STUDY OVERVIEW

- ✓ Surveyed production constraints and opportunities for important GCP food crops in priority farming systems with high degrees of poverty
- ✓ Focused on wheat, rice, sorghum, cassava, cowpea and chickpea
- ✓ 15 broad farming systems with large numbers of stunted children, drought incidence and large production areas of food crops in South Asia, East Asia, sub Saharan Africa
- ✓ Three rounds of surveys using a 'Delphi' methodology with over 670 panelists familiar with the crops and systems
- ✓ Estimated smallholder farm yield gap (defined as *Highest achieved yield on farm – Average yield on farm)*
- ✓ Identified important abiotic, biotic, management and socio-economic constraints and yield losses
- ✓ Panelists proposed solutions to the most severe constraints.

Findings with Yield Gaps

- ✓ Large smallholder farm yield gaps identified for most crops and farming systems
- ✓ Crop yield gap smallest for rice, mid size for wheat and cassava; larger for sorghum and the legumes
- ✓ Yield gaps larger in marginal, dryer farming systems in Sub-Saharan Africa, and smallest in the high input and yield systems of East Asia

Possible Implications for GCP?

- *Significant scope for improvement of farm yields if severe constraints can be identified and then alleviated*
- *Bigger challenge for rice? More opportunities to raise yield for other crops, but still may be more difficult since are marginal crops/systems*
- *Focus more on crops for the more marginal systems, especially Africa?*

Findings with Constraints

- ✓ Abiotic, biotic, management and socio-economic constraints all important contributors to yield gaps, with variation by different crops
- ✓ Many severe specific constraints reported for the crops in the systems
- ✓ Most severe constraints were considered to be getting worse (in fields and years)
- ✓ Combined yield losses from ten most severe constraints identified contributed 45% (cassava) to 56% (chickpea) of average yield gap
- ✓ Groups of related constraints often dominated, e.g. poor management, high cost and deficiency of N fertilizer, and soil fertility depletion were widely reported for the cereals, as were drought stress and poor water management. Specific biotic constraints and the high cost of their control dominated the legumes.

Possible Implications for GCP?

- *Need to carefully select constraints to work on – insufficient resources to work on all; somebody's favorite may not be important*
- *Consider flexible support to several important related constraints for different crops x systems to make a big difference*
- *Set boundaries for work it will support (mainly abiotic and biotic) and encourage other programs/institutions to work on complementary areas (management, socio-economic?)*
- *Appreciate that drought and water management problems very important for the cereals; but less so for the legumes and cassava*

Findings with Solutions to Severe Constraints

✓ Wide range of variety/germplasm, crop management and policy/socio-economic solutions proposed for the most serious constraints identified, and often several given for same constraint.

✓ Solutions to biotic and abiotic constraints often involved development and deployment of improved germplasm with tolerance or resistance to various pests, diseases, nutrient and water stresses
- especially common for wheat or rice, particularly in Asia.

✓Many of the suggested solutions for sorghum, cowpeas, cassava and chickpea involved interactions, synergies and systems thinking.

✓ Some germplasm suggestions incorporated systems perspectives, e.g. need for earlier maturing genotypes to better fit intensifying cropping systems, e.g. with rice or chickpea in South Asia.

✓ Many detailed solutions suggested breeding better varieties, but linked with quick deployment of the improved seed and a focus on farmer awareness to ensure the adoption.

Possible Implications for GCP?

- *Producing better germplasm with the right traits can often do a lot, but…….*

- *One simple intervention on its own will rarely solve the severe often complex constraints identified. Sets and sequences of interventions are required, and different approaches and actors necessary to accomplish them.*

- *GCP may need to work with other programs and institutions, encourage close cooperation between researchers (geneticists, plant breeders and agronomists), and with extension, plus incorporate farmer/community participation in the evolution and deployment of solutions for each crop and system.*

Broadening the approach?

✓ Concerns about systems effects and interactions, particularly with crops that are usually intercropped (cowpea) or have several functions/uses (sorghum, cowpea, cassava), imply a need to move beyond a focus on single crops and on yield losses per unit land area in future assessments.

✓ This methodology may be usefully expanded to survey system productivity losses and opportunities, in say a few priority African systems, where several of these crops are all important.

Using the Findings in GCP?

✓ GCP can use the important constraints and suggestions on varietal, germplasm or genetic solutions to:

- Justify current investments in particular thrusts with these crops for the farming systems
- Decide priority traits x crop x system on which to support new research.

✓ Further debate between some key panelists − perhaps in the form of a workshop − on how to rationalize and prioritize the many constraints and solutions, and then to use them in priority setting, could be useful for the GCP?