The Roots and Tuber Crops Working Group
Proceedings of the first meeting

2nd September 2015

Held at the Ethiopian Institute of Agricultural Research
The primary purpose of the Roots and Tuber Crops Working Group is to bring together lead agriculture sector policy makers, researchers, project implementers, extension workers, traders and agro-processors to share emerging best practice that will support increased production and productivity of roots and tubers.

Introduction

The Roots and Tuber Crops Working Group is a joint initiative of the Ethiopian Institute of Agricultural Research (EIAR), the Ministry of Agriculture (MoA), the Centro Internacional de le Papa (CIP), the Food and Agriculture Organisation (FAO) and the USAID funded Agricultural Knowledge Learning Documentation and Policy (AKLDP) project. AKLDP is a five-year project being implemented by the Feinstein International Center at Tufts University. The first one-day meeting of the Roots and Tuber Crops Working Group was held on 2nd September 2015 at the EIAR headquarters in Addis Ababa. The meeting was structured around presentations of innovative work, question and answer sessions, group work and plenary discussions.

The meeting objectives included:

- Developing a stakeholder map to confirms who is doing what, where and how.
- Developing mechanisms for improved coordination of research and development interventions, specifically with regard to the use quality seed of roots and tubers for emergency seed relief.
- Assessing the need for a National Roots and Tuber Development Strategy.
- Proposing strategies and funding sources for the promotion of roots and tubers among processors and consumers.
- Assessing the potential contribution of roots and tubers to establishing climate-smart agricultural production systems.

These proceedings include summaries of the five detailed presentations that were made by the organizers and highlight the key outputs of the group work and plenary discussions. Additional details are included in the annexes. For further information please contact: Ato Gebremedhin (EIAR) gebregiorgis2003@yahoo.com and Adrian Cullis (AKLDP) adrian.cullis@tufts.edu
A. Opening address

Ato Gebremedhin and Adrian Cullis welcomed the participants. An outline of the purpose, agenda and expected outcomes was presented. Dr Adugna, the Deputy Director of EIAR, formally opened the meeting with an address that highlighted the policies and strategies put in place by the Government of Ethiopia to help transform the agricultural sector; namely the Growth and Transformation Plan, a more liberalized market economy, and agricultural extension. Some of the key needs for the sector are seen as improved technology, greater commercialization and more intensive but sustainable farming practices. Dr Adugna called on the participants to assess the achievements so far with root and tuber (R&T) crops research and technology, and to share their knowledge so as to help address Ethiopia’s future food security and livelihood needs. He anticipated that the meeting would identify the bottlenecks in technology generation and transfer, as well as recommend approaches to scale-up existing R&T crop production technology for the benefit of Ethiopia’s farming communities.

B. Presentations

1. MOA - Overview of Root Crops in Ethiopia

W/rt Meseret Shiferaw delivered a presentation highlighting both the constraints and opportunities facing the production of root crops in Ethiopia, including their importance to food security in drought prone areas. He emphasized the high productivity of horticultural crops compared to cereals, the growth in demand (both domestically and for export), and the possibilities offered by the improved technologies now in place. The factors that constrain horticultural crop production include insufficient improved varieties, an inability to overcome biotic factors (disease/pests) and bottlenecks in the effective marketing of harvested crops. The presentation explained the MoA’s areas of intervention, including enhancing smallholder farmer productivity as well as setting national targets for increasing root and tuber crop productivity from now until 2020. The Ministry’s overall implementation strategies to address the key constraints to productivity were outlined.

2. EIAR - Status of root and tuber crop research and development in Ethiopia

Ato Gebremedhin began his review of the current status of Roots and Tuber Crops research in Ethiopia by explaining the core reasons behind food insecurity and malnutrition, and the shortcomings of the grain-led approach to agriculture. He introduced the principal R&T crops in Ethiopia as enste, potato, taro, yams, anchote, Ethiopian dinish, cassava, tannia and sweet potato; highlighting their value during the ‘hunger months’ due to their capacity to survive poor soil and moisture stress. The agricultural technologies that have been developed by EIAR were explained in depth, including the release of potato, sweet potato, cassava and enset varieties, as well as the average yields possible from the improved varieties. The continued multiplication and dissemination of healthy planting materials (disease-free seeds) is seen as critical to the promotion of R&T technologies. Ato Gebremedhin summarized Ethiopia’s national research facilities, as well as the programs undertaken with farmers towards improved production. After highlighting some of the specific issues around the need for Quality Declared Seeds (QDS), he provided a set of recommendations for more effective R&T research and development.
3. CIP - Strategy to improve livelihoods of potato and sweet potato farmers

Dr Elmar Schulte-Geldermann explained the work being conducted by CIP in Ethiopia to improve the livelihoods of potato and sweet potato farmers. CIP’s strategic objectives include combating micronutrient deficiency at the household level with resilient orange-fleshed sweet potato and bio-fortified potato; and improving the livelihoods of potato farmers in Africa by tackling deteriorated seed quality through an integrated approach. With nine projects currently underway in Ethiopia, CIP’s 35 staff and 4 offices have established a broad network of partners, with EIAR as the major partner. Dr Schulte-Geldermann outlined the progress made to date and CIP’s long-term vision for their work in Ethiopia; including specific potato breeding goals and an effective, functioning and certified seed market. The various lessons learnt were highlighted, including the need to address disease spread, to decentralize seed production, and to establish district and zonal potato/sweet potato farmer organizations.

