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

Lessons from the Past and Policies for the Future

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An Ever-green Revolution

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Neo-Malthusians like Lester Brown have again warned of impending famines.
Era of Sharing of Genetic Resources

Daruma
(Japanese semi-dwarf)

X

↓

Fultz-Daruma
(semi-dwarf, high yield)

Fultz
(U.S. winter wheat, high yield)

Turkey Red
(U.S. winter, high yield)

Locals
(adapted to U.S. Northwest)

X

↓

Norin 10
(semi-dwarf, winter, high yield)
(Dr Gonziro Inazuka in 1935)

X

↓

Gaines
(semi-dwarf, winter, U.S. adapted)

Local Strains

X

↓

New Wheats
(semi-dwarf, high yield, adaptable, rust-resistant, fast-maturing, spring)
Science and Agricultural Progress

1968 – The Beginning of Green Revolution

17 July, 1968

Synergy between Technology and Public Policy
The 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.
“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
Paradigm Shift: Adding the Dimension of Environmental sustainability

- Green Revolution
  - Commodity Centered and Laboratory Research
- Ever-green Revolution
  - Integrated Natural Resources Management Centered and Participatory Research with Farm Families
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
“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)
“Man has lost the capacity to foresee and to forestall. He will end by destroying the earth”

- Albert Schweitzer
Neem in Agriculture

- Integrated Pest Management
- Integrated Nutrient Supply
Microbial Fertilizers and Pesticides

Pesticide Market
Western Europe : 26.7%
South/South East Asia : 26.7%
North America : 21.9%
Challenges

Defend the Gains
- Biotic and abiotic stresses
- Climate Change

Extend the Gains
- Dry Farming, Hill Areas, Islands

Make New Gains
- Diversification and value addition
- Quality enhancement
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

4) Post-harvest Technology
- New strains with improved keeping, processing and transport qualities

5) Animal Health
- Vaccines
- High quality feeds and fodder

6) Environment
- Biomonitoring through Bio-indicators
- Higher Carbon Sequestration

IFOAM: Genetic Engineering is excluded in organic agriculture.

Biotechnology and Organic Agriculture
Sea Level Rise: Bio-shield

Mangroves
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
*Prosopis juliflora* has wide adaptation to water stress and drought conditions. Used as source material for drought tolerant genes. 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

Towards a Food Secure India
A Call for Policy Initiatives and Public Action

Food Security
Availability
Access
Absorption

Awareness – Analysis - Action
Agrobiodiversity and Sustainable Nutrition and Health Security

MSSRF Pathway

Conservation → Enhancement → Cultivation → Consumption

*In situ* on-farm Field Gene Bank

Participatory Plant Breeding

Community Seed Bank

*Ex situ* (cryogenic) Community Grain Bank

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

MSSRF
Torch Bearers of the Rural Knowledge Revolution
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.