Legumes in the Collaborative Crop Research Program

Charlie Riches
Natural Resources Institute, UK
CCRP: Support to agricultural research aimed at improving food production and nutrition - 35 projects in 12 countries of Africa and Latin America.

- Background to CCRP
- What we aim to do
- How we operate
- Legume portfolio
- Main partners
- Challenges
Collaborative Crop Research Program

- CCRP-I 1994 – 2000: ~$2 M / yr
- CCRP-II-a & b 2001 – 2008: ~$4 M / yr
- CCRP-III 2009 – 2013: ~$10 M / yr
Communities of Practice (CoP)

East & Horn of Africa: Crop Improvement

W Africa: Millet- and sorghum-based cropping systems

High Andean Cropping systems

Southern Africa: Integrating legumes in cereal-based systems
CCRP assistance

Grant assistance
• Research grants – 1 to 4 years;
• Partnerships within and between countries led by NARS, CG, African Universities, NGOs;
• Studentships – supporting post-graduates in regional and overseas universities; mentoring role in early career;

Non-grant assistance
• Research methods support (Statistical Services Centre Reading University) – e-support, face to face, workshops;
• Technical assistance grants;
• Thematic workshops (e.g. seed systems; botanical pesticides);
• E-Write-shop trial (February 2012)
• Multi-environment trial initiative (April 2012)
## Regional Communities of Practice

<table>
<thead>
<tr>
<th>Function</th>
<th>Mechanism(s)</th>
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</table>
| Networking          | • Convening: CoP meetings  
                      | • List-serve for networking  
                      | • Exchange visits          |
| Learning            | • CoP meeting, peer review, reflection  
                      | • Thematic workshops  
                      | • Studentship grants  
                      | • Technical assistance to projects  
                      | • Research methods support |
| Collective action   | • Connecting up the R&D value chain  
                      | • Coherence in grant-making  
                      | • Better practice – research quality |
Agricultural Systems

Agro-resource base being degraded; climate issues

Cropping systems and diets are impoverished

Inputs inaccessible and prospects are poor for many

Risks are high, resources are limiting

Research + Development Systems

National programs poorly resourced

Links between research and outcomes often frail or lacking

Potential for NGOs, FOs variable but worth strengthening

Donor initiatives burdensome to some, missing others

Need to support new generation
Livelihoods
- Improve incomes, financial stability
- Risk management

Sustainability
- Building soil fertility
- Water management
- Biodiversity conservation

Nutrition
- Food security via purchase and self-provisioning
- Dietary diversity
- Coping with seasonal hunger
- Coping with economic crisis

Multifunctionality
Building assets
- Human
- Physical
- Methodological
- Natural
- Social
- Etc.

AEI

Etc.
Agroecological Intensification (AEI)

Improving systems performance by maximizing the internal efficiency of the production system & of input use

– Systems health →
  community, human, crop and soil health

• Flexible options
• Multi-functionality
• Risk management
• Holistic, integrated

Principles

• Productivity under resource limitation
  – Resource efficiency; economic & social viability

• Diversification
• Resilience

Elements

• Soil fertility and health
  – Microbiology, chemistry, structure

• Water use efficiency
• Pest and disease management
• Plant breeding
  – Improvement of crop components
Working from both ends through CoP+

- Policy
- Institutional analysis
- Seed systems
- Pest management
- Soil fertility management
- Bio-pesticides
- Crop breeding
- Bringing pieces together at community level

Components

Local integration

Integration mechanisms

Technologies

Interactions

Not all done in each project!!!
Legumes as a key systems element

• Attributes
  – Stover, grain
  – Biomass
  – N fixation
  – P acquisition
  – Ground cover (vs. erosion)

• Roles in
  – Human nutrition
    • Protein, lipids
  – Soil nutrition
    • N fixation; P acquisition; high-quality residues
  – Livelihoods
    • Gender bias → nutrition bias

Photo: C. Nicklin
<table>
<thead>
<tr>
<th>Region</th>
<th>Crops</th>
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<tbody>
<tr>
<td>Andes</td>
<td>Lupin, Groundnut</td>
</tr>
<tr>
<td>West Africa</td>
<td>Bambara, Cowpea</td>
</tr>
<tr>
<td>East &amp; Horn</td>
<td>Chickpea, Cowpea, Lablab</td>
</tr>
<tr>
<td>Southern Africa</td>
<td>Bambara, Beans, Climbing beans, Cowpea, Groundnuts, Soya &amp; pigeon pea (ISFM)</td>
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Groundnut in the Valleys of Bolivia