4. FAO - Lessons Learned from FAO Root and Tuber Crops Interventions in Ethiopia (2009-15)

Dr Bateno of FAO began his presentation by highlighting Ethiopia’s rapidly expanding population and explaining that roots and tubers are estimated to provide 20% of per capita daily calorie intake in sub-saharan Africa. Despite being grown on only 0.21 million ha (1.4% of the cultivated area) in Ethiopia, root crops provide 10.3% of overall crop production (42 million qt). Dr Bateno then introduced the constraints to more effective root and tuber production and the six projects underway through FAO to address these. A detailed explanation was provided on the implementation modalities, key results and the impacts on project beneficiaries. In outlining his recommendations to address the challenges and lessons learnt from FAO’s interventions, Dr Bateno called for: considerable local capacity building; the promotion of more efficient irrigation technologies and soil improvement methods; a focus on integrating R&T production with nutrition; activities specifically targeted engaged unemployed youth; support to producers’ cooperatives; and a greater focus on women.

5. GRAD – Experience in the potato value chain

In his presentation Ato Gizachew Sisay of SNV reported on the achievements of the component of the Graduation with Resilience to Achieve Sustainable Development (GRAD) project that is focusing on the potato value chain. Identifying the potato as an important commodity for household consumption and for generating income, the project has: initiated and promoted community based improved potato seed multiplication using model farmers; enabled diffused light storage unit construction; and provided intensive training, mentoring and coaching for both ware potato producers and seed multipliers. A crucial component has been the facilitation of market linkages by engaging the private sector. The processing company involved has increased its daily potato consumption from 1,000 kg to 20,000 kg and the linkage has helped farmers to see the benefits of working with a reliable buyer and selling collectively. A number of challenges remain, but increased consumption levels and increased income from potato production has demonstrated its viability as an alternative crop.

A more detailed summary of each of these presentations is given at Annex 2 the end of these proceedings. For more information or to request the original presentations containing key data and images, please contact the authors using the participants list at Annex 1.
C. Group Discussions

Following the presentations the participants were divided into two sub groups and asked by the facilitators to consider some key discussions points:

1. **What are the minimum standards required for the design, implementation and review of R&T projects for both emergency and development projects?**
2. **Does Ethiopia need an R&T Master Plan to guide the development of R&T work?**
3. **What should be our next steps? For example is there value added in the establishment of an R&T Group? If yes, what should it seek to achieve in 2015?**

The group discussions were useful in clarifying the existing research and development needs of all root and tuber crops and the potential opportunities for doing so.

Recommendations (Group one)

(Facilitated by Dr Elmar Schulte-Geldermann with Dr Tesfaye Abebe as the rapporteur).

1. **Do we need a National Root and Tuber Crops Platform?**
   The group had a thorough discussion on this issue and came up with the following conclusions:
   - It is a good opportunity to bring this sector onto the top agenda of the government;
   - It will be a good strategy to pool the many resources under the various NGOs operating in the country to the greater benefit of poor smallholders;
   - It will also be useful for attracting both donor and government attention as it will help both parties follow the implementation of the different projects they have supported financially;
   - It will help with better coordination among the different projects working on these commodities and avoid duplication/overlapping of efforts.

2. **Do we need a strategic plan of the National Roots and Tuber Crops?**
   Different Federal Ministries, public organizations and Regional Bureaus including the Ministry of Agriculture (MoA) all have their own strategic plans. There is also the small-scale Horticulture Development Strategy that also covers root and tuber crops. (This clearly shows how these crops are swallowed within the ocean of horticultural crops). A consolidated strategic plan with a detailed and coherent implementation plan, which is aligned with the MoA strategic plan, is crucial for:
   - Following the impact pathways of different development projects;
   - Putting in place a sustainable system that will help the farmers;
   - Proposing certain policy issues for government intervention e.g. internal quarantine for seed movement across Regional States; and
   - Designing development projects by development organizations
   The strategic plan should be prepared by a few members of a task force drawn from MoA, EIAR, CIP, RARIs, NGOs (SNV and World Vision) and the university. Once this group has drafted a plan it should pass through wider scale circulation for comment and then be endorsed at a large-scale workshop. If resources or funding are obtained it is suggested consultants do the drafting.

3. **Data management**
   Finally discussions were held on the poor status of the national root and tuber crops statistics, which has seriously influenced and blurred government views on these crops. The very low figures mean they are not considered as an essential commodity within the extension package. To bring the figures closer to their reality on the ground it was suggested an approach be made to the officially responsible Central Statistical Agency to obtain clear knowledge of the methods they follow, and the time at which they collected these data; and to then request them to redo the work if it is found they lack some elements in their steps, for example advising them of more appropriate timing for better precision. The Jeldu area potato coverage figure that used satellite images for example shows how the CSA figure does not tally with the reality on the ground. The problem of using extrapolation from a small pocket was also mentioned as an issue that leads to a misleading output. Random sampling from different major potato growing Regions could be considered if funding is secured.
Recommendations (Group two)
Facilitated by Dr Berga Lemaga with W/ro Atsede Solomon Retta acting at the rapporteur.

