

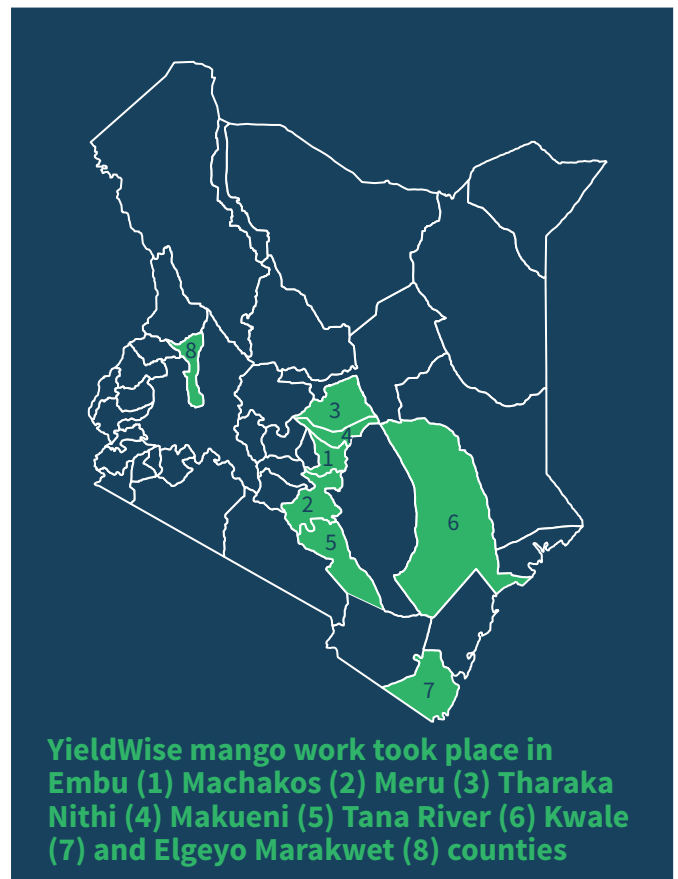
Making Mangoes Count



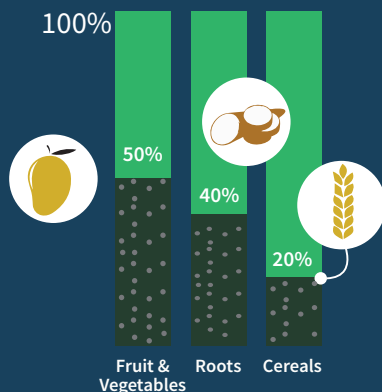
Kenya

At the beginning of 2017, as in most years, favorable weather led to a bountiful harvest in Embu, Machakos, Taita Taveta and other mango-growing regions in Kenya. For four blissful months between December and March while the mango season lasted, the juicy, colorful fruit was available for sale in many towns and villages – in markets and supermarkets, on pavements, in roadside stalls, and even in open car boots. Business boomed for mango traders as they ferried their cargo from farms to different parts of the country. But while consumers were enjoying the sweet abundance at good prices, many mango farmers were in despair. Taking advantage of the glut, traders would come to the farms and select the best fruit at low prices, leaving many more mangoes on the farms. With nowhere else to take it, farmers ate and gave away what they could, fed it to their cows and goats, and left the rest to slowly rot.

Food loss is a critical issue, impacting food security and food production across the world. In fact, 30 per



Food loss is a global problem but farmers and companies in Africa stand to benefit significantly from solutions



40% of staple foods in Sub-Saharan African are lost before they can even hit the market.



Existing technology and training used in developed countries can help maximize yields.



470 million smallholder farmers could benefit from increased income by preventing crop loss.

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cent of all food produced for human consumption is lost before it reaches consumers, while 40 per cent of what reaches the table is thrown away. In Africa and other developing regions, more than 40 per cent of fruits and vegetables spoil before they can be consumed, including mangoes in Kenya. In addition, post-harvest loss reduces the incomes of small-holder farmers by 15 per cent.

