



Strengthening Seed Systems to Spread Sweetpotato's Benefits

Beyene Demstu is a researcher based at the Mekele Agricultural Research Institute, Tigray Region, in northern Ethiopia. For much of his 20-year career, he has focused on the use of biotechnology and tissue culture to accelerate the breeding of highland legumes, wheat and barley, but in 2012, he began working with sweetpotato. He is now convinced of the value of promoting sweetpotato, especially vitamin A-rich, orange-fleshed varieties.

“Sweetpotato is very new to my region but it has a very big potential. Malnutrition of children under five years is 30-40% and most of it is vitamin A deficiency. With sweetpotato, you can feed the children and improve their nutrition status,” Demstu said.

Sweetpotato is an important food security crop in much of Sub-Saharan Africa (SSA), and orange-fleshed sweetpotato (OFSP) is a vital source of beta-carotene, which is converted into vitamin A in the body. OFSP can thus prevent the blindness, disease, and premature death that commonly result from vitamin A deficiency in SSA. But the crop's potential is often diminished by a lack of sufficient and timely access to disease-free, or ‘clean,’ planting material.

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The quickest way to grow sweetpotato is to plant vine cuttings, but preserving vines or the roots they sprout from until the next planting cycle can be a major challenge for smallholders in SSA, especially in regions with long dry seasons. Once vines are planted, the plants are commonly attacked by whiteflies and aphids, which serve as vectors for sweetpotato viruses. Those viruses accumulate from one planting cycle to the next, significantly reducing yields.

In an effort to strengthen the research and development interventions to help farmers deal with such challenges, and facilitate the dissemination of quality planting material, CIP has coordinated the creation of a 'seed systems community of practice' for sweetpotato in SSA.

Demtsu is an active member of that community of practice (CoP), and is collaborating with CIP to do research on methods to increase the multiplication rate of sweetpotato, so that there is more clean seed to reach more households. "All I do is to try and assist farmers to get clean planting material."

The seed system CoP was officially launched in April 2014 at a meeting of approximately 40 specialists from across Africa held in Entebbe, Uganda. By the end of 2015, the CoP had grown to include 120 members from SSA, Europe, USA, and Peru, most of whom participate virtually, via a Google discussion group. Meetings have also been held in Kigali, Rwanda in May 2015 and in Nairobi, Kenya in December 2015.

The CoP allows scientists to exchange knowledge and experiences of challenges and lessons related to sweetpotato seed systems. Demtsu explained that he has already gained useful knowledge of biotechnology and sweetpotato from colleagues in the community. "I do not have to reinvent the wheel; I just listen and learn from those who have more experience and knowledge," he said.

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CIP organized the CoP under the Sweetpotato for Profit and Health Initiative: a 10-year, multi-donor initiative that seeks to reduce child malnutrition and improve smallholder incomes through the effective production and expanded use of sweetpotato. This initiative is a partnership mechanism of CIP's Resilient

Nutritious Sweetpotato Program. The CoP was initiated with funding from the Bill & Melinda Gates Foundation, but many organizations are now involved in it, including national institutions, NGOs, and the private sector.

One of the major challenges that participating scientists are working on is how to ensure the survival of planting material in areas with extended dry periods. A root-based vine multiplication system called Triple S (Sand, Storage and Sprouting) is being tested and promoted in Uganda, Tanzania, and Ethiopia. Normally, it is the task of women farmers to keep a small plot of sweetpotato irrigated through the dry season to ensure the survival of vines for planting in the next season. With the Triple S system, farmers store small roots in sand during the dry season and then plant them in seedbeds six to eight weeks before the rains are expected. Once they are watered in the seedbed, the roots will sprout and provide cuttings to plant when the rains begin.

When new technologies such as Triple S are tested and validated, researchers specifically look at the resources they require, who has those resources, and what specific factors could assist or hinder their uptake by different types of farmers, including youth and women. For Triple S in particular, women in Tanzania commented that they liked it because they could be confident that they would have planting material, and know exactly when they would have it, rather than having to look for it when the rainy season begins.