1. Quality assurance and strategy document
The group agreed on the need for the preparation of a strategy document and recommended that it focus on
- How to implement QDS in the seed system as there is no formal certification for root and tuber crops in the country.
- The availability of clean starter seed (pre-basic) is necessary as QDS has a relatively higher tolerance level than the formal certification standards. (All RMT methods should be used).
- To strengthen regulatory action, capacity building in terms of facilities and human resources is necessary.
- Awareness creation about QDS is needed for different stakeholders—farmers, seed regulatory body, research and extension workers. Traders often have no knowledge about the issue and awareness is vital for common understanding.
- A decentralized seed system should be facilitated to help each region or locality have its own seed market. If a disease or other problem occurs it will be easy to contain before it disseminates to a larger area.
- The regulatory offices and laboratories are in their infant stages; the strategy document should focus on this and find donor funding.
- Field registration should be practiced for proper rotation, as is the case in Brazil.
- For other root and tuber crops, like cassava, taro, yam etc. the strategy should be developed in such a way that the seed system can be started from the early stage.
- Networking of stakeholders is vital to avoid the duplication of efforts and allow synergies.
- Seed producers must be organized, and work together with the government regulatory body, to monitor the quality of seeds themselves.
- Research centers should give technical back stopping.
- A detailed guideline must be available for implementing quality assurance.
- The strategy should be prepared so as to ensure more emphasis in GTP-2.

2. Next steps for the R&T group
- Formulate a national committee that can develop a strategy document for enforcement by policy makers.
- The strategy document should include the diverse uses of root and tuber crops, for example cassava, taro and enset can also be used as animal feed.
- Climate change and mitigation/adaptation oriented research should be considered for the future.
- Work should generate and adopt gender sensitive technologies.
- Marketing should aim at encouraging more producers (e.g. in Nigeria bread consists of 70% wheat and 30% cassava to give market opportunities for cassava producers).
- Attention needs to be paid to storage facilities for seed/planting material and food.
- There is a need to look at technology from other countries experienced in processing and value addition. (For example in SNNPR cassava flour is available in the market in Awasa but there are no standardized protocols or quality control measures).

3. Data management
Networking between stakeholders will help in the sharing of information and using portals. The group also highly recommended that since the statistics by CSA and FAO did not match, there a need to work on this issue to get accurate data on these crops. This requires capacity building on how to do surveys and collect data to get a complete figure.
D. Plenary ‘Question and Answer’ Session

After lunch, during which participants had ample opportunities for networking, Ato Gebremedhin (EIAR) led a plenary ‘Question and Answer’ session together with Adrian Cullis (AKLP).

Questions to EIAR

1. Bacterial wilt (BW) disease in potatoes is becoming a serious problem for potato growers in Ethiopia. What should be done, and by whom, to try to help control the spread of this disease?

The spread of the BW is due to uncontrolled (lack of quarantine) seed movement from area to area. Seed tubers are purchased by organizations without knowledge of how the seed has been handled and where it has been grown. Once the disease is introduced to a plot it is very difficult to control it. The disease is both soil born and seed born and can also be transmitted through irrigation from an infected potato field to healthy field.

There are several control measures that have been recommended by research organizations including: mapping the distribution (disease, races); determining losses, host range and rotation; weighing the relative importance of cultural practices against BW; screening potatoes for resistance/tolerance; and establishing proper sanitation and inspection procedures for tuber seed production. Future development considerations include: creating awareness of the risk of BW among potato growers in the country; developing a regional seed production and supply system for Ethiopia; developing a self-imposed quarantine that may later develop into a regional quarantine system; developing a strong network in seed tuber production system; and implementing the quality declared seed system.

To prevent the introduction of BW into a new area the following measures are recommended: plant healthy seeds; plant in BW-free soil; irrigate using non-contaminated irrigation water; use sanitation measures. Integrated disease management and sanitation practices include the removal of diseased plants and the use of proper rotation, soil amendments and nematode control.

2. Ethiopia has a rapidly expanding population, and food security is a priority Government concern. What are we doing in the root and tuber crops sector to ensure we have the varieties to meet Ethiopia’s growing demand?

Root and tuber crops can give high yields per unit area and the use of these crops is one means to eradicate poverty in the highly populated areas of the country—areas where there is shortage of cultivated land. The use of these crops is at an infant stage in Ethiopia however, compared to other sub-Saharan countries such as Nigeria (cassava), Uganda (sweet potato) and Kenya and South Africa (potatoes). It is therefore paramount to push Government and Non-Government Organizations to allocate enough funds for the research and development of root and tuber crops. The recently developed technologies (varieties, agronomic management) for some of the crops (potato and sweet potato) need to be scaled up at the farmer level. The shortage of inputs, mainly healthy planting materials, needs more focus.