To address the problems associated with post-harvest loss, in 2016, The Rockefeller Foundation launched the YieldWise Initiative with a focus on fruits, vegetables and staple crops in Kenya, Nigeria, and Tanzania. In Kenya, The Rockefeller Foundation partnered with TechnoServe to tackle loss in mango production, working with various actors across the value chain to improve lives and livelihoods. Mango production in

Kenya has increased over the last ten years, and the quantities produced between 2005 and 2017 more than tripled from 254,113 tons to 772,700 tons, making it the third-largest mango producer in Africa.

A four-pronged strategy was set in motion to deal with the challenge comprising of training and aggregation, access to technology, access to markets and access to finance. It was anticipated that the program would reduce the post-harvest losses of participating farmers, and that the learnings could be replicated in food value chains that had similar losses.

A baseline survey revealed that widespread infestation by fruit flies was one of the most distressing experiences for mango farmers. The flies lay eggs under

Four-pronged strategy to tackle loss and waste in mango production



Training and aggregation



Access to technology



Access to markets



Access to finance



This is how it works: Paul Mutendwa, Chairman of the supervisory committee of Masii Horticultural Farmers' Center, explains how the fruit fly trap captures the destructive insects and keeps them away from the mangoes. The Center has a demonstration plot where farmers learn best practices in mango farming.

the skin of the fruit and when they hatch, the larvae feed on the flesh of the fruit, causing it to turn mushy and rot. Farmers were losing large quantities of their produce to fruit fly attacks each year with no idea how to solve the problem. So widespread was the menace that Kenya had imposed a ban on mango exports.

A further discovery was that the mango varieties many farmers had planted were not very popular with the local markets or processors. This limited their market options as traders would only purchase what they knew they would be able to sell.

Implementation of the YieldWise initiative began with a pilot engagement of 4,000 farmers across a variety of counties in Eastern, Central and Coast regions, increasing to 21,000 by the end of 2019. The farmers were experiencing post-harvest losses at an average of 21%. TechnoServe deployed extension officers to train farmers on agronomic practices that helped them get the best from their trees – including grafting and planting improved mango varieties, spacing of trees, training on the importance of pruning, and adoption of simple technologies. TechnoServe collaborated with private sector players to set up demonstration plots on land owned by lead farmers for training, illustration and marketing purposes.

Through media partnerships, information targeting mango farmers was broadcast on local radio stations. Working with private sector players, the program presented an assortment of 12 to 15 technologies to farmers to see which ones they found most useful. They ranged from fruit fly traps, harvesting sticks and crates for transportation to solar-powered coolers, resins and waxes that could be used to increase the shelf life of the fruit. In the end, it was the fruit fly traps, harvesting sticks and cooling facilities at aggregation centers that the farmers identified as high potential options to solve their most immediate problems. It was clear that farmers were more interested in tools that demonstrated impact at farm level as opposed to those that would benefit somebody else. Crates, for instance, are beneficial for storing fruit without damage during transportation, but this is more important for traders than for farmers, hence the minimal interest in them.

Farmers did not have access to new and innovative PHL technologies. YieldWise bridged this gap and introduced them to solar drying and cold storage technologies. The cost of a fruit fly trap is about Ksh250 (US\$2.50), which most farmers could afford and which addressed a tangible problem they faced. Produced by Farmtrack International and Kenya



Mango processing plant at the Karurumo Farmers' Agricultural Self-Help Group Aggregation Centre in Embu County.