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Another major challenge is protecting healthy plants from the whiteflies and aphids that are responsible for spreading sweetpotato virus diseases. A low-cost net tunnel technology has been developed and promoted among vine multipliers who sell sweetpotato planting material to farmers. This technology has been

implemented successfully in Rwanda's Rulindo and Kamonyi Districts, which CoP members visited following the meeting in Kigali in April 2015.

The Kigali meeting was opened by Dr. Jean Jacques Muhinda, Director General of the Rwanda Agriculture Board. He commended the researchers from his institution, the other national sweetpotato programs, NGOs, and CIP for their work on developing a clean seed system for sweetpotato. "I urge you to benefit from this annual consultation and I trust that you will take back ideas to your own country communities to test and put into practice for the benefit of sweetpotato farmers across Sub-Saharan Africa," he said.

This kind of encouragement, commitment, and support from the public and private sectors will be critical in the development of effective sweetpotato seed systems. For members of the CoP, such collaboration not only helps to drive up demand, it also facilitates the implementation of effective delivery channels that will put clean seed in the hands of farmers when they require it.

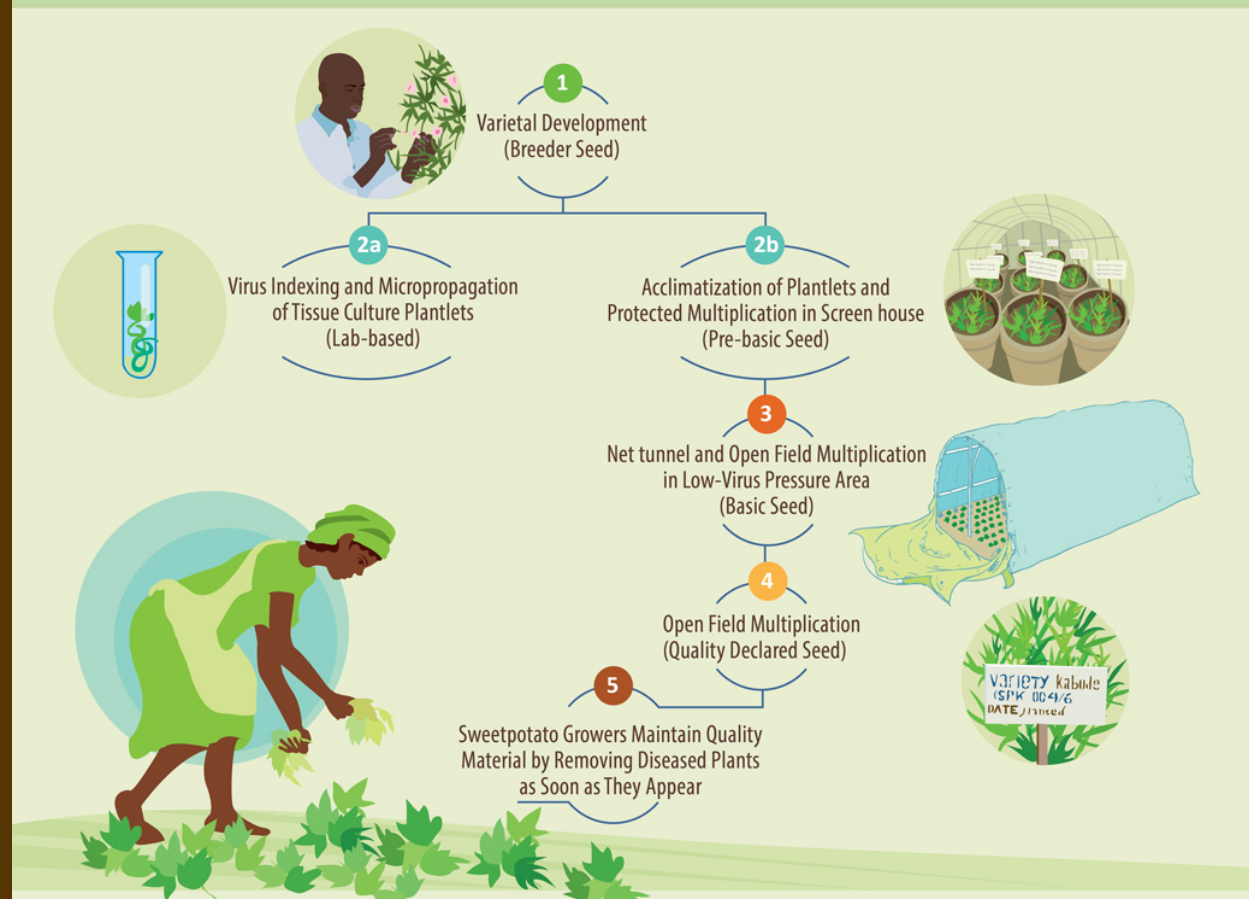
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Quality Seed: the Basis of Better Potato and Sweetpotato Production