3. Are we mechanizing fast enough to assist and attract young farmers to the roots and tubers sector?

Although much still has to be done by research institutes in this regard, there are some technologies already available—such as planters and harvesters for potato and also decorticators of enset. There are also cassava slicers, chipper and solar dryers developed at Melkassa research center. But all these technologies need to be scaled-up for users.
4. Are we building the skills and capacities that we need to support the transformation of the roots and tubers sector – breeders, plant protection, growers and processors? How many people do we need – how many have we got? What is the gap and how are we filling it?

The national agricultural research system, including EIAR and the regional research institutes, are trying to allocate researchers in different places, but the quality and the quantity of the existing personnel to handle the root and tuber crops research and development is far below requirements. In this regard all partners should give more emphasis to allocating resources.

5. What is the role of the private sector in supporting the roots and tubers sector in Ethiopia? Are there enough private sector actors? Does Ethiopia need more investors? Can they play a role in expanding the varieties of potatoes available? Do they work well with Government?

More private sector involvement is required in root and tuber crops development: so far there are very few private sector agents involved in the subsector. For example only one company, Solagrow PLC, is involved in potato seed production, although there are some companies that are trying to be involved in the processing of potatoes. The sector needs more private sector engagement and more experts. As a new subsector it needs more money and knowledge, as well as the support of all stakeholders including different level of government.

6. Ethiopia is urbanizing quickly, and towns and cities are growing at an estimated 8 per cent per year. Men are moving to the towns but in some families women remain behind. Are women getting enough support to grow roots and tubers? What of the men in the cities - are there opportunities to grow potatoes in the city?

Urbanization is growing very fast in Ethiopia and more people are coming to towns for the purpose of working in construction and other developments. This creates a demand for more potatoes and other roots and tubers in cities, alongside the use of processed foods. Involving women and girls in production and marketing of the subsector is very important to increase the productivity of crops. There have been few activities specifically involving women. In the future it will be necessary to involve them in training and other activities—including production, post harvest management and marketing.

Questions to GRAD

1. What is the value added of a project that is only 5 years in duration? What happens to the beneficiaries after the project closes out? Would it not be better to support Ethiopia’s research institutions with funds that ensure sustainability rather than NGOs that are here today and gone tomorrow?

GRAD is working in close partnership with key institutions like EIAR and CIP to try to overcome challenges in the potato sector. More globally, it works in parallel with the PSNP4 and shares all learning on its successful approaches with these government counterparts. Our view is that GRAD’s work is only of value to the extent that it can provide cost-effective ideas and solutions to the permanent structures. At the same time, GRAD seeks sustainable graduation of up to 65,000 PSNP households, and has already seen nearly half of its beneficiaries graduate. If GRAD is ultimately successful, most of its targeted households will no longer need extraordinary support from government or NGOs. EIAR and others are receiving support to improve facilities and capacities. GRAD’s role is not to duplicate that, but to help the research institutions improve dissemination of improved technologies and the overall financial viability of the sector (i.e. supporting development of potato value chain). It is a relatively small investment for a very important task. The best mechanism of ensuring sustainability is to make interventions profitable and market oriented. In this regard, each value chain is designed to be profitable and linked with sustainable markets (through private sector engagement). Thus when the project is completed this linkage will remain.
2. **What is GRAD doing to help address systemic constraints in the sector?**

The view of stakeholders is that a five-year implementation period should be sufficient to move households to a level of self-sufficiency. But to do so, the systems must be in place to support households after the project has finished. The seed supply system is particularly important. GRAD is supporting potato seed cooperatives to become better at seed multiplication and storage and to become better managed at the same time. In addition, GRAD is testing community-based multipliers, i.e. model farmers who receive quality seed from the research community and multiply it to sell to the local cooperative and a small set of local farmers. Both cooperatives and model farmers are being introduced to the diffused light storage technology, which is cost effective and made primarily with local materials. GRAD has created a network of private agro-dealers that, while not heavily involved in potato seed, are providing new sources of inputs and tools to PSNP communities. Finally, linkages to good markets will help solidify the value chain. Market outlets through cooperatives and to private sector processors are being supported. Organizing producers into groups called FEMA (Farmers economic and marketing association), or supporting them to join existing cooperatives, is another way of addressing one of the systemic constraints in meeting market requirements in terms of volume and quality.

3. **What is GRAD’s experience in innovative extension systems that the Government might learn from and replicate within the national agriculture extension system? For example, does GRAD have any experience in media-based systems that are showing promise?**

GRAD has worked closely with the MoA and ATA to develop training content for DAs on market-based/demand-driven extension. Approximately 700 DAs have received the training so far and are supporting both GRAD and non-GRAD HHs. But we feel that DAs can never support all HHs and all sectors in the areas. The solution is to complement the work of DAs with both model farmers from the community and private sector actors such as agro-dealers. Agro-dealers, apart from inputs supply, play a role as service providers and disseminate technology and practices through model farmers. If all are active in promoting similar messages and best practices, most of the large number of small-holder farmers will get at least some TA support. GRAD has recently started to collaborate with Digital Green (an NGO working with the MoA) to test video-based extension. DG would be a good source of information on the technologies being tested and successes to date. Private sector actors such as Gondar Malt Factory have started to assign their own extension agents to provide embedded services such as extension training.

