Stories of change

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Agricultural technologies bring healthy diversity to school meals

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Key messages

- By increasing production and reducing post-harvest losses, improved agricultural technologies enable farmers to supply school feeding programs and enhance dietary diversity.
- By adopting drip irrigation for open-field vegetable production, a group of smallholder farmers in St Kitts-Nevis have seen yields increase by 30%.
- In greenhouse-based sweet pepper production, appropriate varieties combined with local compost increased yields by more than 100%.
- Controlling exposure to temperature, humidity and sunlight and the use of food grade polyethylene wrapping have been shown to reduce post-harvest vegetable losses by more than 50%.
- Mulato grass provides improved, protein-rich fodder for small ruminants, including in dry months when natural pastures are virtually barren.

Context

Caribbean countries have paid limited attention to local food production, relying instead on imported, high-calorie, processed foods which have contributed to high rates of obesity. In Trinidad and Tobago and St Kitts-Nevis, for example, local produce comprises less than 10% of school meals, with local farmers constrained by ineffective cultivation practices, poor water management and unsuitable varieties. In response, the *Farm to Fork* model, developed specifically for the Caribbean, offers an alternative food and nutrition security strategy that links agriculture to health and nutrition, based on three pillars: increasing the quantity of fresh fruit and vegetables in school meals; improving procurement from local farmers to supply school lunch programs; and equipping smallholder farmers with technologies and capacity to enhance their year-round production (Phillip *et al.*, 2014).

Through the *Farm to Fork* project and supported by Ministry of Agriculture staff, smallholder farmers have adopted appropriate water management technologies to cope with seasonal variations in rainfall. Working with farmers, the

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Heat tolerant tomato and sweet pepper varieties were evaluated to determine productivity levels under greenhouse conditions

project has also investigated and promoted high yielding vegetable varieties, improved post-harvest handling of fresh fruit and vegetables, and new sources of year-round forage for sheep and goats. By increasing the quantity and quality of local fruit and vegetables - and potentially animal-protein products - in school meals, the *Farm to Fork* model offers a way to increase nutritional diversity of school feeding programs and contribute to healthier lifestyles for children.

Emerging outcomes

Drip irrigation for increased year-round production

In St Kitts-Nevis and other parts of the Eastern Caribbean, water is scarce during the dry season, restricting year-round crop production. Working with the Ministry of Agriculture, the project introduced drip irrigation (a water saving measure whereby small amounts of water are applied directly to the root zone) to 16 smallholder farmers, who were also trained in techniques for soil moisture monitoring and conservation. As a result, the farmers - many of them women - overcame water scarcity and achieved year-round production of eight different fruits and vegetables to supply the needs of the St Kitts-Nevis' school feeding program.

Over two consecutive years (2011 and 2012) production increased for most vegetable crops, resulting in increased income for the farmers and improved consistency in supply. Yields increased from 18 to 32 metric tons per hectare in tomato, from 17 to 25 mt/ha in pumpkin and from 3 to 10 mt/ha in string beans. The project demonstrated that technical and institutional support for irrigated agriculture resulted in increased yield and opened new markets for farmers, particularly women.

Improved varieties to increase crop yields

In St Kitts-Nevis and Trinidad and Tobago, open-field cultivation of fruits and vegetables is the norm, despite being subject to the extremes of heat and soil moisture stress during the dry season, and to flood damage during the wet season. The alternative is protected, greenhouse crop production, which is also practiced by smaller numbers of farmers. Enhanced productivity for both systems can be achieved, however, through the adoption of improved varieties. Under the project, three open-field pumpkin varieties were tested for their suitability to supply school feeding programs. CEStarz and Bodles Globe, two locally-developed pumpkin varieties, significantly outperformed an imported, international variety, Future NP-999, in yield, taste qualities, shelf-life and vitamin A content. Further improvements are now continuing to enhance the taste of CEStarz and to encourage wider use by farmers.

In support of farmers practicing protected vegetable cultivation, heat tolerant tomato and sweet pepper varieties were evaluated at the University of the West Indies in Trinidad to determine productivity levels under greenhouse conditions. Two of the seven heat tolerant tomato varieties (IT 71 and Versatile) tested under greenhouse conditions produced significantly more fruit per plant (Figure 1).