Schematic of sweetpotato seed system



Creating viable systems for multiplying and distributing potato and sweetpotato seed in developing countries is vital for getting improved varieties out to farmers, and to help increase their yields. Because potato is propagated by planting tubers, and sweetpotato by planting vine cuttings, there are problems associated with planting material – commonly called seed – that can become major constraints for smallholders. Compared to true seed, sweetpotato vines and seed potatoes are perishable, creating storage challenges, and their

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multiplication rates are low. There is also a high risk of viruses accumulating in plants and passing from one planting cycle to the next via seed, which can result in major yield losses over time. Studying the factors involved in seed degeneration of vegetatively propagated crops has been a priority of CIP as part of research sponsored by the RTB program. Understanding these factors helps to design technologies and approaches to slow down degeneration and maintain seed quality for more cropping seasons, which benefits farmers directly.

CIP has developed successful technologies for producing and multiplying disease-free planting material that have been transferred to developing nations. It works with partners to design seed systems that are appropriate for local conditions, and that allow smallholders to participate in, and benefit from, the dissemination of improved varieties. CIP also promotes training in on-farm practices such as positive selection, which allow farmers to limit the negative impact of pathogens. Seed systems play an important role in CIP's efforts to tap the full potential of potato and sweetpotato to improve food security, diets, and incomes around the world.

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Ecuador Launches National Effort to Improve Potato Production

In a massive greenhouse near Sangolquí, southeast of the Ecuadorian capital of Quito, the National Agricultural Research Institute (INIAP) is producing tons of seed potatoes using aeroponics and other rapid propagation technologies. That greenhouse is the epicenter of an ambitious government effort to improve potato production by expanding farmer access to certified, disease-free seed. The idea for this innovative undertaking grew out of a training course that CIP and INIAP organized several years ago, and CIP has continued to provide technical backstopping and other support as the government develops a strategy to boost potato production across Ecuador.

Most of the approximately 85,000 farmers who grow potato in that Andean nation are smallholders who own less than five hectares of land. Ecuador's average potato yield is well below that of neighboring countries – 9 tons/hectare compared to 14 t/ha in Peru and 19 t/ha in Colombia. According to Javier Jiménez, INIAP's Director of Technology Transfer, a major cause of this gap is that Ecuadorian farmers commonly plant seed potatoes that are contaminated with pathogens, which decrease yield and potato quality.

Jiménez explained that although the Ministry of Agriculture, Livestock, Aquaculture and Fishing (MAGAP) has had a program for certifying disease-free seed potato in place for decades, the vast majority of farmers continue to purchase seed potatoes in informal markets or save part of each potato harvest for planting. He noted that farmers often use the smallest potatoes for seed, because they are worth less on the market, but those potatoes are usually infected with pathogens that will compromise their next harvest.

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“The challenge on a national level is to be able to offer quality seed in a timely manner and in the quantities that the country’s farmers require,” said Jiménez.

To meet this challenge, the government has set a goal of increasing the supply of certified seed by more than 600% in order to expand the area planted with disease-free seed to 15,000 ha – approximately 30% of the area dedicated to potato in Ecuador – by 2018. Crop scientists expect that this will increase potato yield by 25%.