**Question to FAO**

*What is FAO doing that is more than just projects to help address systemic constraints in the sector?*

One of the systemic constraints mentioned is the spread of diseases with planting materials. This can be addressed with the establishment of an effective quarantine system. In this regard FAO is supporting MoA, and the agriculture sector, in the general drafting of a national pest management support service system (PMSS) for Ethiopia. The draft document was presented to regional and federal representatives (participants were from research, agriculture education and extension) at a workshop held from September 3 to 5, 2015 in Addis Ababa, with participants providing very important inputs. Regions also presented a review of pest management and challenges in their respective regions. Plant quarantine was one of the issues discussed in the workshop. The draft PMSS and the proceedings of the workshop will hopefully be shared to stakeholders in the near future.
E. Concluding Remarks

Ato Gebremedhin brought the first meeting of the Roots and Tuber Crops Working Group to a close with a brief summary of the day.

It was agreed that the next steps would be to implement the recommendations given and to develop a strategic plan for root and tuber crops research and development. The document would be prepared by consultants and AKLDP, with CIP and GRAD to contribute the required finance. Ato Gebremedhin and Adrian would follow up this activity. It was agreed that the next meeting would include a field visit.
Annexes

1. List of participants
2. Summaries of the presentations by MoA, EIAR, CIP, FAO and GRAD
3. The forthcoming African Potato Association meeting
ANNEXE 1

List of Participants

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ANNEXE 2

Summaries of the presentations made at the first meeting of The Roots and Tuber Crops Working Group

Presentation 1. Overview of Root Crops in Ethiopia by the Ministry of Agriculture

Ethiopia has a great variety of climate and soil types that can grow a diversity of horticultural crops for home consumption and foreign markets. Currently, the majority of the horticultural crop production comes from smallholder farms, although their areas of production and their contribution to the country’s total agricultural output are not well known. Horticultural crops are rich in vitamins, carbohydrates and other nutrients. In some areas of the country, root crops, particularly potatoes and sweet potatoes, are used as the staple food for a considerable portion of the population. Root crops in general, and sweet potato, in particular are drought resistant and serve as security food crops in drought prone areas.

Opportunities
1. Agro-climatic suitability and rich water resources for diversified irrigated agriculture.
2. Growth/rise of demand for horticultural crops, particularly in urban areas.
3. High productivity of horticultural crops as compared to cereals.
4. Export possibilities are very encouraging.
5. Favorable policy support by the government, and frequent efforts of research centers, higher learning institutes and the private sector to develop and disseminate new improved technologies of horticultural crops
6. Presence of development partners as an excellent resource for dissemination of technologies.
7. High demand for quality seeds.

Constraints
1. Insufficient number of improved varieties of horticultural crops.
2. Lack of quality planting materials/seeds.
3. Biotic factors - mainly disease and insect pests. (Potatoes damaged by potato tuber moth. Sweet potatoes mainly attacked by sweet potato weevil, sweet potato butterfly and beetle. Plus blights, soft rot and virus diseases.)
4. Post harvest handling. (Crops deteriorate quickly and farmers unable to sell quickly face high economic losses)
5. Marketing - vegetable, root and tuber products are sold mainly at local markets or district capitals. Lack of reliable market a major bottleneck of vegetable farming.

MoA interventions
In the second phase of the GTP, crop development will continue to be important for food security, export earnings and fulfilling the demand of the growing agro-industries. Crop development activities will focus on enhancing smallholder farmers’ productivity and strengthening the role of private investors by addressing the systemic bottlenecks in the sector. Crop development will be categorized into three areas - major food crops, industrial crops and export crops - with clear baseline, appraisal targets and end line targets. In terms of smallholder root crop development the target is to increase the average productivity of roots and tubers from 147.6 Quintals/ha in 2015 to 225.05 Quintals/ha by the end of 2020. Total volume of produce should increase from 2,402.84 thousand ton at the base year to 3,764.19 thousand ton at the end year.

MoA major implementation strategies
Strengthen Horticulture Development Extension.
Install integrated pest management system.
Reduction of post-harvest losses.
Strengthen seed and seedling and other inputs supply.
Value chain improvement.
Capacity building.
Improve market support provisions.
Strengthen Out growers Scheme.
Strengthen the partnerships with stakeholders.
Presentation 2. Status of root and tuber crop research and development in Ethiopia by EIAR

Chronic food insecurity and malnutrition remain a major public health problem in Ethiopia. Ethiopia suffers from malnutrition, for example vitamin A deficiency. Household incomes of most Ethiopian farmers are low. Food is scarce, especially during the dry periods. Underlying causes of food insecurity are rapidly increasing population pressure, widespread environmental degradation, recurrent drought, low productivity of the agricultural sector and limited market access. Efforts to address the problem through a grain-led approach have not been very successful.

The principal R&T crops grown in Ethiopia are Enset (Ensete ventricosum), potato (Solanum tuberosum), taro (Colocasia esculenta), yams (Dioscorea spp.), anchote (Coccinia abyssinica), Ethiopian dinich (Coleus edulis), cassava (Manihot esculenta), tannia (Xanthosoma spp.) sweet potato (Ipomoea batatas) and air yam (Dioscorea bulbifera). Of these, anchote, ‘Ethiopian dinich’ and enset are indigenous to Ethiopia. Currently most of the root and tuber crops are grown as security crops and/or to bridge the food deficit months because of their ability to reach maturity during these ‘hunger months’. Most of them can thrive on very poor soils and in moisture stress conditions.

