

An International Dialogue on Agricultural and Rural Development in the 21st Century

Lessons from the Past and Policies for the Future

Beijing, 9 September 2005

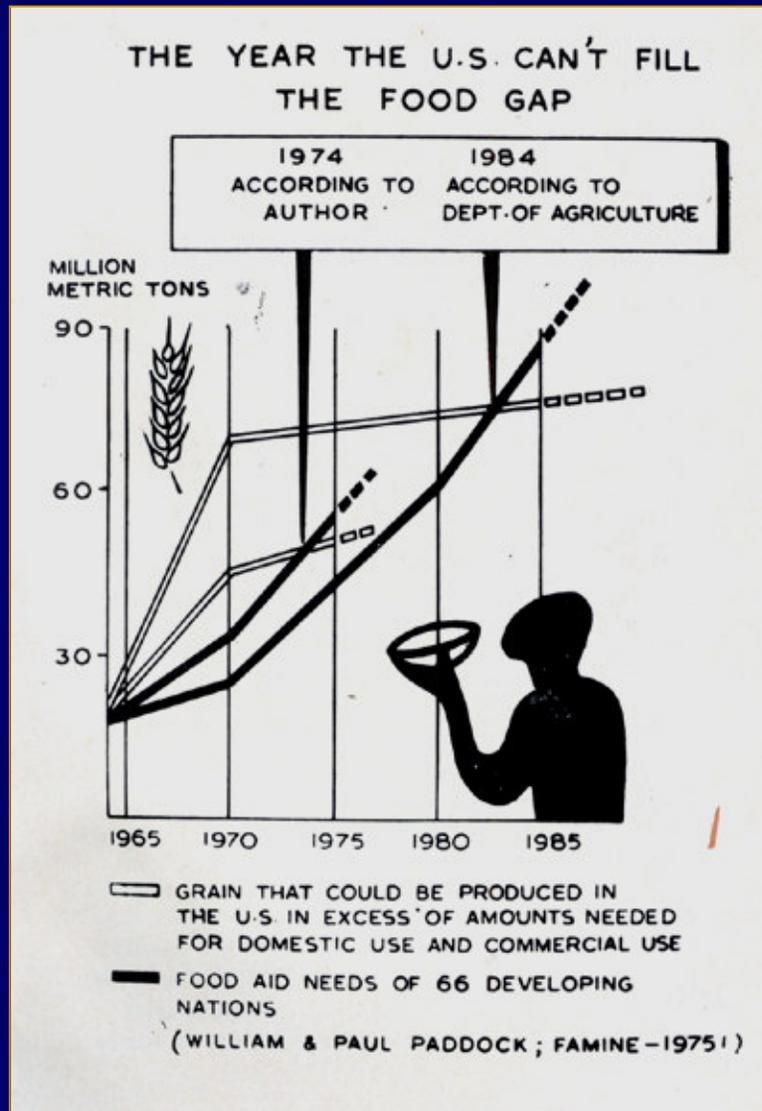
An Ever-green Revolution

M.S. Swaminathan, FRS

President, National Academy of Agricultural Sciences and
Chairman, National Commission on Farmers, GOI



