

Project number: 6200
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The Chenchu Potato project



Key external stakeholders:

Small holder farmers in Sub Saharan Africa, NGOs involved in agriculture and specifically seed potatoes, policy makers, potato scientific and economic community, seed potato industry

Practical implications for stakeholders:

Potato has multiple benefits for subsistence agriculture but in Ethiopia its productivity is still low often affected by disease, poor access to seed and inputs such as fertiliser and low soil fertility while not all farmers can access or utilise interventions equally due to resource constraints.

- Bacterial wilt is also one of the main constraints to potato production in sub Saharan Africa.
- Access to disease free seed and clean land is necessary to safeguard potato production and livelihoods.
- Farming practices are often unsustainable, low cost changes to systems can improve outputs.
- The farming community in Chenchu has very diverse needs often related to access to resources
- Social networks and family groups are important in dissemination of seed and other technologies.
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Main results:

- Discovery of a bacterial wilt epidemic (BW is one of the most destructive pathogens of potato in sub-Saharan Africa) in Chenchu and many other regions in Ethiopia which was being spread through seed.
- A better understanding of the effect of farming systems, practices and rotations on nutrient management to allow better management of inputs and manures to allow more sustainable practices.
- Understanding of farmer's demographics and practices within different social groups allows tailored interventions to better support their understanding and needs.

Opportunity / Benefit:

- Improved health and availability of seed potato and better understanding of how bacterial wilt spreads and control, measures by farmers.
- Improved agronomic practices to promote balanced soil fertility across farm holdings ,
- Recommendations for more sustainable farm systems and rotations to protect soils and increase sustainability
- Improved extension and technology interventions based on farmers understanding and ability to access inputs

Collaborating Institutions:

VITA

Wageningen University and Research, Centre for Crop Systems Analysis & Knowledge Technology and Innovation

University College Dublin, School of Agriculture and Food Science,

Teagasc project team: Prof. Rogier Schulte PI (Now at Wageningen University)
Dr Denis Griffin,
Mr Michael Hennessy, Dr John Burke,
Dr Seamus Crosse, Dr Lance O'Brien

Students

Abdulwahb Abdurhaman, Dr. Waga Derrseh,
Dr. Yennesh Tadesse, Ayano Teika

External collaborators: Prof. Paul Struik, Dr. Conny Almekinders, Wageningen University
John Weakliam, John Gilliland, VITA
Dr. Steffen Schulz, GIZ, Addis Ababa, Ethiopia (formerly CIP Ethiopia)
Dr Elmar Schulte Gelderman CIP Nairobi
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1. Project background:

The Irish NGO Vita has a long history of working with local actors to distribute healthy seed potatoes of new improved varieties (mainly introduced by the International Potato Centre CIP) to farmers. This can dramatically increase potato yield compared to local degenerated seed stocks. In 2011 a collaborative project between Teagasc, Wageningen University and the Irish NGO Vita to study seed potato systems in the Chencha Wereda in Ethiopia began. Three local PhD and one MSc students (Abdulwahb Abdurhaman, Waga Derrseh, Yennesh Tadesse and Ayano Teika) were recruited to work at the crop, farm and community levels to identify and solve constraints to production and develop further seed potato interventions. Many issues arose during the project period. Initial experiments to evaluate the effect of positive selection on seed health and degeneration rate of seed due to virus were quickly overcome by bacterial wilt, which dominated many aspects of the project not just at farm level but also at community level. During the period of the research the students were based in Chencha to undertake the work. At a workshop with farmers at the end of the project, findings were presented to local farmers to help improve their on-farm practices. Improved potato disease control strategies and local production of disease free seed, targeted extension packages tailored to farmers' situations, soil fertility management and rotation recommendations are amongst the outputs that will improve livelihoods in the region.

