

Plant Production and Protection Division



Sustainable crop production Intensification Processes, Practices, People

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Why do yield growth rates matter?

- “Achieving further reductions in poverty and hunger while protecting natural resources for future generations will depend on sustaining rates of gain in cereal yields on existing cultivated land” (Ken Cassman, now Chair of Science Council, CGIAR)
- A 33% rise in food prices lowers standard of living by 3% in developed countries and by 20% in developing countries (Gary Becker, Nobel Laureate, University of Chicago)



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Limited land and water resources

- Land area (per capita) **declining: from 4.3 ha in 1961 to 1.5 ha in 2050**
- **1.6 billion** people face economic water shortages
- Competition for water – **70%** of fresh water already used for irrigation
- Use of land and other resources for biofuel production
- Unfair internal and external competition for smallholders





- The IUCN Red List gives a total of over **19.5 thousand threatened species** (vertebrates, invertebrates, plants, fungi and protists) in 2011.



Climate change will exacerbate food security and food prices

Higher climate **variability**
Extended **drought** periods
Extreme **precipitation**

=

Less reliable
rainfall





Agriculture needs to change

- Yield growth rate for cereals declining: **3.2% in 1960 to 1% in 2050**
- Smallholder system: **85%** of developing-country farmers farm **on < 2 ha**
- Low and improper fertilizer use – **21 kg/ha/year** in Africa and **9 kg/ha/year** in Sub-Saharan Africa





What can be done?

Ecosystem process and efficiency

- Building in resilience
- Pre-investment in ecosystem health
- Reducing waste in-field and beyond the field (COAG)





What can be done?

Intensifying knowledge to optimize inputs

- Rebuild human and institutional capacity, and life-long learning
- Scientifically sound participatory approaches to technology development and dissemination
- Infrastructure and access to credit and markets
- Input-output markets and 'smart', and 'perverse' subsidies





What can be done?

Integrated systems above and below ground and diversification

- Sustainability comes from integrating components
- Developing integrated systems is a process





What can be done?

Modifying our production systems by including ecosystem services

- Grassland ecosystems covers **52.2 million km²** which is equal to more that **40%** of the global land area
- Irreplaceable source of livelihoods and food security
- Proper management of natural grassland has tremendous potential for livestock production
- Livestock makes up over **50 % of agricultural GDP** in many developing countries
- Through sustainable **grazing**, livestock can provide milk and meat from grass while contributing to the maintenance of soil fertility and climate change mitigation





Components of SCPI (G)

- Support breeding
- Support seed systems including local seed systems (30% area in developing countries under improved varieties, so strong and diversified seed systems essential)





Components of SCPI (G)

- More climate-resilient varieties
- Possibility of combining traditional and new technologies (e.g., shuttle breeding with biotechnologies)
- Increase focus on Perennial crops





Components of SCPI (G)

- Higher the genetic variability, higher the potential for genetic improvement
- Pedigree breeding + recurrent selection
- Preservation of germplasm
- Multi-lateral access to germplasm
- N fixation, genetic modification, photosynthesis manipulation, exploiting metabolite pathways remote possibilities



Components of SCPI (B) :

Protect and enhance biological processes and biodiversity

	Cambodia	China	Laos
Fish	70	52	27
Crustaceans	6	2	5
Molluscs	1	4	8
Amphibians	2	4	10
Insects	2	3	16
Reptiles	8	-	7
Aquatic Plants	13	19	20
Total	102	84	93