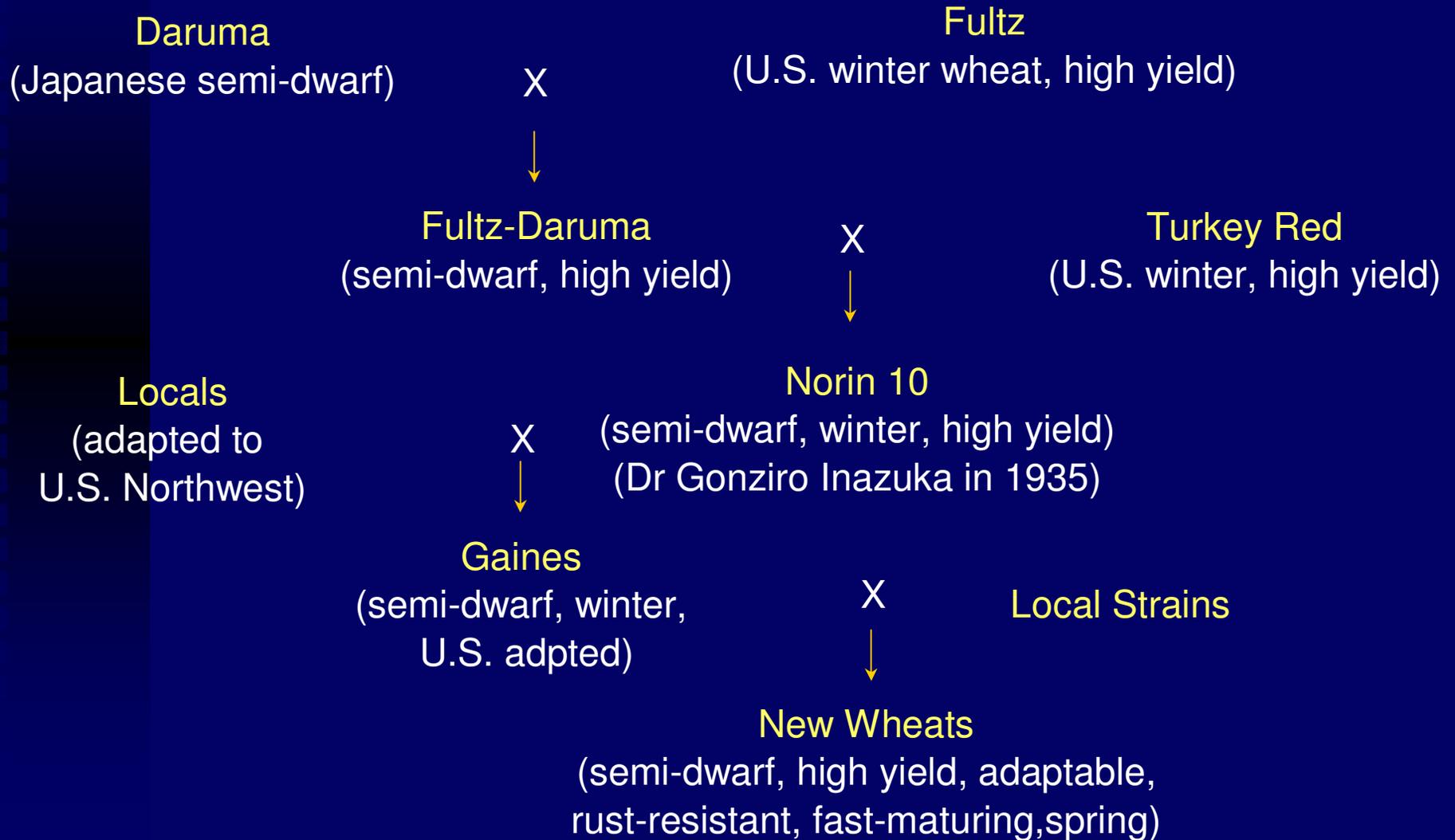
Inevitability of Famines



Neo-Malthusians like Lester Brown have again warned of impending famines



Era of Sharing of Genetic Resources



Science and Agricultural Progress

1968 – The Beginning of Green Revolution



Synergy between Technology and Public Policy



Green Revolution in Rice – Result of the Discovery of Genes for Dwarfing by Chinese Scientists



The Green Revolution in the Nineteen Sixties in Wheat, Rice and Maize: a message of hope on striking a balance between the rates of growth in population and food production.