2. Questions addressed by the project:

The project specifically set out to:

- Improve the technological aspects of seed potato production systems, specifically with regard to seed health as affected by virus and bacterial wilt disease.
- Improve the agronomy and farm management of the farms that are part of the seed potato production systems
- Understand the societal context of seed potato productions, so that recommendations for improved practices are of relevance and applicable to the subsistence farmers
- Understand how well do farmers understand bacterial wilt, and are they willing to engage in actions to control the disease.

3. The experimental studies:

Three PhD and One MSc candidates carried out collaborative research focused around the potato crop at different intervention points.

- 1) Seed potato systems, by experimentation at the farm level on seed improvement technologies such as positive selection and subsequently molecular characterization to trace BW? sources.
- 2) Farming systems, by characterizing farm practices, crop rotations, soil fertility and land and labour availability.
- 3) Development interventions. Comprehensive household surveys, in depth interview with beneficiaries and focus groups discussions to understand the impact and uptake of seed distribution interventions at the community level and Seed cooperatives.
- 4) Knowledge transfer. Focus group and one-to-one interviews to explore farmers understanding of bacterial wilt including management practices and willingness to engage with community initiatives to prevent the disease.

4. Main results:

The study on seed systems focused on the use of positive selection to improve and maintain health of seed stocks in the region primarily by selecting disease free plants for the following season's seed stock. However it soon became apparent that bacterial wilt caused by *Ralstonia solanacearum*, was endemic in the region which causes serious yield losses in ware crops but also the loss of seed or severe disease and spread in the following drop if seed is used). The focus of the study changed to the history of the recent disease outbreak of bacterial wilt, in Chencha and beyond. Bacterial wilt had reached epidemic proportions in a very short time, coinciding with large-scale introductions of seed potatoes. Using molecular techniques the origin of the infection was traced to latent infections of seed potatoes from the Central Highlands disseminated across Ethiopia. We recommend community-based bacterial wilt management strategies and rigorous testing of the seed system.

The study on farming systems assessed production constraints and the agronomic and socioeconomic sustainability of existing systems. It also explored synergetic solutions to alleviate constraints and to expand potato cultivation. Sustainability was strongly constrained by poor soil fertility, low labour efficiency and low economic return. Crop rotation, soil fertility management, and other farm practices were inefficient. Looking ahead, a reconfiguration of farm management is needed. While constraints and possible solutions varied across households; advisory models need to be pluriform to adapt to farmers ability to access and utilise inputs and technology.

In the third study, the success of interventions was found to be largely dependent on whether farmers have the capacity and infrastructure to adopt the new technologies offered. Dissemination of high-quality seed of improved varieties flowed from rich to poor farmers, based on social relationships. The positive impact of interventions on farmers' livelihoods varied depending on existing farm resources and households' priorities. The overall insight of this study indicates that wealth status and diversity of household strategies are important factors in the design of agricultural technology interventions. In addition, the study found that farmer's cooperatives for marketing seed potato focused more on improving the members' seed potato production capacity and less on building good governance in the seed chain. The experiences showed the tensions between prescriptive rules, collective action and individual interests, which made it very hard to maintain quality seed standards and friendship at the same time.

Results from the fourth study (MSc) highlighted that communities are aware of bacterial wilt, but many struggle to identify the disease in the field and are unsure how to manage bacterial wilt, both on their own farm and within the community. As this disease is difficult to eliminate, participants did show a willingness to engage in collective action to combat bacterial wilt. The research also indicates that women and poorer farmers will need more help during collective action, and will benefit from a specifically targeted training approach

Further detail on recommendations and findings are available in the publications and theses from the project listed below.

5. Opportunity/Benefit:

This project has provided insight into many aspects of Potato Production in the Chencha region of Ethiopia which is representative of many other highland regions in Ethiopia. The Project has highlighted an epidemic of Bacterial wilt across many regions of Ethiopia transmitted through seed and has provided options for the local production of seed on virgin land. The project has also highlighted many farming practices that can be altered to benefit sustainability such as improved crop rotations and better management of animal manures and fertilisers on farms to balance soil fertility. In addition the project has sought to understand how farmers interact with new technology and interventions such as dissemination of seed of improved varieties and the formation of seed cooperatives. It is clear that relationships and socioeconomic group have a significant impact which may allow better targeting, continual evolution and tailoring of interventions in the future to different demographic groups of farmers to ensure better outcomes for all.

