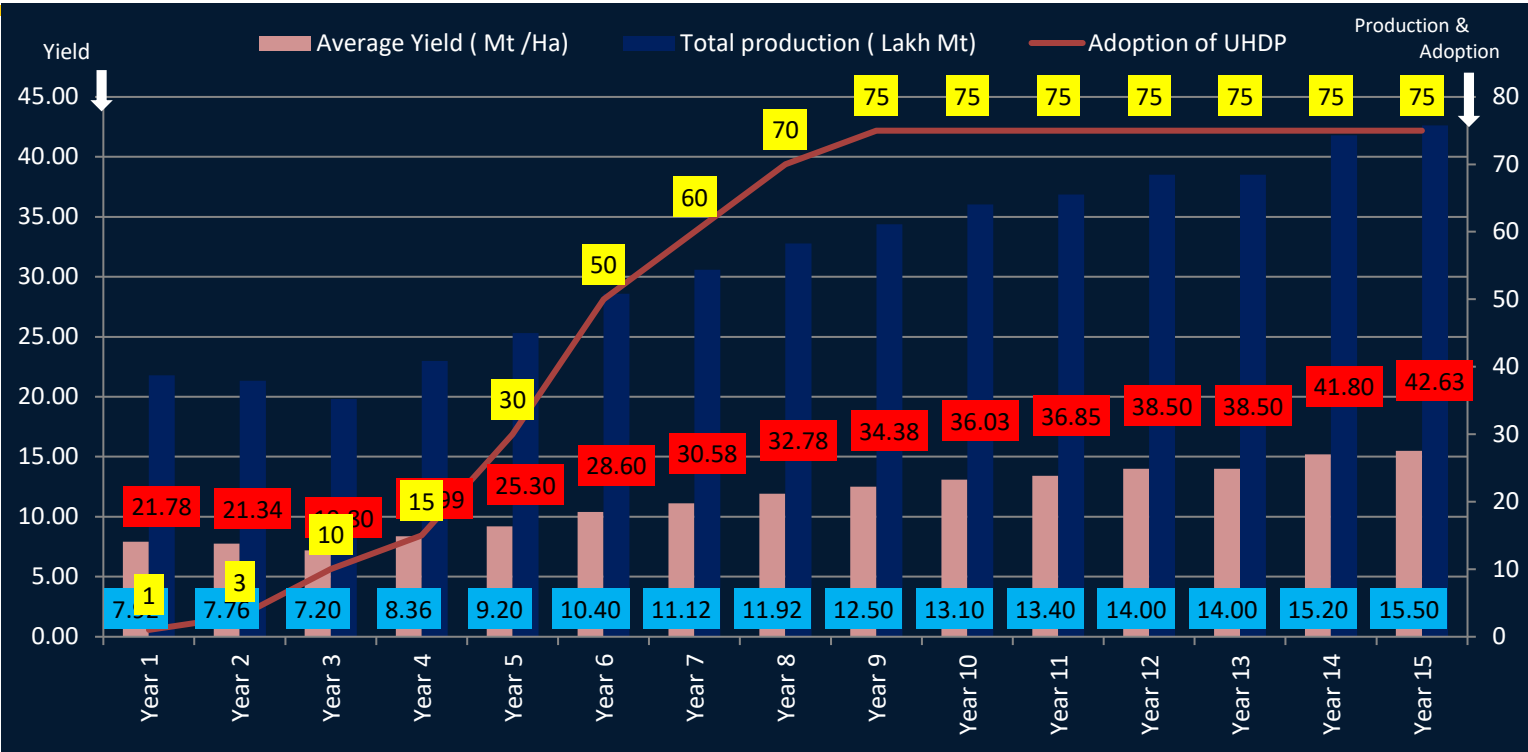


**High Density apple orchards in USA with productivity 39.6 Tonnes / Ha**



**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**