China : Home of Hybrid Rice



Integrating Best of Technology

Functional genomics

Microarray

Proteomics

Gene
discovery

QTL/physical mapping

Map-based cloning/
cDNA cloning

Genetic
Engineering
Transgenics

Marker Aided
Selection

Cultivar Selection

Crop Improvement

Mendelian breeding

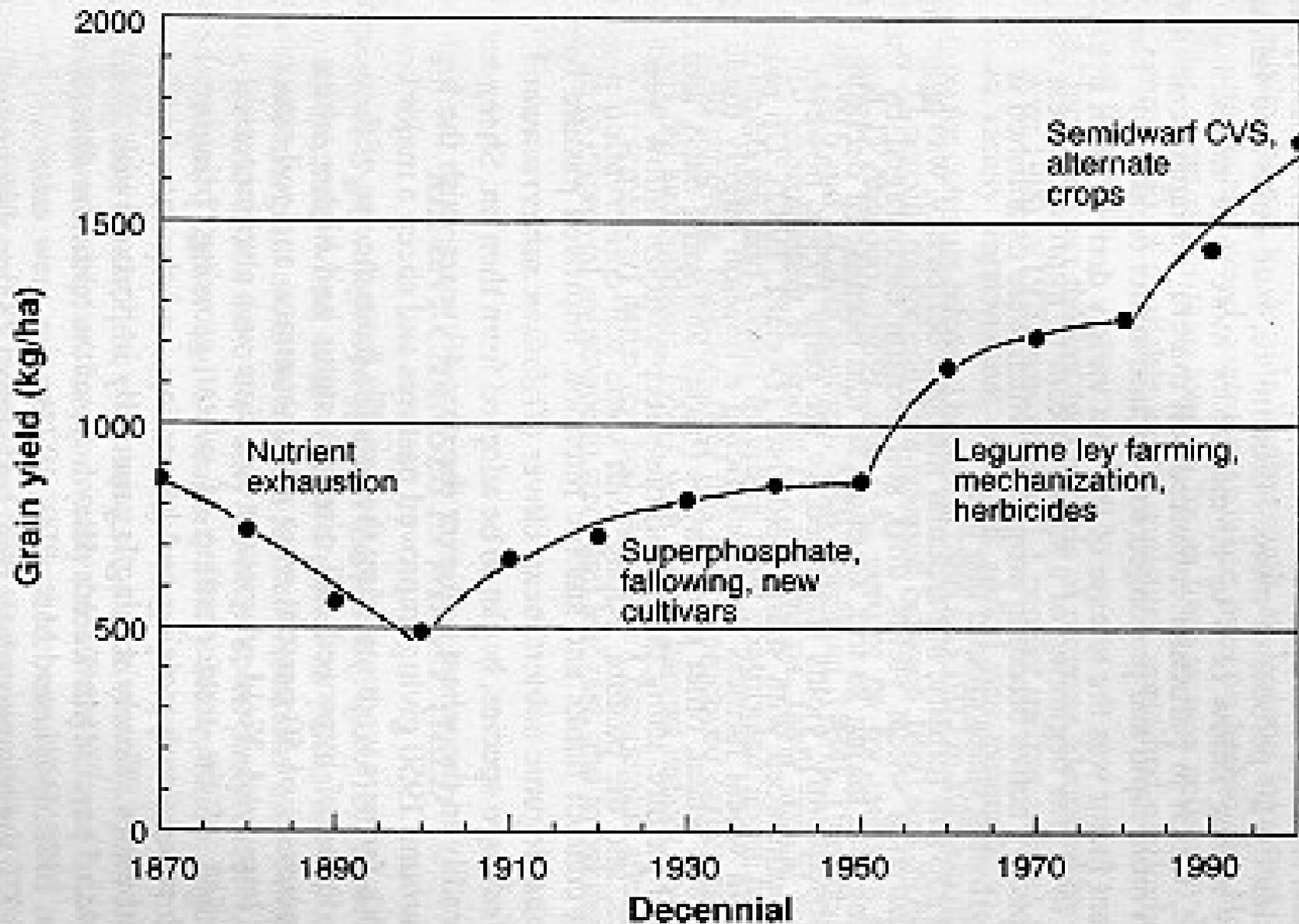
Cultivars with good
combining ability

Crossing

Phenotyping
and selection



Variation in Australian Average Wheat Yield (Ten-Year Mean) from 1860 to 2000



Source: Donald, 1982. Yield plotted at the end of the decennial; yield for 1997-2000 assumed to average 1.71 t/ha.

Sustainable Food Production

“Intensive cultivation of land without conservation of soil fertility and soil structure would lead ultimately to the springing up of deserts. Irrigation without arrangements for drainage would result in soils getting alkaline or saline. Indiscriminate use of pesticides, fungicides and herbicides could cause adverse changes in biological balance as well as lead to an increase in the incidence of cancer and other diseases, through the toxic residues present in the grains or other edible parts. Unscientific tapping of underground water would lead to the rapid exhaustion of this wonderful capital resource left to us through ages of natural farming. The rapid replacement of numerous locally adapted varieties with one or two high yielding strains in large contiguous areas would result in the spread of serious diseases capable of wiping out entire crops, as happened prior to the Irish potato famine of 1845 and the Bengal rice famine of 1942. Therefore, the initiation of exploitative agriculture without a proper understanding of the various consequences of every one of the changes introduced into traditional agriculture and without first building up a proper scientific and training base to sustain it, may only lead us into an era of agricultural disaster in the long run, rather than to an era of agricultural prosperity.”

M.S. Swaminathan

MSSRF



Paradigm Shift : Adding the Dimension of Environmental sustainability



Concept of Ever-green Revolution

What nations with small farms and resource poor farmers need is the **enhancement of productivity in perpetuity**, without associated ecological or social harm. The green revolution should become an ever-green revolution rooted in the principles of ecology, economics and social and gender equity.

- M S Swaminathan, 1990



Ever-green Revolution

“The problem before us is how to feed billions of new mouths over the next several decades and save the rest of life at the same time, without being trapped in a Faustian bargain that threatens freedom from security. The benefits must come from **an evergreen revolution**. The aim of this new thrust is to lift food production well above the level attained by the green revolution of the 1960s, using technology and regulatory policy more advanced and even safer than now in existence”

- Edward O. Wilson, 2002

The Future of life



Nobel Prize in Physiology - 1948



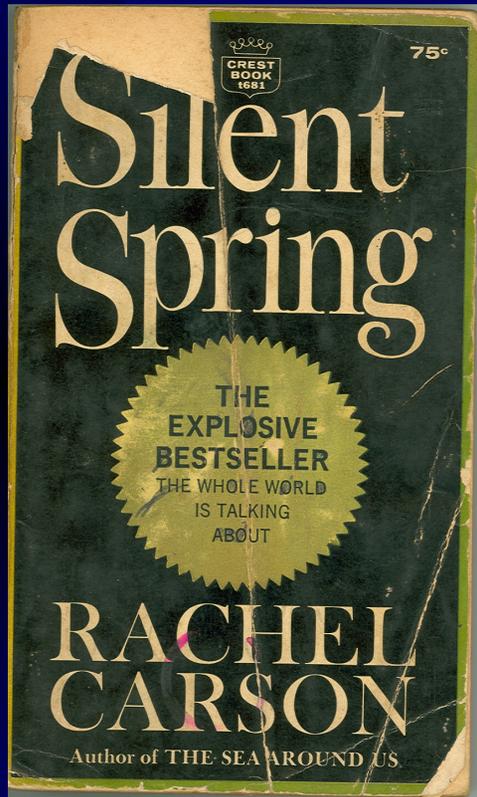
For his discovery of the high efficiency of DDT as a contact poison against several arthropods
Immediate Impact : Control of Malaria

Paul Hermann Muller (1899-1965)