Biologics, two private sector manufacturers, the traps work by luring and killing male flies. Once the trap is full, it is simply replaced. TechnoServe encouraged the two companies to market their products directly to the farmers, and to establish a network of distribution points within easy reach of the farms, addressing both cost and proximity. For many farmers, the use of the traps was an eye-opening experience, and demand grew as they witnessed the positive impact they had on production. By late 2019, the project had supported distribution of 100,000 traps. As their sales increased and business grew, Farmtrack and Kenya Biologics were able to employ more people and even move to bigger premises, ensuring smoother production and distribution. **Over time the project has reached 61,022 mango farmers through effective distribution and utilization of fruit fly traps. This accounts for 37% of mango farmers in Kenya, covering 28% of the total mango acreage in Kenya.**

Lauded for their simplicity and effectiveness in harvesting fruit so that it was not bruised by falling on the ground, the harvesting sticks gained traction quickly with farmers. At the beginning of the project, the sticks were imported, but once they got the idea, farmers began to design their own harvesters using locally available materials like sticks, baskets and tarpaulin liners to pick and catch the fruit, placing it on racks to prevent the sap from staining the fruit.

The results of saving the mangoes from fruit flies and careful harvesting to ensure attractive mangoes for the market should have increased the farmers' sales, but there was still the issue of unmarketable varieties. Mango puree processors and local market consumers preferred the Kent, Apple and Ngoe varieties as they were juicy and kept better after harvest rather than Tommy Atkins, Van Dyke and some traditional varieties which either had large seeds and little flesh, were too stringy or had a very short shelf life. The product mismatch was the next frontier the initiative had to overcome. The training encouraged farmers to graft their trees with modern varieties to improve the marketability of their fruit. At the same time, TechnoServe helped to establish a regional market for Kent mangoes in particular, which are very popular in Uganda and Tanzania owing to their relatively long shelf life.

A key element of the YieldWise Initiative was to encourage and facilitate development of five aggregation centers in the mango zones, working with farmers' groups or cooperatives. Similar centers have worked well for products such as potatoes, coffee, bananas and milk in Kenya, enabling farmers to collect, store and market their produce together, taking advantage of economies of scale and enabling them to negotiate collectively for better prices, thus the concept was not unknown. The final piece was addressing longevity. As the quality and



Value addition: The Karurumo Agricultural Self-Help Group Chairman Alloys Mbogo at the aggregation center's processing plant.

quantity of mangoes increased, it became necessary to put the fruit in cold storage where it could last up to three or four weeks as a market was being sought.

In Embu, the Karurumo Horticultural Self-Help Group has three types of coolers at its aggregation center – a wet processing room, a coolbolt cold room and an evaporative charcoal cooler. Coldrooms installed in Karurumo and Masii Aggregation Centres were the outcome of a partnership between YieldWise, the University of Nairobi and Purdue University to study various coolers and their effectiveness for use in local centres. Under the partnership, Yieldwise supported the development of a processing hub at the University

of Nairobi. The Karurumo Center sold its first aggregated crop of 32 tons of mango from its 53 members and other farmers between January and March 2019. Chairman Alloys Mbogo anticipates that even bigger volumes will pass through the center in the next season as farmers have begun to appreciate its value.

A major challenge faced by the aggregation centers, however, is what to do with the investment when there are no mangoes in season. During the low mango season in Embu, the coolers at the Karurumo center are now being used to store other crops, including watermelon, avocado and macadamia nuts, says



Some of the finished products ready for sale.



A healthy mango crop

Alloys. In addition, the center has installed a drier and processing equipment, which are used to make dried mango, mango juice and pulp, mango wine, banana crisps and banana flour. So far, the products are sold to passers-by and the local community, but the center is working to get a bar code and seeking Kenya Bureau of Standards certification in order to expand its market and reap the benefits of selling value-added products.

Yet it hasn't been completely smooth sailing, as there have been setbacks. The aggregation centers have been a challenge to operate because traders do not feel the impetus to patronize them, preferring instead to go to the farms where they can choose the mangoes they want to buy. However, the project has been able to link the centers to more formal traders such as processors and exporters, who have placed orders for fruit through the centres.

Noting the suspicion that exists between traders and farmers, the project convened forums where they can meet, get to know and understand each other and, hopefully, negotiate new ways of working together. Conversely, some farmers do not send their produce to the centers due to lack of transport, or limited understanding of the benefits of aggregation, speaking to the need for more sensitization and training if the centers are to optimize their capacities.