Organization: Fundacion Valles

- Technical assistance to organic producers to improve quality and reduce aflatoxin for export to EU
- Local organic seed system
- Internal control system for organic certification
- Equipped university lab for aflatoxin testing – aiming for international accreditation
- Monitor and ameliorate aflatoxin in local food systems
West Africa

Improving Bambara Productivity

- INERA: Burkina Faso – improved cultivars and production methods, greater participation by farmers and farmer organizations in bambara marketing.

Developing drought-resistant, phosphorous efficient cowpea

- INRAN: Niger with INERA: Burkina Faso - screening for enhanced P-acquisition and utilization in short duration pest-tolerant cultivars; testing with
East & Horn of Africa

Enhancing productivity and utilization of chickpea in banana system of Uganda

• Mbarara Zonal Agricultural Research and Development Institute – looking for a crop to provide reliable yields for vulnerable households facing protein deficits during the dry season;

Development of high yielding and pest resistance cowpeas in Uganda

• Makerere University - aim to provide pest/disease resistance cowpea varieties. Their baseline highlighted the importance of leaf traits.

Multiple legumes and management strategies for reinvigorating and maintaining the health and productivity of mixed farming systems

• KARI - looking at a suite of legumes, matched to socio-ecological niches along an ecological transect. Originally funded by the CRSP.
East & Horn of Africa

*Planning legume pest/disease survey:*

- Meeting in December 2011 to plan a possible survey on legume pests and diseases in western Kenya.
- Pests and diseases can be an important constraint for legume integration.
- What is size and shape of the pest/disease problems being encountered by scaling-up projects (e.g., Gates and AGRA-supported)?
- What are AEI-type of approaches? Alternatives to pesticide application, - leaves are important for diets, people lack cash, and/or there are health/environmental concerns.
Strategic issues for grant making in SAf

- *Increasing productivity and yield stability* - crop breeding, selection and promotion of improved legume cultivars (disease, pest and soil factors);

- *Enhancing access* - decentralised seed systems;

- *Enhancing soil fertility in cereal-based systems.* Understanding the multiple roles of grain legumes contributing to household nutrition, farm income, and plant nutrient cycling;

- *Enhancing nutrition and livelihoods.* Improving the quality and diversity of diets through availability & utilization of legumes. Opportunities for farmers to increase participation in markets - trade-offs

- *Reducing pre-harvest & post-harvest yield loss.* Focus locally available crop protection practices.
Productivity - Crop Improvement

Bean Bruchid Management Malawi & Tanzania

Sokoine University Tanzania with Chitedze Research Station, Malawi & Oregon State University.

- Transfer known sources of bruchid resistance into farmer preferred cultivars (using MAS) targeting *Acanthocellides* and *Zabrotis*;

*P-efficient legumes – Mozambique*

IIAM with Penn State & Zamorano, Honduras

- Bean & soya breeding, selection for P deficient soils – root traits & agronomy
Productivity - Crop Improvement

Climbing Beans Malawi, Mozambique & Tanzania

Chitedze Research Station, Malawi with CIAT, Uyole Research Station, Tanzania & IIAM, Mozambique

• Demonstrate a model for how climbers fit into maize based systems
• Identify lines of MAC types resistant to BCMV

Cowpea/Alectra Malawi & Tanzania

Ilonga Agricultural Research Institute, Tanzania & Bunda College, Malawi & University of Virginia

• Cowpea breeding/selection for Alectra resistance, early maturity

Groundnut Breeding/Aflatoxin Malawi & Tanzania

ICRISAT, Malawi, NASFAM & Naliendeli Research Institute, Tanzania

• Breeding foliar disease resistance (combined GRD, Early Leaf spot and rust) & aflatoxin resistance
Productivity - Crop Improvement

*Bambara groundnuts Malawi, Mozambique & Tanzania*

Bunda College, Malawi, Naliandeli Agricultural Research Institute, Tanzania; IIAM, Nampula; & NRI, UK