Environment and Development : Early Warning

Rachel Carson 1962 : Silent Spring



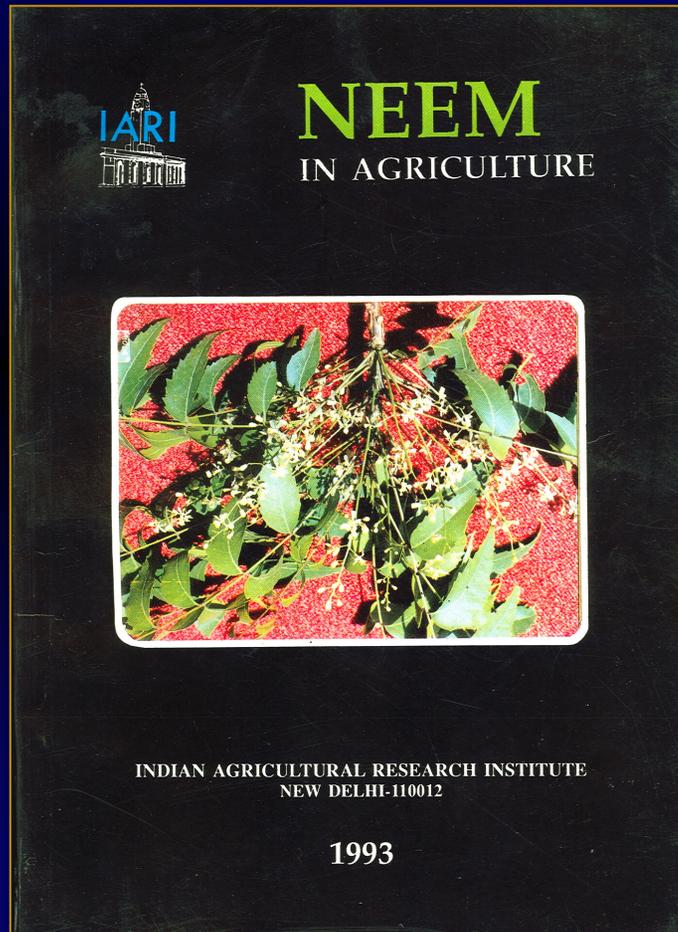
“Man has lost the capacity to foresee and to forestall. He will end by destroying the earth”

- Albert Schweitzer

Origin of Integrated Pest Management Methodologies



Neem in Agriculture



- Integrated Pest Management
- Integrated Nutrient Supply



An Earth Saving Revolution

*A means to resolve
our world's problems
through Effective Microorganisms (EM)*

Teruo Higa

Translated by Anja Kanal

英語版●地球を救う大変革

Sunmark Publishing Inc.

