

Selecting the best plants to improve seed potato

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The potato is an important food crop in the highlands of Kenya. It is mostly grown in agro-ecological zones more than 1500 metres above sea level, where population density and pressure on agricultural land is high. Potatoes are used for local consumption and are sold in rural and urban markets. A major problem in smallholder potato production in Kenya is that many seed potatoes, the material for planting a new season's crop, carry viruses and/or bacteria. In the growing plants, these viruses and bacteria can cause wilt, which leads to lower yields. In the past, interventions to tackle this problem have focussed on specialised commercial seed producers who make healthy seed potatoes available. These are purchased mostly by the large-scale potato farmers. This approach, therefore, has had a very limited impact on the quality of seed potato used by smallholder potato farmers. As a result, high quality seed potatoes are not easily available to small scale farmers. Varieties released by research centres are made available only in limited amounts and are expensive. Therefore, the majority of farmers continue using seed potatoes which they save from their last crop. When they do not have enough seed from their own crop, they may buy seed from neighbours. Alternatively, farmers may plant potatoes that they buy on the market, which were sold for consumption rather than seed.

Build-up of diseases

The main problem with re-using vegetative planting material year after year is the build-up of virus diseases: in potatoes, these are transmitted through the tubers. Potato farmers in Kenya only renew their planting material, on average, once every six seasons. It is estimated that only four percent of all seed potato planted during a season comes from specialised seed growers. A recent survey of seed potatoes, sold in rural markets in the main potato areas in Kenya, showed that less than one percent of all seed checked was virus free. Potato Leaf Roll Virus and Potato Virus Y, which are the viruses causing the most serious yield losses, were found in over 70 percent of the seed tubers sampled in this survey. Considering this, it is clear that a completely different approach in potato production systems is required. Instead of focussing on upgrading the quality of planting material through specialised seed growers and on improving the poorly developed seed markets alone, attention should also be paid to enhancing the quality of farmer-saved seed potatoes. As the latter accounts for 96 percent of the potatoes planted in Kenya, any improvement in the quality and vigour of home produced seed would have a tremendous impact on crop production.

Positive selection

A few years ago, a technique known as "positive selection" was suggested by the International Potato Center (CIP) as a possible option for increasing the vigour of smallholders' seed potato. Positive selection means selecting only the healthy-looking



Photo: Peter Gildemacher

Before positive selection techniques were introduced, potato plants in farmers' fields often showed multiple symptoms of infection by viruses and bacteria.

mother plants, showing good production characteristics, for seed collection. Positive selection is well known for both increasing and maintaining seed quality in cross pollinating crops that are reproduced through botanical seed. This technique has resulted in landraces of many crops that are well adapted to the circumstances under which they are selected. In potato farming, however, positive selection will not result in new landraces, as it is vegetatively propagated, but it can help in fighting crop degeneration caused by seed borne diseases.

In 2004 and 2005, positive selection was successfully pilot-tested in Kenya by smallholder potato growers in Narok district. Over the next two years, CIP, in collaboration with the Kenya Agricultural Research Institute (KARI) and the Ministry of Agriculture, trained over 100 extension agents and farmer-trainers on all aspects of positive selection, including broadening their background knowledge on potato pest and disease management. "The training was a real eye-opener, we never knew that most of our potato plants were sick" said Michael Macharia, who was trained in May 2005. "This technology responds directly to the needs of our potato farmers because they have no access to clean seed."

Introduction to farmers

After this training, plans were set in motion to introduce the positive selection technique to farmers. The extension agents and farmer-trainers in turn worked with more than 70 farmer groups involving some 1200 farmers. A participatory research approach was used, where a demonstration experiment formed the core of the training curriculum. The potato field was the classroom, learning by doing was the mode of teaching, and group interaction was considered crucial for building knowledge.