Research challenges
The major gaps that require research intervention in root and tuber crops production and use can be grouped into the following areas:

- Production technologies (Adaptable high yielding and good quality varieties; Improved agronomic packages; Good quality seed/planting material; Improved soil fertility and water management; Genetic resource conservation and utilization of indigenous root and tuber crops; Control of major diseases such as late blight and bacterial wilt of potato, bacterial wilt of enset, virus in sweet potato)
- Post harvest, processing and utilization (Storage, packaging and processing techniques; Information and awareness on different recipes; Appropriate processing equipment)
- Marketing and transportation (Market information and distribution system; Market linkages between producers and consumers)

Agricultural Technologies Developed by National Agricultural Research System, EIAR

- Release of potato, sweet potato, cassava and enset varieties.
- The development of integrated disease management technologies for the control of the major diseases.
- Average improved potato yields on-station (35 t/ha) and on farm (25 t/ha) compared to non-improved national average of 10 t/ha.

Availability of improved and high yielding varieties and other technologies will have very little impact without seed production technologies. Thus, multiplication of improved varieties and its dissemination with production packages are a critical aspect in the promotion of R&T technologies. In-vitro technology, combined with conventional practices, has enhanced the commercial production of disease free seeds, which is an important pre-requisite to maximize yields in potato. At HARC different RMTs have been in use for multiplication of healthy planting materials for potato producers in various parts of the country.

Capacities

- Modest Tissue Culture at Bahridar, Holetta and Areka
- Seven screen houses at Holetta
- Two screen houses –CIP - Holetta
- Three screen houses - Adet
- Cold storage - Minitubers, early generation and Germplasm
- Two aeroponic units at Holetta
- Modest irrigation facilities

Technology promotion and adoption
Participatory potato technology development and dissemination has been under taken in the Central Highlands of Ethiopia since 1998 using Farmers Field School (FFS); on farm variety adaptation trials; informal seed production through farmer participatory approaches; and trainings.
Why Quality Declared Seeds? Current Scenario on potato Seed production in Ethiopia

- The formal seed system in the country does not accommodate R&T Crops.
- Farmers use traditional mixture varieties, including local ones.
- There is a lack of consistent supplies of good quality planting materials, although there is high demand for clean R&T crop planting materials in the country.
- There is a lack of knowledge on phytosanitary measures and quarantine issues related to safe movement of germplasm, plants and planting material across borders.
- The planting material R&T is bulky and perishable.
- Temptations of farmers and traders to sell ‘Ordinary’ seed as ‘Quality’ seed is huge.
- High movement of potato seed from place to place as a result seed born disease such as BW could be transported/transmitted.

Recommendations

- Working in Partnership: avoids duplication of efforts and promote complementarities.
- Strengthening the capacity at all levels (Human power, Laboratory and Budget).
- Give emphasis to Quality Declared Seeds (Standards for disease and insect pest limits, Packaging, Prices, Marketing and Seed certification).
- Highly decentralized seed multiplication schemes allow farmers in remote areas to gain access to affordable quality seed.
- Quality seed needs to be clearly separated from ware potatoes through branding, labeling, and the creation of separate seed value chains.
- Increased seed storage capacity (DLS) contributes to the establishment of sustainable seed systems.
- Empower farmers through continuous training, follow up visits and M&E.
Presentation 3. Strategy to improve livelihoods of potato and sweet potato farmers by CIP Ethiopia

Potatoes and sweet potatoes are valuable for food security, providing more food per unit area and per unit of time than grain crops. (Potato: 216 MJ/ha/day; Sweet potato: 194 MJ/ha/day; Maize: 159MJ/ha/day; Wheat 135 MJ/ha/day). They mature before cereals and bridge the hunger gap months; providing highly nutritious quality protein, vitamins and micronutrients. They are also less affected by food price inflation, as they are not globally traded commodities.

CIP Projects
CIP in Ethiopia has 35 staff, 4 offices, 9 projects, a $4.2m annual turnover, and is 95% project financed. It takes a partnership approach working with 28 GOs, NGOs, Universities, IOs, and the private sector. Current projects:
1. Better Potato for a Better Life (BPBL) (2010-2016) - USAID, $11m
2. Nutrition and Health Project (2013-2016) Irish Aid, €2.1m
3. Africa Rising: Research in sustainable intensification for the next generation (2014-2015), ILRI, $0.4m
4. Sweet potato Action for Security and Heath in Africa-SASHA (Ethiopia component) (2014-2015), funded by Bill & Melinda Gates Foundation, $0.24m
5. Improved Soil Fertility Management for Sustainable Intensification in Potato Based Systems in Ethiopia and Kenya (2014-2017), funded by BMZ, €0.6m
6. CGIAR Research Program on Roots, Tubers and Banana, Potato breeding for Africa $ 233,225 annually
8. Trait observation and Discovery Network (2015-2017) with the support of GIZ, €65.270