Microbial Fertilizers and Pesticides

Pesticide Market

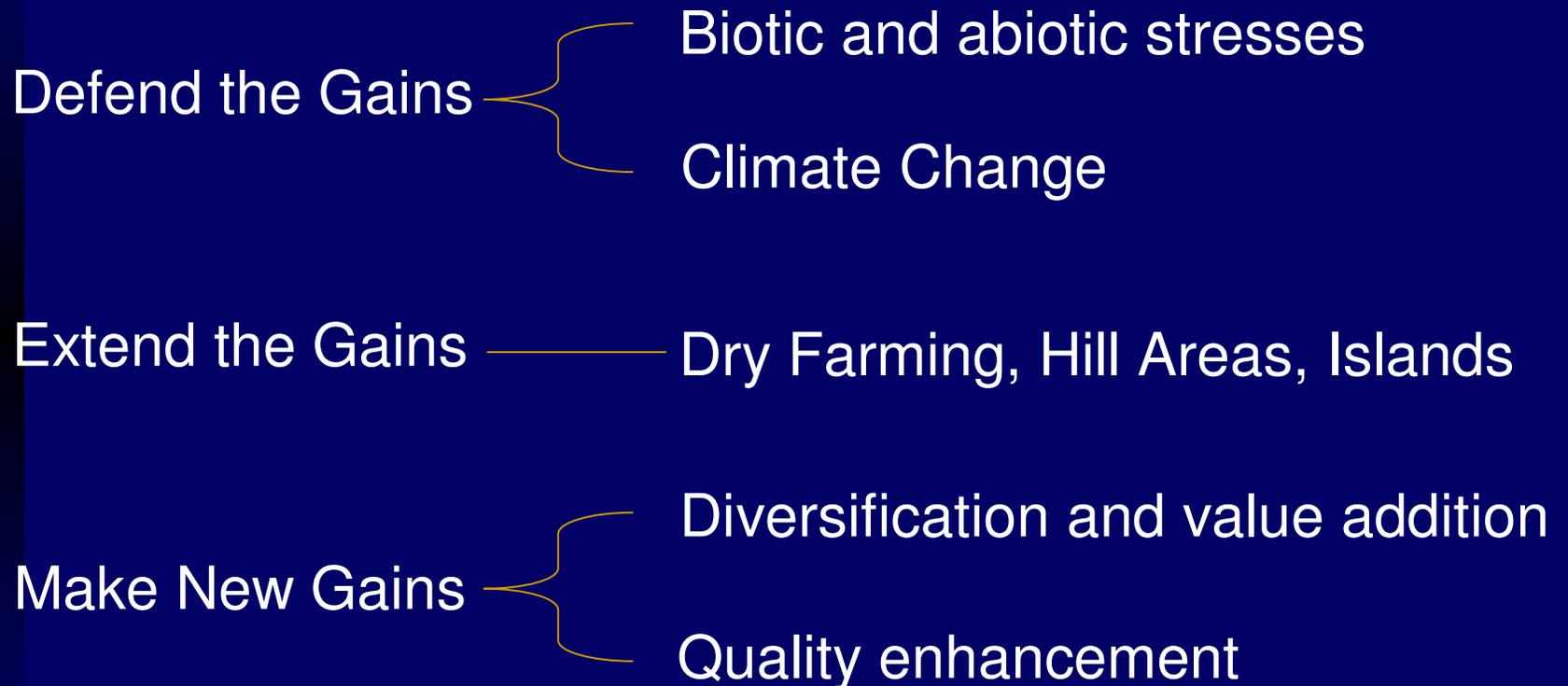
Western Europe : 26.7%

South/South East Asia : 26.7%

North America : 21.9%



Challenges



Biotechnology and Organic Agriculture

1) Soil Health

- Vermiculture
- Bio-fertilisers
- Stem nodulating green manure crops

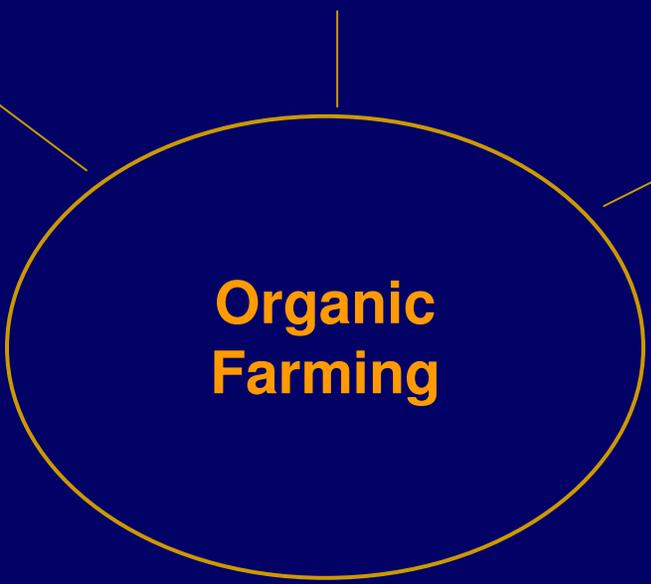
2) Water Quality

- Bioremediation

3) Plant Health

- Genetic Resistance
- Biopesticides

Organic Farming



4) Post-harvest Technology

- New strains with improved keeping, processing and transport qualities

6) Environment

- Biomonitoring through Bio-indicators
- Higher Carbon Sequestration

5) Animal Health

- Vaccines
- High quality feeds and fodder

Sea Level Rise: Bio-shield

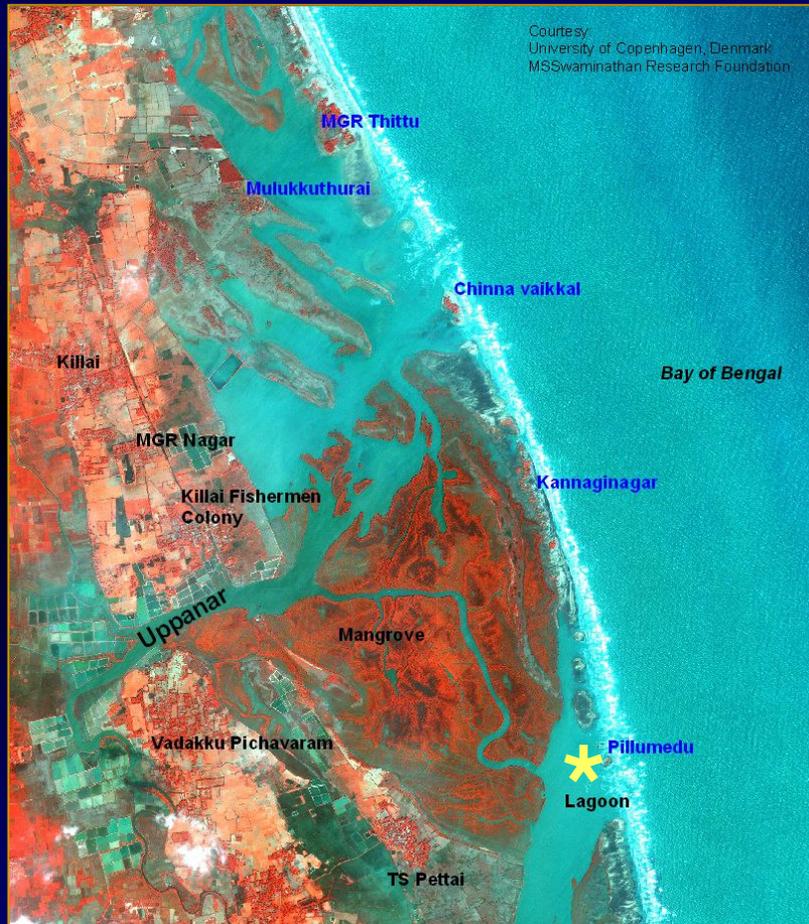


Mangroves



Pichavaram Mangrove Forest, Tamil Nadu

High Resolution Remote Sensing Data (4 m. multispectral IKONOS data of Space Imaging, USA) 29 December 2004