With the single focus of improving the quality of seed potatoes, farmer groups would meet regularly during two subsequent cropping seasons, for a total of eight training sessions. Groups of farmers are first shown how to distinguish between sick and healthy plants in a potato field. This field is then divided into two plots. On one of these plots, healthy looking plants are pegged just before flowering, and then checked again for health and vigour two weeks later. Potato plants that are still pegged after this second check are harvested one by one, and only those plants with a satisfactory number, size and quality of tubers are

maintained as mother plants for seed. In the other plot, seed potatoes are selected following the common farmer practice. In the next season, tubers from both selection methods are planted separately in a farmer managed trial and farmers score the disease incidences in both plots. After holding a field day to demonstrate the positive selection technology to other farmers, the potatoes in the experiment are harvested and the results are analysed by the group.

Promising results

Potato yield from these trials increased, on average, by 28 percent. The positive selection method yielded an average of 14.2 t/ha, compared to 11.8 tonnes per hectare using seed potatoes selected the way farmers commonly do. A lower incidence of virus and bacterial wilt symptoms on plants was visible in the plots with positive selection, compared to the plot where the common farmer selection practice was used.

Two years after the first training, a survey showed that over a quarter of the farmers trained have adopted the positive selection method on their farm. These farmers claim to have more than doubled their yields since they were introduced to this technique: "I have done positive selection for three seasons and it has doubled my yields. I expect to harvest 20 bags of potatoes from this 1000 m² plot (corresponding to about 22 t/ha). Fellow farmers are now coming to me to buy seed potatoes as they have seen it is better than what they have. My last crop looked so good that thieves came during the night to harvest..." recounts Mr. Wainaina Njoroge, a member of the Pagima Farmers Group in Naivasha district. A researcher from KARI's national potato research centre in Tigoni, Limuru, adds: "We have indeed witnessed several cases of theft from fields where farmers had planted seed following the positive selection process. This is of course not nice, but it is maybe a good indicator that the results of this selection method are appreciated by many".

Some farmers who have now practised positive selection continuously for several seasons have observed that there are progressively less sick plants in their fields. As a result of the positive selection most plants look healthy after some selection cycles and at that stage it becomes easier to peg the unhealthy looking plants instead. The tubers harvested from these plants can then be used for own consumption, or sold on the market. Some farmers went even further than this and decided to remove the few sick plants as a possible source of infection.

Prospects for scaling up

The Kenyan potato farmers participating in this programme have shown that positive selection makes a valuable addition to commercial production of seed potatoes, in fighting declining yields that are attributed to low seed quality. The training programme has improved farmers' awareness about seed potato degeneration as a result of viruses. The participating farmers also know more about bacterial wilt management and other agronomic practices that can lead to improved yields.

Potato farmers can now choose to either buy commercial seed potatoes or practise positive selection. Although the positive selection technique does not require any cash investments, it does require an extra five days of labour per hectare of potatoes. For the more commercially oriented farmers it may, therefore, still be more lucrative to invest in commercial seeds. Many smallholder farmers, however, find it better to put some extra time into selecting their planting material, than buying seed potatoes. Eventually, small farmers should find a balance

between renewing their planting material once in a while (by obtaining it from a reliable commercial source) and keeping the quality of their seed potatoes high through positive selection.

The positive selection training programme in Kenya was evaluated and improved based on comments from the participating farmers, farmer-trainers and extension workers. CIP has published a manual on the positive selection technique for trainers, a picture book on potato diseases for use by the trainer in the field and a farmer leaflet in English. The farmer leaflet has limited text and is thus very suitable for translation into local languages. CIP also hopes to translate other publications so that they are available for facilitating the training of smallholder potato farmers on this low input technology in non English speaking countries.



Photo: Peter Gildemacher

For positive selection of mother plants, farmers look for vigorous plants in their fields and pinpoint these using pegs or stakes.

At the same time, CIP is studying the approach of developing the positive selection technique with farmers, assessing its potential for addressing the problem of low quality seed potatoes in other countries. Trials are currently being done with farmers in Ethiopia, Uganda, Peru and India and the technique is also being promoted in Mozambique and Malawi. ■

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