Jiménez explained that INIAP has collaborated with CIP on the development of a two-pronged approach to reaching these goals: ramping up the supply of certified seed potato using the latest rapid propagation technologies, while helping MAGAP extension officers teach farmers ‘positive selection’ – an on-farm method for selecting healthy potatoes to use as seed in the next planting cycle.

“Given what a major constraint low quality seed is for Ecuador’s farmers, it’s a relief to see the government prioritize potato and invest heavily in an integrated approach to improve farmers’ seed quality,” said Peter Kromann, CIP scientist based in Ecuador.

Kromann explained that the idea for the initiative was born during a CIP-INIAP course on aeroponic systems held between 2011 and 2012, but it has become a reality thanks to a major commitment by the government. Ecuador’s President Rafael Correa signed an executive decree last year calling for a vast increase in the amount of land planted with certified seed potato, and he inaugurated the INIAP aeroponic greenhouse last July.

CIP has been testing and promoting aeroponics – a system for propagating plants in chambers bathed in a mist of water and fertilizers – for potato since 2006, and introduced the technology in Ecuador in 2008. Aeroponic systems can produce more potatoes faster than planting seeds in the ground, and they make it easier to ensure that the resulting tubers are disease free. CIP has

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consequently promoted the use of aeroponics for potato seed in ten countries to date.

Jiménez explained that most of INIAP's 2.2-hectare greenhouse in Sangolquí is dedicated to aeroponics, but potato seed is also being produced there using hydroponics and by planting sections of vines from disease-free mother plants. By early 2015, INIAP had produced 22 tons of seed potatoes using aeroponics and other rapid propagation methods, but that seed needed to be multiplied in the ground in order to produce enough certified seed to supply all the farmers that the MAGAP aims to reach. INIAP works with a network of 16 certified seed multipliers – private farms, farmer associations, and public institutions – that have undergone training and are registered with MAGAP and which sell the seed they produce to the ministry for distribution.

“We have worked with CIP in the design of a system for getting the seed we produce in the greenhouse to the farmer,” said Jiménez.

One of the most experienced seed multipliers in the network is a consortium of farmer associations called CONPAPA, which was founded more than a decade ago with support from CIP and INIAP. Luis Montesdeoca, the administrator of the CONPAPA branch in the province of Tungurahua, explained that 13 of the group's 70 active members are certified potato seed multipliers. They sell the seed they produce to CONPAPA, which in turn sells to its members and MAGAP. Since CONPAPA has been multiplying and distributing clean seed to members for eight years, those farmers provide an example of the importance of clean seed; they produce an average of 14-15 tons/ha, compared to the national average of 9 tons/ha.

“We have improved productivity in every sense: we are producing greater quantities of potato, we have greater control and, primarily, we've eliminated the mixing of varieties, which was a big problem,” said Montesdeoca. He explained that the ability to produce a consistent quality of potato allows CONPAPA to supply processors of frozen french fries for restaurants, which pays better than

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fresh potato markets. With help from CIP, some CONPAPA members are now producing native potato varieties for a company that produces gourmet potato chips, which pays an even higher, fixed price.

In hopes of producing more such success stories across Ecuador, CIP and INIAP have collaborated on the development of a curriculum to help MAGAP extensionists train farmers in the multiplication of seed and the selection of healthy seed potatoes from their harvests, and are working with MAGAP on a strategy for scaling out the multiplication and distribution of certified seed.

“If INIAP reaches its goals, the country will be able to increase its potato production, food security, and farmer income,” said Kromann. “This initiative could serve as an example that inspires increased governmental investment in potato in other countries.”

“CIP has played an important role in the design of the strategy; CIP colleagues have accompanied us in meetings with the minister or other actors, and they are helping us to design the structure of a system for the production and use of potato seed,” observed Jiménez. “I think the experience that CIP has shared with us, and the advice and recommendations have helped us a lot.”

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