- Villages named in blue colour were affected by Tsunami.
- Villages named in black did not suffer because of the protection provided by mangrove forests
- * Shows the opening of Lagoon

Bio-shield and Tsunami



Genetic Shield



LIMITED FIELD TRIAL

**TRANSGENIC RICE PLANTS WITH
A GENE FROM MANGROVE SPECIES**

*With approval of the RCGM
Govt. of India
vide permit number BT/BS/17/20/2000-PID
December 2003*



**IGCAR CAMPUS
KALPAKKAM**

MSSRF



Genetic Shield



Prosopis juliflora has wide adaptation to water stress and drought conditions

Used as source material for drought tolerant genes



Control

36 days of water withdrawal

Preparing for adverse changes in precipitation



Participatory Genotype Development

Combining Genetic Diversity and Genetic Efficiency



Pre-breeding

(Generation of novel genetic combinations for use by grass root plant breeders)

Participatory Breeding

(Farm family – Plant breeder Collaboration)

De-mystify Technologies



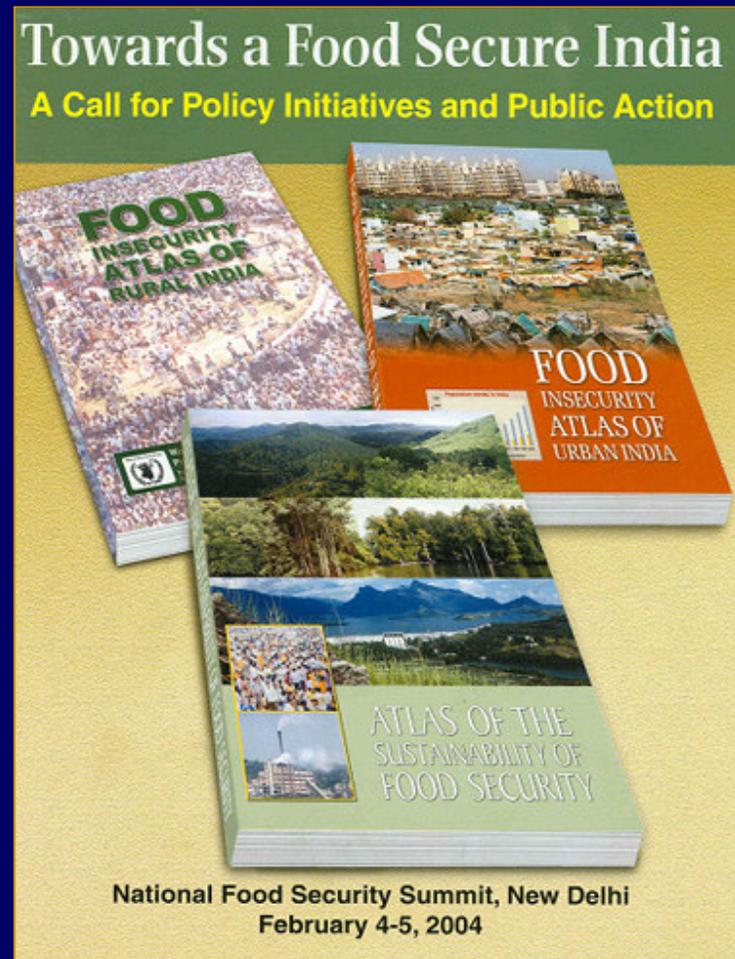