Progress to date
- Over 15,000 HH with children under 5 years now increase their regular intake of OFSP and other vitamin A rich foods OFSP as part of a diverse diet.
- Two new products containing OFSP as a main ingredient are available in urban and rural markets.
- Since 1985, 30 CIP P varieties released by national system, grown on 26% of total P area (160,000ha) and since 2005, 2 CIP OFSP varieties released.
- Infrastructure for decentralized production of disease-free in-vitro plantlets of P established at ARC Holetta, Adet and Mekelle, and for SP at ARC Areka
- 2 aeroponics units and 3 screen houses annually produce 150,000 disease-free, generation 1 P minitubers
- More than 120 Farmer Cooperatives in SNNPR, Oromia, and Tigray produce quality planting material
- Around 170,000 HH reached with quality P seed tubers and 360,000 HH with quality SP planting material
- QDS informal seed inspection system for P & SP successfully piloted and approved by Ethiopian Standard Authority – roll out in SNNPR, Tigray, Amhara, and Oromia ongoing.

Our Vision for Ethiopia
- 400,000 households reached with OFSP (SO 1) in 4 regions
- 250,000 households reached with quality potato seed (SO 3) in 4 regions
- Vibrant private seed market (farmer-to-farmer & commercial seed producers)
- Informal seed inspection system (QDPM) functioning and self-financed in major seed production areas (SO 3)
- At least 12 and 6, improved potato and sweet potato varieties released and disseminated to farmers in all regions, respectively.

Lessons learnt
1. Quality control is required to prevent further spread of devastating diseases of major importance. Uncontrolled distribution of planting material of unknown quality led to spread of diseases into many regions – cases of Bacterial Wilt and viruses.
2. Decentralized seed production a “MUST” due to limited road network & high transport costs ($20 to $80 per ton per 100 km) but also to strengthen regional seed self-sufficiency and reduce spread of diseases.
3. Separate value chain for seed potatoes needed: Labeling, Seed quality control mechanisms & awareness creation about benefits of using quality seed (demonstrations, field days).
4. District / Zonal potato/sweet potato farmer organizations/representations needed.
5. Strengthening business & leadership skills of Coops (accounting, tendering, customer relations, conflict resolution).
Presentation 4: Lessons Learned from FAO Root and Tuber Crops Interventions in Ethiopia (2009 to 2015)

Despite recurrent drought, floods and pests, Ethiopia’s root and tuber crops growers have managed to improve food security and livelihoods through increased productivity and diversified feeding habits. In order to provide a conducive/enabling environment for resource-poor farmers to grow crops sustainably/profitably FAO has supported six root and tuber projects:

1. Food security support to 28000 vulnerable households affected by drought and soaring food prices in Ethiopia
2. Scaling up of root and tuber crops diversification in 15 woredas of Amhara, Oromia, SNPP and Tigray regions
3. Disaster risk management: Root and tuber crop intervention in SNNPR
4. Food security support to drought affected communities through emergency seed, vaccination and livestock feed in Ethiopia
5. Support to vulnerable households to improve food security through crop diversification and yield improvement in Ethiopia
6. Building Resilience of Pastoral and Agro-pastoral Communities in Afar Region

Implementation

- Participation of implementing partners and stakeholders: Project designing and planning; Implementation; and Monitoring and evaluation.
- Closely working with governmental and non-governmental implementing partners: Seed producers - Private and public; Research – EIAR, RARIs, Universities (Haromaya and Jimma)
- Institutional and human resources capacity building: Organize and support tailor made and hands-on skill trainings; Support and provision of materials for DLS construction; Organizing field days - crop fields; Demonstration - food preparation and value addition; Preparation of training materials and distribution to beneficiaries

Results

1. Distribution of high quality planting materials to food-insecure households;
2. Establishment of root and tuber crop nurseries and cooperatives to produce adequate planting materials;
3. Improved post-harvest management, value addition and product marketing; and
4. Capacity built of Government staff and the community to sustain and take forward root and tuber crop work.

Impacts on beneficiaries

- Increased agricultural production and productivity due to improved access to better varieties, production technologies, trainings and experience-sharing forums, like farmer field days and cross-site visits;
- Increased and diversified household income, with a significant impact on female-headed households;
- Notable shift in cropping patterns, from cereal-dominated subsistence farming practices to high-value, market-oriented cash crops;
- Farmer-to-farmer exchanges of planting materials of improved varieties allowed farmers to continue cultivating root and tuber crops even after the project was completed;
- Better, diversified diets and improved nutritional status among beneficiary households, as well as a change in beneficiary attitudes to nutrition and dietary values;
- Considerable increase in the production and use of nutritional products: orange-fleshed sweet potato which is rich in vitamin A;
- Improved knowledge base with a wider range of technical skills, and greater awareness on root and tuber crops in general and their significance in ensuring food and nutrition security in particular;
- Strengthened the capacity of beneficiaries, including DAs and experts of line Government offices through training, material support and exposure visits;
- Increased participation of the community and partners in all stages of operation, from needs assessment to project planning, implementation and monitoring.
Challenges in the implementation of the projects
1. Lack of local sources of high quality planting materials: for cassava and taro production there was a serious shortage of high quality planting materials;
2. Poor quality planting materials: due to a lack of local sources of planting materials, at times they have to wait for days before being planted and thus will lose much of their quality parameters;
3. Low capacity is one of the challenges constraining food security and economic development in general and R & T crops (human & institutional) in particular;
4. Limitations in technical competencies are particularly pronounced among newly assigned DAs and woreda experts;
5. Lack of technical expertise: as root and tuber crops were newly introduced to some of the project regions, the technical experts and DAs lacked the expertise to support beneficiary households to obtain maximum possible benefits from the crops.