Traders, commonly known as brokers, are key players in the mango value chain. For months, TechnoServe

staff had tried unsuccessfully to get data and information from individual traders that could be used to address issues that were being faced by the whole mango ecosystem. The organization convened meetings to get the traders to talk to each other and out of these discussions came the decision to form the Association of Kenya Mango Traders (AKMT). The traders registered themselves in 2017, starting off with 34 members. By the end of 2019, there were 73 members. Traders pay US\$ 1,000 for membership, indicating the value they believe the platform provides.

"As a member, we get markets for traders and also give them access to financial credit by guaranteeing them as a member of the association," says AKMT chairman Mr. Julius Njuge Maina. "We also lobby county governments to improve conditions for trading. Members feel safe because we actively work on their behalf." As a result of the formalization, the traders now have access to credit facilities, which was never the case before. Already, 11 traders have received loans from two financial organizations – the Agricultural Finance Corporation and Equity Bank – enabling them to expand their businesses and buy more mangoes.

While the initial focus of the YieldWise program was primarily on the farmer, improving production and finding markets for the mangoes, TechnoServe discovered that farmers have the least influence in the

value chain, having no idea where to supply their produce or at what price. Instead, the most influential person in the whole value chain is the trader because he is the one who goes to the farmer to get the volumes and then supplies the processor and the exporter. If he does not have money to buy and move produce, the whole system suffers.

While the formation of the AKMT was an exciting step forward, TechnoServe felt it was important to give the farmers an option of where to market their produce in order to get premium prices. The YieldWise program therefore encouraged formal buyers to begin viewing the small-holder farmers as shareholders in their businesses. A few processors such as Premier Foods, VERT and Keitt Exporters were keen on integrating the small-holder farmer into their value chain, creating direct linkages with them and reducing total reliance on traders. While the arrangement worked for farmers who had quality produce and could offload it all to the processors, the majority of farmers and processors preferred to transact with the traders to avoid complications of transport logistics, and the risk of poor quality mangoes being rejected at the factory gate.

Nevertheless, for those processors and exporters who did make the direct linkages to the farmers, there was an added bonus in new opportunities for growth, and greater eligibility for loans to expand their businesses. TechnoServe took the processors to expositions to help them get new markets, with the expectation that they would then buy more mangoes from the farmers.

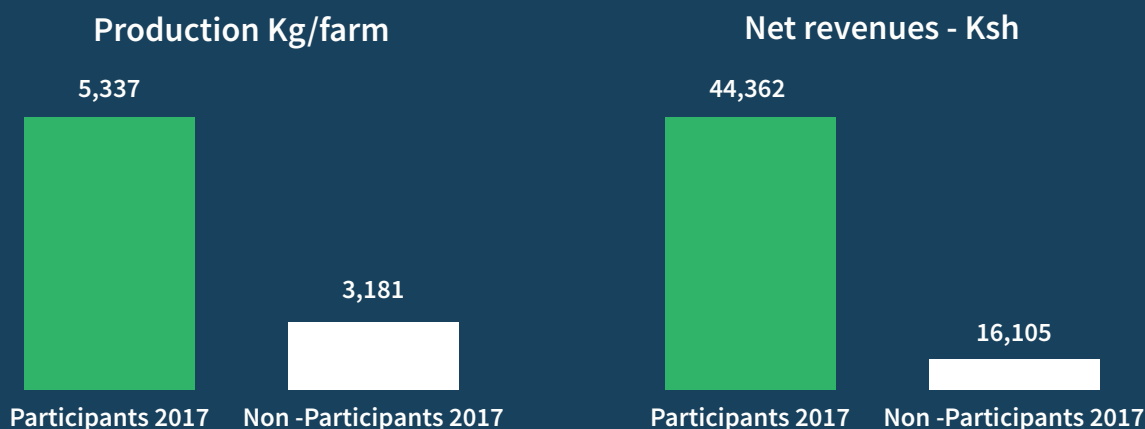
At the consumer end, the project also ran a public campaign dubbed “Eat, Drink Kenyan Mango” partnering with several local juice companies, including Premier foods with their Orchid Valley brand, Pick and Peel, and Afya Picana to promote drinking of mango juice in Kenya.