MSSRF / WFP : Food Insecurity Atlas

Hunger

Chronic

Hidden

Transient



Food Security

Availability

Access

Absorption

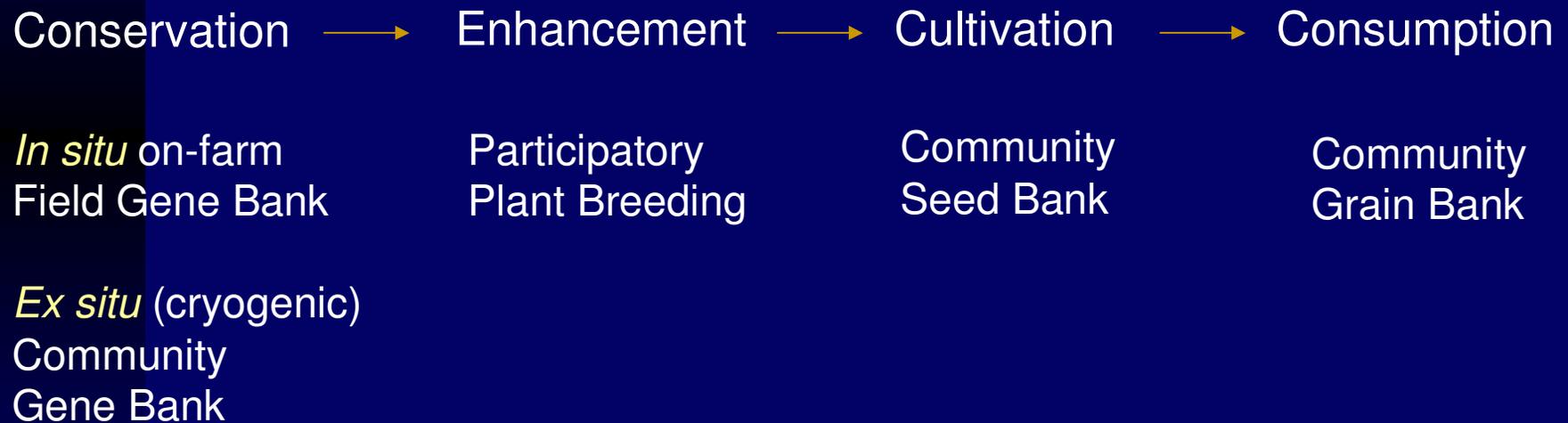
Awareness – Analysis - Action

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Agrobiodiversity and Sustainable Nutrition and Health Security

MSSRF Pathway



The Way Ahead

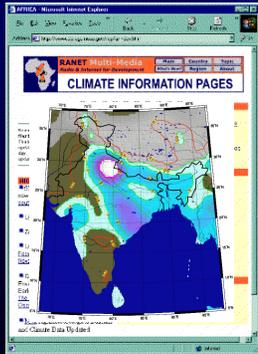
Our ability to achieve a paradigm shift from green to an ever-green revolution and our ability to face the challenges of global warming and sea level rise will depend upon our ability to harmonise organic farming and the new genetics.



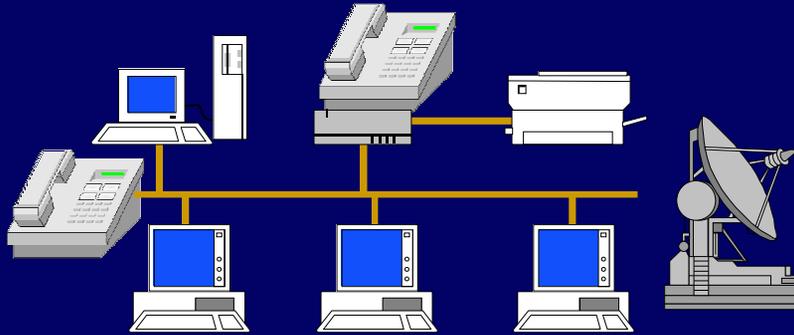
Jamsetji Tata National Virtual Academy for Rural Prosperity [NVA]

ICT-enabled knowledge flow

Lab to Lab, Lab to Land, Land to Lab, Land to Land

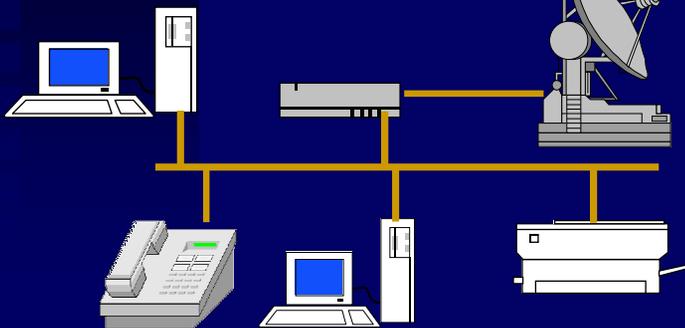


Web based
interactive
portal

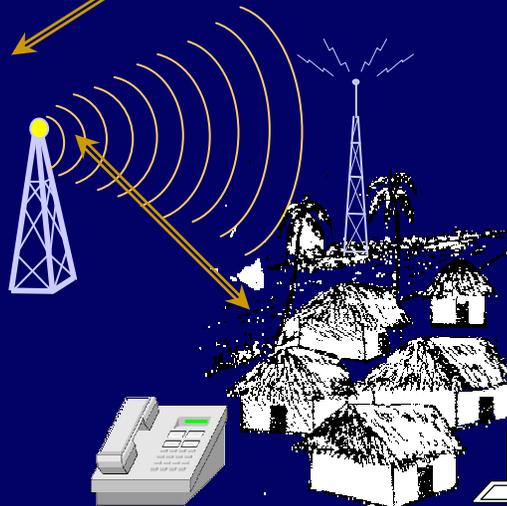


State Level Hub (MSSRF)

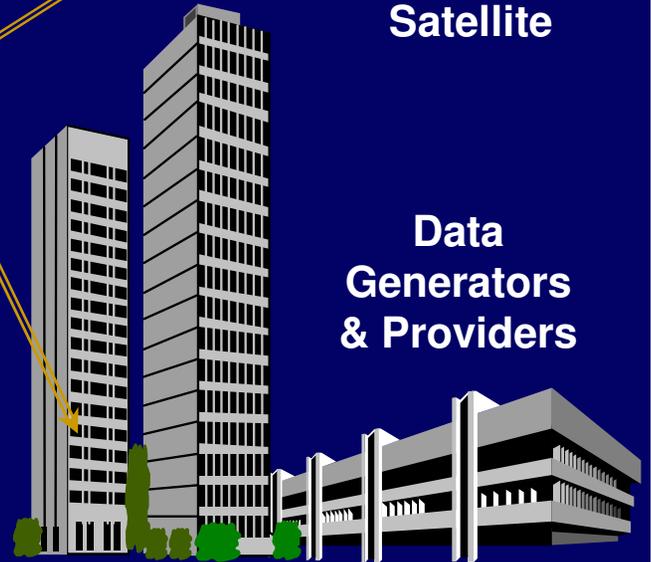
Data Managers (both connectivity and content)