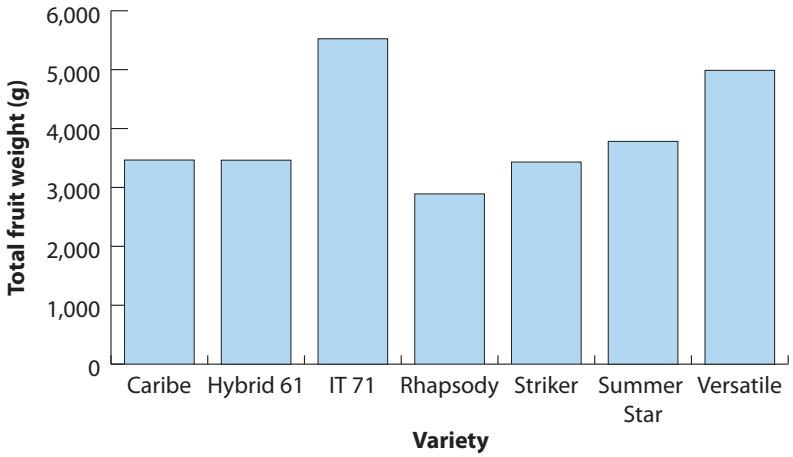

Figure 1: Yield of tomato varieties grown under greenhouse conditions

Compost use in protected agriculture

Currently, farmers practicing greenhouse cultivation plant their crops in commercially-produced, imported compost. This, however, reduces their profit because of its high cost and is unsustainable for many. Under the project, use of locally made compost has increased productivity, quality and profitability. In controlled trials, local compost combined with perlite (a permeable volcanic mineral) increased yields by more than 100% compared to imported materials, while reducing the cost of the compost by over 20%. Shelf life of sweet peppers grown in the local compost was also extended, retaining acceptable quality for an additional five days. Forty-five greenhouse farmers were invited to the controlled trials to see the various composting technologies and learn about the value of local composts as a substitute for more expensive, imported materials.

Lose less, eat more

Research to quantify post-harvest losses was conducted for tomato, string beans, eggplant, okra and cucumber. The results from St Kitts-Nevis indicated high levels of post-harvest losses for crops grown by subsistence farmers and sold in street markets, including 54% and 57% loss in string beans and tomato respectively (Figure 2). In Trinidad, studies revealed that open-field tomatoes had greater (25%) defects than greenhouse tomatoes (5.5%) which increased to 39% and 27% respectively after five days in covered storage.

Simple interventions were recommended to reduce post-harvest loss along the supply chain. These included the use of cloth shades to protect produce from direct sunlight and high temperatures. The use of food grade polyethylene wrapping to protect vegetables such as eggplant was shown to prevent weight loss and inhibit discoloration and loss of firmness, with quality maintained even after 10 days of storage at 30°C. Curing, which involves exposure to the sun in order to harden the outer skin, was used to improve the storability of pumpkin, making it more readily available in off-seasons.

Mulato grass as year-round livestock feed

In St Kitts-Nevis, smallholder famers typically feed livestock with leaves and stems cut from bushes and trees. These are low in protein and scarce during the dry season, reducing livestock growth, meat supply and farmers' income. Under the project, mulato grass - a non-native, drought-tolerant grass with high protein levels - was investigated to determine whether it could provide better year-round nutrition to sheep and goats. The grass established well, covering 98%

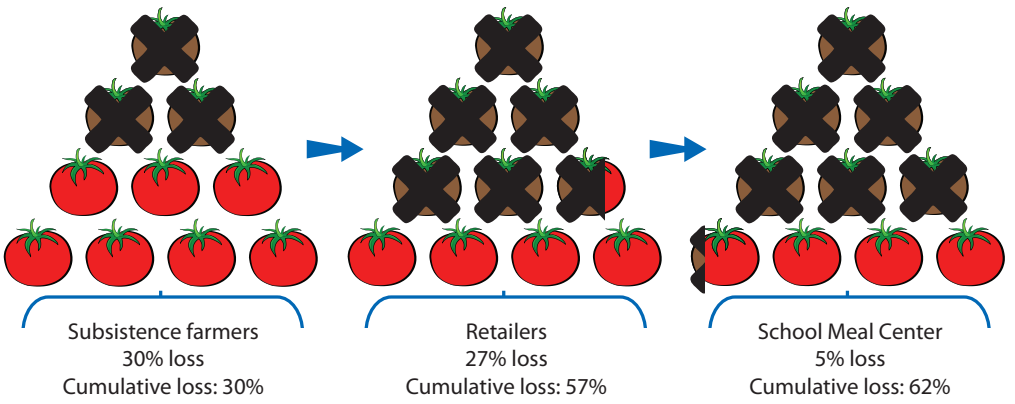

Figure 2: Cumulative loss of tomato in St Kitts-Nevis

of the soil surface after 20 weeks. It produced 15% more biomass and contained around 6% more protein than other good forage grasses of the region, and also provided up to 8 mt of biomass per hectare during the dry season, when production in natural pastures is close to zero. As a result, farmers increased the area planted with mulato grass by five-fold.

Conclusion

These results and outcomes, while yet to reach the stage of large-scale adoption, are important, as improved production and supply of high quality vegetable crops and animal protein products can support school feeding programs, increasing both the quantity and diversity of foods being provided on a daily basis, and thereby having a positive impact on children's health and nutrition. In addition, these technological interventions can positively affect livelihoods by alleviating food insecurity, generating income and enhancing human health, the main goals of the *Farm to Fork* model. As such, they warrant further development and testing with farmers, to build on this potential, increase production and efficiency, and create a reliable local supply of high quality foods for school feeding programs.

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Mulato grass provided up to 8 mt/ha of biomass during the dry season

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