- Selecting productive lines (link to WAf)
- How can additional planting be integrated into existing crop systems?
Productivity – soil fertility management

*Best Bets Legumes, Malawi*

Bunda College, MSU with NGOs & extension

- Identify adapted “best bet” legumes to improve soil health, crop productivity & deliver nutritional benefits - multifunctionality

- Informs policy for exit strategy from fertilizer subsidy
Productivity – pest management

Botanical Pesticides

Lunyangwa Research Station, Malawi, CIAT, Uyole Research Institute, Tanzania; Kew Gardens London & NRI

• Characterisation of pesticidal plant species, optimum harvest, extraction and application methods – particularly *Tephrosia vogelii*
Seed Systems

Bean Seed Delivery

CIAT, Malawi with NARS in Malawi, Mozambique and Tanzania

• Widespread use of PVS by many partners, comparison of diversified, local seed systems;

• Mainstream the use of promising seed dissemination models & develop bean commodity platforms in each country.

Groundnut Breeding/Aflatoxin Malawi & Tanzania

• Village seed banks in Malawi and farmer seed groups in Tanzania

Cowpea/Alectra Malawi & Tanzania

• Seed production groups to stimulate early adoption of new cultivars (QDS);

P-efficient legumes – Mozambique

• Role of social networks in bean dissemination

• Social certification
Post harvest & nutrition

Groundnut post-harvest Malawi & Tanzania

Compatible Technologies (MN), ICRISAT, Malawi & SUA, Tanzania

• Reduce post-harvest losses (hand tools); develop groundnut-based complimentary foods & nutrition education;

Cowpea/Alectra Malawi & Tanzania

• Cowpea processing (de-hulling) & recipes

Bambara groundnuts Malawi, Mozambique & Tanzania

• Nutrition education to promote greater consumption of bamabra in diversified diets
Nutrition

Best Bets Legumes, Malawi

Bunda College and Ekwendeni Hospital Malawi & University Western Ontario

• Delivery of nutritional benefits by diet diversification, nutrition education is key to adoption!
Food safety

*Groundnut Breeding/Aflatoxin Malawi & Tanzania*

With Kamuzu Central Hospital, Lilongwe

- Documenting extent of aflatoxin, raising awareness and investigating/promoting mitigation measures for growers, traders, consumers and policy makers
Value Chains - Markets

*Bambara groundnuts Malawi, Mozambique & Tanzania*

- Development of a bambara sector development model combining surplus production with increased urban consumer demand for bambara products to stimulate and sustain bambara production.

- How to develop “market pull” to motivate farmers to increase bambara production AND understand the likely tension between household consumption to improve nutrition/food security and income generation.

*Groundnut Breeding/Aflatoxin Malawi & Tanzania*

- Understanding groundnut value chains in both countries to identify entry points for information and opportunities for producers.
Communication

Innovative Communication media and methods

Danish Management, Copenhagen, ICRISAT, Malawi & Naliendeli Research Institute, Tanzania

• Using a Learning Alliance approach to bring stakeholders (growers, traders, policy makers and researchers) to facilitate flow of information on aflatoxin and improved cultivars
• Exploiting the use of video, radio, TV, mobile phones in the groundnut value chain;
HR & research infrastructure

10 MSc and 1 PhD studies under way in SAf universities in 2011
4 PhD and 2 MSc underway in North America & EU

4 PhD graduates back in post

Clustering projects:
• Bunda
• SUA – biotech lab (BeCA, IAE, Kirkhouse, McKnight)
• IIAM
Challenges – systems perspective

• $G \times E \times M \times C$
• Niche matching – understanding how where we work fits broader contexts, baselines
• Broad adaptation v local performance and farmer/market preferences – “Best Fits”
Challenges – raising quality

• Project design issues - fuzzy research & evaluation questions, ambition v resources/skills to generate adequate evidence
• Moving to funding “inception periods” to review literature, clarify hypothesis, research questions, complete baselines, DDS, build local partnerships AND develop longer-term work plans

• Data management - Important data sets under utilised
• Lack of regional institutional capacity in RM mentoring
• Need for greater integration of evaluation with planning of research – taking stock
• Mentoring of young scientists – fellowships?