Block level hub



Data Users (Rural families)



Data
Generators
& Providers



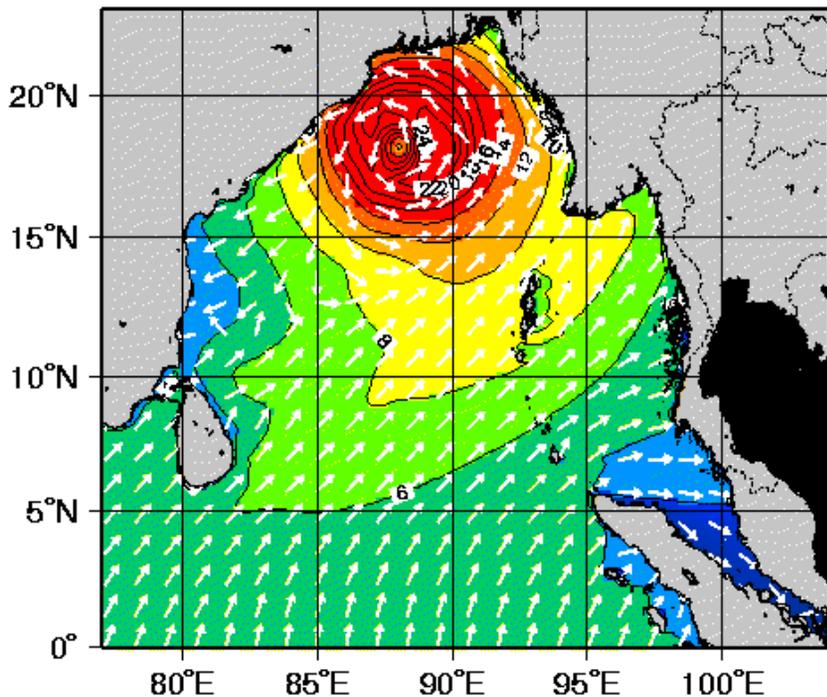
Uplink
Satellite

MSSRF

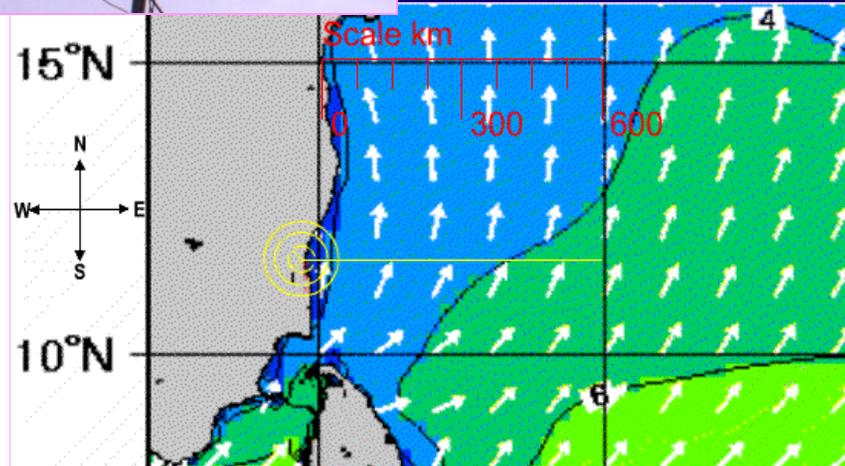


UNCLASSIFIED

Significant Wave Height in feet 36 HR FCST Valid: 29OCT99 00
Predominant Wave Direction Vector 36 HR FCST Valid: 29OCT99
Ocean areas colored black are not modeled and contain no useful information



WAVE MODEL (WAM)
NAVAL OCEANOGRAPHIC OFFICE
Approved for public release. Distribution is unlimited



WAVE HEIGHT
0-2 feet upto about 10 km or so from the shore
2-4 feet between 10 km and 375 km
4-6 feet after that

<http://www.nemoc.navy.mil/Library/Metoc/Indian+Ocean/Bay+of+Bengal/Models/Swaps/Sig+Wav+Ht+and+Dir+Series/index.html>

Life saving role of VKC during Tsunami (26 December 2004)- VEERAMPATTINAM

MSSRF



Torch Bearers of the Rural Knowledge Revolution



MSSRF



No Time to Relax

Shaping our Agricultural Future

Population rich but land hungry countries like China and India have no option except to produce more food grains and other agricultural commodities per units of land and water under conditions of diminishing per capita availability of arable land and irrigation water, and of expanding biotic and abiotic stresses. Such a challenge can be met only by harnessing the best in frontier technologies and blending them with our rich heritage of ecological prudence. Eco-technologies for an Ever-green revolution should be the bottom line of our strategy to shape our agricultural future.