Source: Balzer, Balzer, Pon, 2002; Luo, in press; Xaypladeth, in press



Components of SCPI

Reduce amount of chemicals and promote efficiency

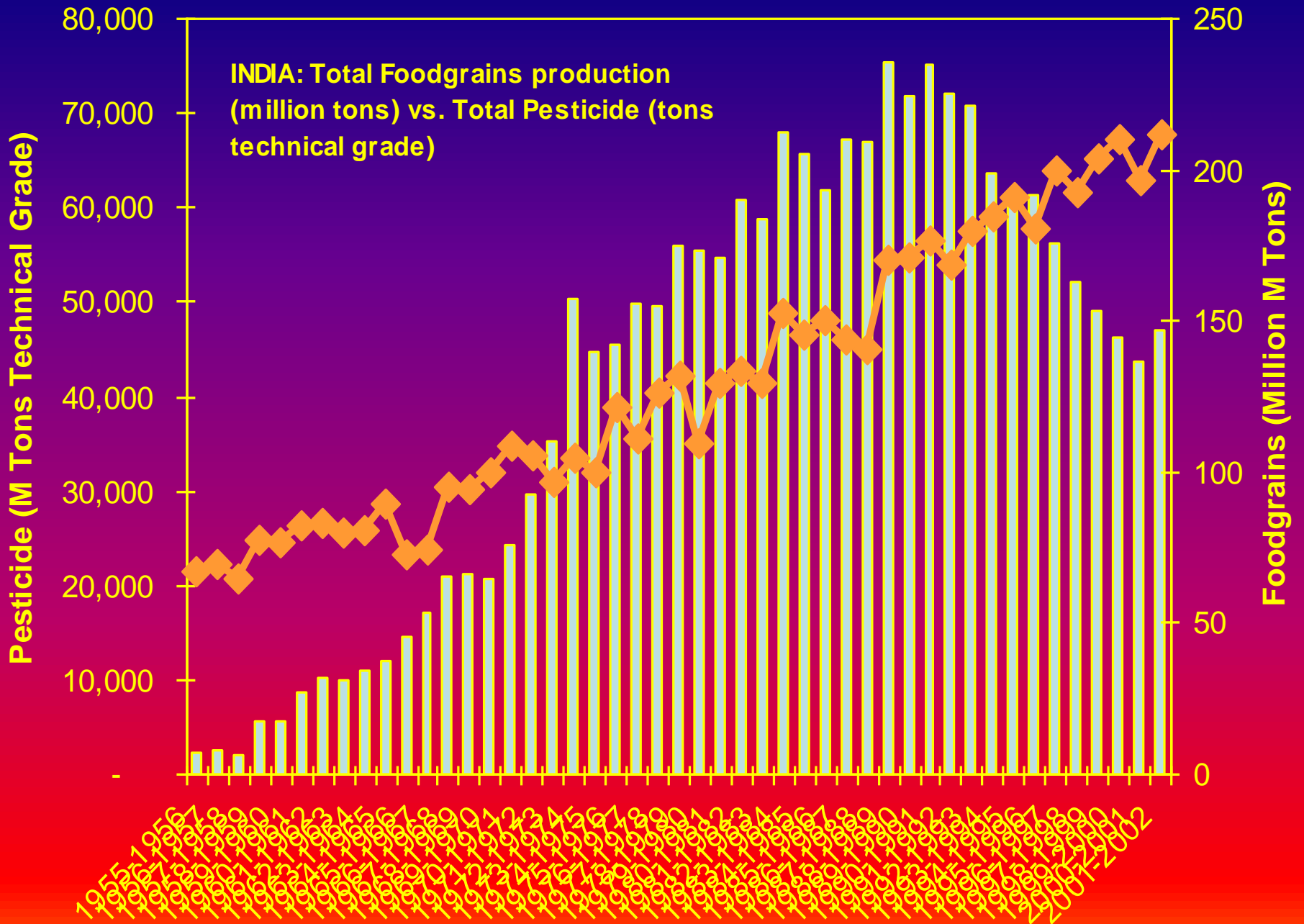




Components of SCPI

- Urea use reduced by 78 to 150 kg/ha
- Paddy yields increased by 900 to 1,100 kg/ha
- Average net return \$188/ ha higher than with broadcasting







Components of SCPI

- “Improved resource management, such as conservation tillage or even no-till systems and judicious use of inputs based on synchronizing nutrient availability with crop demand, have a much greater potential for impact” (Ken Cassman, now Chair, CGIAR Science Council)





What else must be done?

- Rebuild human and institutional capacity
- Good governance
- Access to land and other resources
- Infrastructure and access to credit and markets
- Input-output markets and 'smart', and 'perverse' subsidies





Reinforcing policy for food security

- **Investment** in agriculture remains critical to sustainable long-term food security
- **Safety nets** are crucial for alleviating food insecurity in the short term, as well as for providing a foundation for **long-term** development
- **Access to information, ICT, Private sector**, knowledge and innovation with full farmers' participation
- **Development of science** especially targeted to ecosystem processes





Thank you



Ecosystem processes

Yield Gap = Average yield of best varieties under no constraint – Average farm yield

Yield gaps (40% for wheat, 70% for rice, and 30-200% for maize; 30% average over crops and environments) point to potential for higher yields

Maximum yields have maximum losses