Linking farmers directly with the processors builds sustainability of the YieldWise strategy. Early in the implementation of the program, TechnoServe made a deliberate decision to adopt a market system facilitation model that would allow it to be more of a facilitator and less of an implementer. As a result of using this model, 64,156 metric tons of mangoes has been sold through Yieldwise, while 18 market actors have received financing of over Ksh 100 million (US\$ 1 million). The model enables backward integration of farmers, teaching them how things are done so that they can continue even in the absence of TechnoServe.

Furthermore, the project has partnered with county governments in Tana River, Tharaka Nithi, Embu and Meru to invest in new and improved aggregation centers, and to connect these centers to the electricity grid. Several counties have included activities related to mango production in their Integrated Development Plans.

In Embu County, 90 per cent of farmers use fruit fly traps, and the county is working towards a pest-free zone. “The county is keen to see farmers adopting

Yieldwise effect on Mango Production and Revenue



improved mango varieties such as Apple and Kent," says County Horticultural Crops Officer, Mr. Charles Wanjau. Not only will this mean more income for the farmers, but it will also extend the mango harvesting period because Kent is a late maturing variety. Mr. Wanjau foresees a time soon when the county will be able to export mangoes. "If we could increase the exportable mango by attaining the high quality needed, we will be able to more than double our revenue," he enthuses.

The concerted activities in the YieldWise initiative have had an enduring impact on post-harvest loss in mango production in Kenya. **The contribution of the project core activities to mango loss reduction is substantially impactful as farmers in Kenya have witnessed an 11% increase in yields, 16% decrease in postharvest loss, 33% increase in marketable volumes, and 84% adoption of postharvest loss technologies since the initiative started. Farmers' losses dropped from 25% in 2016 to 21% in 2019. Out of the 21,000 farmers that Yieldwise worked with over 17,000 are still using one or more of the technologies introduced to them.** With a solution to the troublesome fruit flies, increasingly organized channels of marketing, and support from the county governments, post-harvest loss is no longer a cause for anxiety, even with the proliferation of mangoes at the height of the harvest season. The farmers can now truly enjoy the fruit of

their labor.

Arising from its work in the mango value chain, The Rockefeller's Food Initiative in January 2020 launched a far-reaching campaign dubbed 'Komesha Fruit Fly.' Working in partnership with, among others, the Government of Kenya, USAID and the Research Triangle Institute, the campaign seeks to establish mango fruit fly-free mango zones and to increase farmers' knowledge about how to reduce food loss by adopting post-harvest treatment technologies.



Embu County Horticultural Crops Officer Charles Wanjau is confident that the county will soon be able to export mangoes

Through implementation of sustainable interventions like the use of fruit fly traps, hot water treatment of fruit and adherence to new mango certification protocols, the campaign has the potential to open premium export markets for Kenyan mangoes, to grow the consumption of mangoes and hence increase the livelihood of farmers. Notably, the success of the campaign and further development of the mango sector will require a multi-sectoral approach to address matters such as integrated pest management, market access, agro-processing, access to financing and rural

Rockefeller Foundation's YieldWise initiative was launched in 2016 with the goal of reducing post-harvest loss in select countries and value chains by up to 50 percent. More than 40 percent of fruits and vegetables in developing regions spoil before they can be consumed.

Using a multi-pronged strategy, YieldWise sought to improve millions of rural lives by increasing incomes, increasing the availability of food and protecting finite environmental resources.

The initiative targeted tomato and cassava production in Nigeria, mangoes in Kenya and maize in Tanzania.

YieldWise Initiative in the mango value chain in Kenya was implemented by TechnoServe; an international nonprofit that promotes business solutions to poverty in the developing world by linking people to information, capital and markets.