Recommendations
1. Expand local capacity building activities, such as the establishment and strengthening of multiplication nurseries and post-harvest management facilities and techniques;
2. Improve capacity on integrating root and tuber crop production with water harvesting and management systems and dry season preservation of planting materials;
3. Strengthen wide-scale expansion of water-efficient irrigation technologies, such as household single-line, pot drip and family drip irrigation systems;
4. Promote intensive soil improvement methods, such as green manuring, composting and application of farmyard manure, along with root and tuber crop production;
5. Focus on integrating root and tuber crop production with nutrition;
6. Strengthen activities that are aimed at addressing the growing number of unemployed youth by engaging them in group root and tuber crop processing, value addition and petty trading, as well as hiring water pumps for irrigated production of the crops and providing repair and maintenance services;
7. Support producers’ cooperatives and other sources of clean and high quality initial planting materials by enhancing their capacity and business structure;
8. Promote farmer-to-farmer extension and exchanges of planting material;
9. Follow strategic approaches in providing trainings and cascading the knowledge to beneficiary communities to overcome the fast turnover rates of Government staff;
10. Enhance preparation and distribution of audio, visual and printed materials in local languages
11. More focus on women is needed since they play a critical role in sustaining projects.
Presentation 5: Experience of GRAD in the potato value chain

Graduation with Resilience to Achieve Sustainable Development (GRAD) is a five-year USAID funded project (2012-2016), whose objective is to graduate 50,000 chronically food insecure households from PSNP (Productive Safety Net Program) support and increase each household’s income by $365 per year. Its target group is 65,000 chronically food insecure households within 16 woredas of Oromia, Tigray, SNNPR and Amhara. The consortium lead is CARE Ethiopia; with REST, ORDA (Organization for Relief and Development in Amhara, CRS (Catholic Relief Services) and ASE (Agri Service Ethiopia) as the implementing partners. Technical assistance is provided by SNV and Tufts University.

Project background and activities
GRAD identified the potato as an important commodity for household consumption and for generating income. A potato Value Chain (VC) study was conducted for all four GRAD regions and validated with stakeholders. Some of the constraints identified were a shortage of improved potato seed, lack of knowledge and skill on agronomic practices, poor post harvest handling, and market linkages. To enable access to improved seeds, GRAD initiated and promoted community based potato seed multiplication using model farmers. In collaboration with researchers, three potato varieties (Belete, Jalenie and Gudenie) were promoted. Eight diffused light storage units (DLSs) were constructed in 4 woredas with community contribution. The DLSs were also scaled-up at individual level with 20 model farmers. Model farmers were used for demonstration and 1426 Qt of improved potato seed was distributed to 1200 ware potato producers.

Progress and results
Intensive training, mentoring and coaching was provided for both ware potato producers and seed multipliers. Farmers were able to produce a quality ware potato (80Qt – 300Qt/ha) that attracted the market. GRAD facilitated market linkages by engaging the private sector, for example the Balemlay Special Enjera and Food Flour Manufacturing Industry (BSEFMI) in Bahir Dar. The firm provided embedded services (training, logistics, information and sacks) and market access. Farmers started their value addition by sorting, grading and packing. The project provided financial support for the company to expand its processing capacity. Producers were organized into Farmers Economic and Marketing Association (FEMA) cooperatives. Two vegetable cooperatives were established in Lay and linked with BSEFMI. More than 7 MSPs were organized in each region where all stakeholders and actors came together bi-annually to learn, share and identify sector constraints and solutions.

The business-to-business linkage has increased income for potato growers. Over 3000 households in Lay Gayint woreda of Amhara were able to sell 85.7MT of potato in 2014, earning a total profit of ETB 171,400 (over US$8,300) from the production and marketing of potatoes. 40% of potato production is used for consumption and 60% for selling. The processing company has increased its daily potato consumption from 1,000 kg to 20,000 kg. The linkage has helped farmers to see the benefits of working with a reliable buyer and selling collectively.

Challenges and lessons learnt
• Lack of certification of seeds produced by farmers
• Traders/middlemen distorting the market linkages created with big buyers
• Cooperatives are not functioning to their full potential (led by volunteers)
• Limited involvement in processing/being dependent on fresh marketing
• Post harvest problems
• Market linkage didn’t happen as expected because of big volume and quality
• Technology transfer such as quality seed is key for a better quality product and improved productivity of potato
• Being organized as a cooperative and bulking of products attracts big buyers
• Potato can be an alternative crop for climate change adaptation.
ANNEXE 3

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