6. Dissemination:

Main Publications

Collective Production and Marketing of Quality Potato Seed: Experiences from Two Cooperatives in Chencha, Ethiopia (2019). Tadesse, Y., Almekinders Griffin D., & Struik, P. C. *Forum for Development Studies* DOI: 10.1080/08039410.2019.1635523

Potatoes and livelihoods in Chencha, southern Ethiopia. (2019). Tadesse, Y., Almekinders, C. J. M., Schulte, R. P. O. & Struik, P. C. *NJAS - Wageningen Journal of Life Sciences*. 88, p. 105-111

Agronomic and socioeconomic sustainability of farming systems: A case in Chencha, South Ethiopia. Dersseh, W. M., 2017, PhD Thesis. Wageningen University. 157 p.

Making interventions work on the farm: Unravelling the gap between technology-oriented potato interventions and livelihood building in Southern Ethiopia. Tadesse, Y., 2017, PhD Thesis. Wageningen University. 120 p

Assessing extension approaches for bacterial wilt control with potato farmers in Ethiopia. Ayano Teika 2016, MSc Thesis. University College Dublin. 63 p.

Molecular characterization of *Ralstonia solanacearum* strains from Ethiopia and tracing potential source of bacterial wilt disease outbreak in seed potatoes. (2017) Abdurahman, A., Griffin, D., Elphinstone, J., Struik, P. C., Schulz, S., Schulte-Geldermann, E. & Sharma, K. *Plant Pathology*. 66, 5, p. 826-834

Tracing the seed: seed diffusion of improved potato varieties through farmers' networks in Chencha, Ethiopia Tadesse, Y., Almekinders, C. J. M., Schulte, R. P. O. & Struik, P. C., 2017, In : *Experimental Agriculture*. 53, 4, p. 481-496

Understanding farmers' potato production practices and use of improved varieties in Chencha, Ethiopia Tadesse, Y., Almekinders, C. J. M., Schulte, R. P. O. & Struik, P. C., 2017, In : *Journal of Crop Improvement*. 31, 5, p. 673-688

The farming systems of potential potato production areas of Chencha, southern Ethiopia. Mazengia, W., Schulte, R. P. O., Tadesse, Y., Griffin, D., Schulz, S. & Struik, P. C., 2015, *Potato and sweetpotato in Africa : Transforming the value chains for food and nutrition security*. Low, J., Nyongesa, M., Quinn, S. & Parker, M. (eds.). Cambridge: CABI, p. 382-396 15 p.

Popular publications:

Sustaining the 'Irish potato' in the Ethiopian highlands. (2015) Schulte R. Crosse S. and Griffin D. *T Research* Vol. 4 No 10 pp7.

The Ethiopian highlands: fertile ground for seed potato production? Abdurahman, A., Griffin, D., Schulz, S. & Struik, P. C., *T Research* Vol. 4 No 10 pp 8-9.

Making the potato work on subsistence farms. Mazengia, W., Schulte, R. P. O. & Struik, P.C. *T Research* Vol. 4 No 10 pp 10-11.

Putting technology into practice: understanding the adoption of best practices Tadesse, Y., Almekinders, C. J. M., Schulte, R. P. O. & Struik, P. C. *T Research* Vol. 4 No 10 pp 12-13.

Making science work on smallholder farms. Gorman, M. & Hennessy M. *T Research* Vol. 4 No 10 pp 14.

Breaking new ground – creating synergies between science and development. (2015). Gilliland J. & Burke J. *T Research* Vol. 4 No 10 pp 15

The Chencha project workshop, presentations given by the students to local farmers, Extension workers and Vita staff in Chencha. July 2015.

7. Compiled by: Denis Griffin