A new method for estimating sweetpotato early generation seed requirements to supply commercial and institutional markets

- A user-friendly tool to estimate the requirements for Early Generation Sweetpotato Seed (EGS) is now available for use by public sector seed producers.
- The method was first used in Uganda to estimate the seed requirement by root producers for quality seed of improved varieties; then estimates of the number of basic seed multipliers this will require; and finally, the amount of pre-basic cuttings and tissue culture plantlets to be produced.
- Results indicate a need to treble the existing pre-basic seed production capacity; decentralize pre-basic screenhouse capacity to get broader national coverage; improve screenhouse design and utilization to increase efficiency and reduce the cost of pre-basic seed production.
- Scaling EGS production and linkages through the chain will only be successful if there is an expansion in the root markets driving demand for quality seed.

SASHA Sweetpotato Action for Security and Health in Africa

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Fig 1. Pre-basic seed production by NaCRRI, Uganda (Credit: M. McEwan)

What was the problem?

Sweetpotato is a vegetatively propagated crop. Farmers often re-cycle seed from the previous season or source seed from neighbouring farmers for free. This means that private breeders and seed companies cannot benefit from investments they might make in breeding. This may change in the future. Currently National Agriculture Research Institutes (NARIs) hold monopoly status in the majority of sub-Saharan Africa (SSA) countries for breeding, multiplication of improved varieties and delivery to the next level of the seed producers who then supply quality planting materials to root producers. However, NARIs face challenges in correctly estimating the required amount of sweetpotato EGS every season due to lack of information on adoption of improved seed and varieties by farmers and the negative effect of farmers' use of planting materials of unknown health status. This makes it difficult for NARIs to fully sustain their EGS business. Although there are several theoretical frameworks to measure demand for quality seed, these tools are academically-oriented, and do not help NARIs to plan their seasonal EGS production cycles.

What objectives did we set?

The major objective was to develop a national level seed requirement estimation tool for use with country specific multiplication calendars, to help NARIs plan efficiently for the EGS production cycle every season. The tool will be fully programmed and automated so that once required indicators are filled, the tool can automatically provide the national EGS requirement for the current and future seasons. The sub-objectives of this tool were: i) to estimate seed requirement quantity at various stages of the seed value chain (i.e., tissue culture (TC) plantlets, pre-basic, basic and quality seed); ii) to develop a user-friendly tool interface for use by public sector EGS producers; iii) to enable EGS producers to plan their multiplication cycle efficiently and thus, avoid economic losses due to unsold seed.

Fig 2. Basic seed production at Abi Zonal Agricultural Research and Development Institute, in north-western Uganda. Decentralised production of quality seed will be critical for successful scaling (Credit: M. McEwan)

What did we achieve during SASHA Phase 2?

Currently this tool has been used in Uganda. The user can make explicit assumptions for the following parameters to determine the EGS seed requirement:

1. Estimated adoption rate of improved varieties by farmers in the field. This country-specific information can be obtained through secondary data (i.e., FAO, household surveys, literature review), stakeholder meetings, expert opinion, ICT platforms. This step should be completed by crop specialists and research and development R&D experts.
2. The area under improved varieties of sweetpotato is projected based on the estimated adoption rate and forecasting models. The forecasting models are based on historical trends (FAO data) and then adjusted for seasonal effects and other shocks.
3. The seed replacement rate (the number of seasons after which farmers purchase fresh seed of the variety that they are using). This information is obtained from survey reports or expert opinion.
4. Proportion of purchased seed. When a farmer is planting a plot s/he may not purchase all the seed planted. A combination of own saved seed planted in a small area, then extended by taking cuttings from the initial plot and with purchased seed may be used. This will be estimated based on survey data or expert opinion.
5. The seeding rate (amount of seed/plant population per ha) is included.
6. The multiplication rate, number of harvests, seasons, and wastage is accounted for at each stage of EGS production, and then through the seed value chain.

The tool incorporates three seed production systems in use by basic seed multipliers in Uganda: i) the conventional method on ridges or mounds where both vines and roots are produced; ii) rapid multiplication technologies using short cuttings and close spacing on seed beds; and iii) a combination of conventional and rapid multiplication technology production methods.

In Uganda, we estimated that the requirement for quality seed of improved varieties by root producers will increase from 74.6 million cuttings in 2018 to 124.7 million cuttings in 2023. This will require between 100-200 basic seed multipliers, depending on whether the main market segment is smallholder root producers; or where there is a high market demand from institutions purchasing seed. We have used this figure to work up the seed chain to estimate the quantity of basic seed, pre-basic cuttings and tissue culture plantlets required. It is estimated that 1,793 TC plantlets are needed to produce 111,757 pre-basic cuttings per year. Currently, EGS producers have capacity to produce 30,000-50,000 pre-basic cuttings, which requires 500 TC plantlets. Thus, there is the need to treble the existing capacity; decentralize pre-basic screenhouse capacity to get broader national coverage; improve screenhouse design and utilization to increase efficiency and reduce the cost of pre-basic seed production.

Where there any key challenges or lessons learned?

- Several assumptions were made during the calculation which require strong justification with scientific evidence-based data. When not available, experts' opinion can be obtained through key informant interviews or stakeholder consultations until new findings become available.
- Currently this tool has used a linear forecasting model for assessing the area under sweetpotato for estimating seed requirement. However, other forecasting models exist using time series analysis, which could capture seasonal effects, shocks in the trend and other interventions.
- Often demand estimation models provide results for a particular season, year or with field-based studies (willingness to pay), for a specific context. However, EGS producers need estimates on a rolling seasonal basis requiring a dynamic rather than static approach.
- The tool must be user-friendly for public and private sector actors to determine seed requirement estimates on a regular basis.

What's next?

- Extend use of tool to other countries and for the seed of other root, tuber and banana crops.
- Several forecasting models will be used to understand seasonal effects and other uncertainties or risk factors that need to be included in the tool.
- Assumptions will be updated through systematic review of new data, key informant interviews with experts and stakeholder meetings.
- This tool will be fully programmed so that minimum effort will be needed to estimate EGS requirements by public sector actors every season.

Contact

Srini Rajendran, CIP-Kenya • srini.rajendran@cgiar.org
Margaret McEwan, CIP-Kenya • m.mcewan@cgiar.org

Partners • National Crops Resources Research Institute (NACRRI)

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