Technology Sharing Experiences in Sri Lanka

The Industrial Technology Institute (ITI) project team selected three new technologies with the potential for commercial application. The technologies address the problem of post-harvest loss and included: a) the post-harvest application of wax formulations for maintaining fruit quality and extending storage life, b) a pre-harvest spray treatment for retention of fruits on trees to stretch the harvest season and extend the period of availability of mango, and c) a banana fiber-based fruit wrap to maintain quality of fruits during storage and transportation. The models adopted for commercialization of the technologies included interaction with both fruit producers and agro-input industries. The models were chosen to ensure that the benefits of the technologies would contribute to income generation, employment opportunities for women, better returns for farmers while improving food security in rural communities.

In Sri Lanka post-harvest losses remain high at 30–40% of the harvested crop. This loss has been valued at US $ 90 million. In addition to monetary losses, there is much to be desired with respect to nutrition for both urban and rural Sri Lankan populations as diets are well short of approved nutrition recommendations.

The international, collaborative project for "Enhancing the Preservation of Fruits Using Nano Technology" funded by the Canadian International Food Security Research Fund (CIFSRF), provided the opportunity to address these issues with help from other partnering countries. Commercialization is one of the primary mechanisms for implementing technological solutions but it offers several challenges and we discuss the process and success here.

THE TECHNOLOGIES

The project generated several technologies derived from the original hexanal-based Enhanced Freshness Formulation (EFF). Two of the hexanal-based technologies developed and subjected to laboratory-scale evaluation in Sri Lanka were selected for commercial application.

The Bio Wax formulations – of which one is incorporated with hexanal - showed that the storage life of mango could be extended for up to 21 days when fruits were stored at 13.5 °C ± 2 °C. This extended storage period would accommodate transport of the product to distant destinations, domestically as well as abroad.

The pre-harvest EFF spray treatment was tested on two, high value, Sri Lankan mango varieties. The spray treatment technology was observed to maintain the quality of fruits and to extend the harvest period of the tested mango varieties by up to 4 weeks.

Currently polyethylene sleeves are used to protect fruits from physical injury during transportation. Polyethylene is not biodegradable. Banana pseudo stem is a huge agricultural waste in Sri Lanka. Researchers were able to develop technology to use the banana pseudo stem and make biodegradable paper. This creates employment and income-generating opportunities for women in banana growing areas. The eco-friendly paper used as a fruit wrap can replace the imported polyethylene

THE EXPERIENCE OF TECHNOLOGY TRANSFER

Based on interactions with the industry, the prerequisites identified for commercialization of the technologies were:

- Obtaining National regulatory clearance for commercial application
- Identification of suitable industry partners for commercialization.
- Demonstration of the availability of a sustainable market for the technology.

The commercialization process took place in three stages. Once a suitable industry partner was identified, the technology was transferred, and implementation schedules were developed for the commercial production and adoption stages via a series of three interactive models: (1) a big company collaboration model, (2) a medium industry collaboration model and (3) a farmer association model.

Large Scale Industry Partner Collaboration Model: This model related to the commercialization of the modified EFF spray treatment technology and the two Bio-wax formulations. In this instance the ITI entered into

partnership with a large company, an agro-industry service provider, and a supplier and distributor of agro chemicals with business interests in Sri Lanka and overseas.

Commercial Production of Modified EFF and Bio-waxes:

- To convince the industry partner, trials were conducted with a large-scale grower. The grower will share his experiences with the company as well as with other growers.
- Since EFF spray and the Bio-wax were not classified as pesticides or growth regulators, we were able to obtain regulatory clearance from the Department of Agriculture without much delay. Further ground work done by TNAU on biosafety helped to accelerate the process.
- An agreement through which the technologies were licensed to the industry partner was reached, enabling transfer of the technologies for commercial production of the EFF and bio-wax formulations.

Adoption of Modified EFF and Bio-wax Technologies:

- In order to ensure adoption of the technologies, trials were conducted with prospective end users– including growers and farmer organizations.
- With the bio-wax formulations, commercial-scale trials and demonstrations were conducted in collaboration with exporters and supermarket chains.

Medium Industry Collaboration Model: This was adopted for commercialization of the banana fibre-based fruit wrap. The industry partner was based in a banana producing region and had already commenced fibre extraction from banana pseudo stem. The introduction of the fruit wrap added further value to the banana fibre extraction process.

Commercial Production of Fruit Wrap

After sufficient demonstrations, commercial-scale production was done in collaboration with the industry partner. Test market trials followed, and were conducted with an exporter and large-scale grower. It became apparent at this point that the industry partner required assistance to secure a market for his products which was provided by the research team. Food safety concerns were addressed by incorporating a procedure for microbial disinfestation into the production protocol.

Adoption of Fruit Wrap Technology

Collaborative, commercial-scale trials with end users were conducted. End users included a growers' collection and distribution centre, a large-scale mango grower, and a supermarket chain. Researchers engaged in follow-up action and assisted the industry partner to secure a market for the wrap.

Farmer Association Model

A farmer association model was also used for commercialization of the fruit wrap. The association was provided with infrastructure facilities for processing banana pseudo stem via a Canadian government-funded, United Nations Development Programme (UNDP) operating in the Northern Province of Sri Lanka.

Commercial Production of Fruit Wrap

The ITI research team assisted the farmer association with the selection of equipment and the planning of space requirements for the fibre processing plant. The farmer association benefited from test market trials conducted by the industry partner with the exporter and large-scale grower. Food safety issues were addressed by introducing necessary steps in the production protocol.

LESSONS LEARNED

Many lessons were learned including the following:

- Commercialization/commercial production of technology output is a means of promoting the adoption of new technology developed by researchers.
- Researchers had to ensure that the cost of production of the technology, conformed to purchase prices acceptable to industry partners and user markets.
- Market demand and market size were crucial to the sustainability of commercially viable, cost-effective manufacturing of products by industry partners.

- Ensuring credibility of food safety with use of the technology and technology-related products had to be established satisfactorily to meet consumer requirements.
- Shelf life and stability of products (Bio-waxes and EFF formulation) had to be conducive to the rate of movement of product from the production line to the shelf and to when purchased by consumers.
- The need for sustaining consistency in quality and quantity of products to meet market demands.
- Ensuring that opportunities are provided for men *and* women to benefit from employment and income generation.
- Implementing any spin-off technologies can benefit rural communities by providing employment and income-generating opportunities to women – opportunities that are usually in short supply in these regions.
- Availability of researchers to provide necessary support if required, to ensure sustained commercial production of the respective products particularly when working with financially vulnerable industries.

CONCLUSIONS

Commercialization of the new post-harvest technologies proved to be a challenging but rewarding experience. The adoption of the technologies by respective stakeholders will contribute toward increasing the income of targeted farmers and help minimize post-harvest loss. The experiences shared in this outcome story, across the four different models of taking research from the laboratory to adoption by stakeholders, indicate the need for careful attention to three important components of commercialization: product development, production, and adoption. Other critical elements of the process are the need for careful selection of compatible industry partners, close engagement with these partners throughout the commercialization process, aiding the industry partner when required, and the development of pathways for ensuring sustainability of the industry.

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