



## CTA Top 20 Innovation Abstracts

### **1) The Farmer ownership model: Uganda's coffee revolution**

*Joseph Nkandu*<sup>1</sup>

<sup>1</sup> NUCAFE, Kampala, Uganda

In Uganda, coffee farmers have traditionally been price takers, earning less than 2% of the retail value. Under the “Farmer Ownership Model”, developed by Joseph Nkandu, farmers are empowered within the coffee value chain. Under this inclusive value chain approach, farmers have joined together in strong, business-oriented organisations, and earned higher profits. They have collectively invested in developing their entrepreneurial and leadership skills, in forming partnerships with exporters and roasters, as well as in infrastructure for value addition. The model has been adopted by over 600,000 farmers in 160 rural communities and incorporated within the Ugandan government's National Coffee Policy, in 2013. It has also been prioritised for adoption in other farming sectors by national and regional organisations responsible for agricultural development.

### **2) Aflatoxin reduction for Haitian peanut farmers**

*Bryan Sobel*<sup>1</sup>, *Jennifer Armit*<sup>2</sup>, *Ashley Holmes*<sup>2</sup>, and *Patricia B. Wolff*<sup>2</sup>

<sup>1</sup> Meds & Food for Kids, Haiti

<sup>2</sup> Meds & Food for Kids, USA

Peanut farmers in Haiti are at a disadvantage, as the tropical climate provides a perfect breeding ground for *Aspergillus flavus*, the mould which produces aflatoxin. Through partnerships with government, farmers' organizations and universities, Meds & Food for Kids (MFK) has facilitated research and development and provided extension, education and training for farmers, thereby reducing aflatoxin levels in peanut crops. MFK educates farmers on the presence and dangers of aflatoxin contamination and promotes the use of appropriate post-harvest innovations, such as tarpaulins for solar drying, breathable bags to prevent moisture build-up, and pallets and storage depots to keep peanuts safe and

dry. MFK also buys the peanuts from the farmers and conducts moisture and aflatoxin testing at the point of purchase. These practices, which are accessible and affordable to small and medium scale peanut farmers (0.5-1.7ha), lower aflatoxin contamination, improve quality, strengthen the peanut value chain and increase farmer incomes. Since 2008, MFK has purchased 140,636 kg of aflatoxin-free peanuts from local farmers and lowered the health risk to local communities.

### **3) Innovative tropical weather forecasting**

*Liisa Petrykowska*<sup>1</sup>

<sup>1</sup> CEO, Ignitia Ltd., Ghana

An innovative weather forecast model, which provides near-accurate forecasts (82% against 40% for other service providers) to smallholder farmers in tropical regions, has been tested in Ghana. In near-equator regions, weather forecasting accuracy is challenging and highly location dependent. Bringing together a team of research institutions and universities, Ignitia Ltd. has developed a ground-breaking proprietary technology to provide farmers with a daily, low-cost, 2-day forecast via SMS (US\$ 0.04/day) for their specific GPS location. The text message also includes seasonal outlooks, rainy season predictions and pictures. In 2013, around 3,400 farmers took up the service with a less than 0.1% drop out rate. The service is being translated into four languages.

### **4) Bio-herbicide: eco-management of water hyacinth**

*Karim Dagno*<sup>1</sup>, *Mamourou Diourte*<sup>1</sup>, and *Haïssam M Jijakli*<sup>2</sup>

<sup>1</sup> Sotuba Regional Agricultural Research Centre, Institut d'Economie Rurale, Mali

<sup>2</sup> University of Liège, Belgium

The invasion of water hyacinth (*Eichhornia crassipes*), in the Niger River, threatens agriculture and fishing as well as biodiversity, hydro-electric installation and other productive activities. This prolific aquatic weed decreases water flow and aids the spread of waterborne diseases. Use of chemical herbicides to manage water hyacinth can be a hazard to fish and aquatic flora, as well as human and animal health. A group of researchers therefore developed a low cost bio-herbicide formulation using the isolate of bio-control agent *Alternaria jacinthicola* Dagno & MH Jijakli (strain MUCL 53159) in an indigenous vegetable [*Carapa*

*procera* (L)] oil. The bio-herbicide can be produced in large amounts using a substrate made from powdered water hyacinth. It causes hyacinth plants to perish 4-6 weeks after spraying, and has been found to have no effect on 18 types of crop, including rice, tomato, okra and beans.

It is estimated that rice and vegetable smallholder farmers will benefit and agencies such as the Niger Office can save up to 137 million FCFA (€209,000) per year which it would normally spend removing the hyacinth from the river.

## **5) Cowpea then maize: innovative approach to intercropping**

*Gabriel Y. A. Adukpo*<sup>1</sup>

<sup>1</sup> Department of Agriculture, Obuasi Municipal Assembly, Obuasi – Ashanti, Ghana

In Ghana, resource-poor farmers have limited land and capital. Cowpea, a nitrogen-fixing legume, is not a major crop and farmers concentrate on cash crops. The traditional extension message is for farmers to grow maize first and to plant cowpea between the rows once the maize has tasselled. However, one smallholder farmer (0.4 ha) has experimented with the sequencing by sowing cowpea first, then maize ten days later. By establishing cowpea first, the maize benefits from the nitrogen which is fixed in the soil and is available when needed. By planting cowpea earlier, this crop can be harvested before the rains cease. The maize can be harvested later. A yield increase of 11% is estimated for maize and the farmer earns additional income from the sale of cowpeas, equal to around €320 per year. Other farming families have adopted this new practice.

## **6) Biological control of the millet head miner**

*Ibrahim Boukary Baoua*<sup>1</sup>, *Malick Ba Niango*<sup>2</sup>, *Clementine Dabire*<sup>2</sup>, and *Mamadou N'Diaye*<sup>3</sup>

<sup>1</sup> Institut National de la Recherche Agronomique du Niger, Niger

<sup>2</sup> Institut de l'Environnement et de Recherches Agricoles, Burkina Faso

<sup>3</sup> Institut d'Economie Rurale, Mali

The millet head miner moth (*Heliocheilus albipunctella*) is one of the most serious threats to millet production in the Sahel, with grain losses of up to 60%. The parasitoid *H. hebetor*, is an effective biological agent. By understanding the life and egg

production cycle, researchers developed an *H. hebetor* release system to transfer the breeding of the parasitoid from the laboratory to the farm. Jute bags, containing millet, *Corcyra cephalonica* larvae and mated *H. hebetor* females are kept sealed for 48 hours to grow the parasites. At the beginning of the infestation period, 15 jute kit bags containing the parasitoids are placed in granaries and other areas surrounding a village in groups of three, to protect against the millet head miner. Costing approximately €3 to prepare, the 15 bags will protect fields in a 15 km radius, killing up to 80% of head miner larvae. The technique increases millet production by at least 34%. The technology is simple, popular with farmers and can be replicated by them.

## **7) Fuel-less brooder for chicks**

*Emmanuel Kasihe Muterere*<sup>1</sup>

<sup>1</sup> Nyarumbugu Outgrowers Project, Tanzania

Hay brooder technology was promoted by Ethiopian researchers and adopted by the Nyarumbugu Outgrowers Project for use by small farmers in Tanzania. Traditional brooders require fuel - charcoal, gas, electricity or kerosene - which is costly; the fuel-less brooder uses the metabolic heat of an optimum number of chicks per cubic metre. The combined metabolic heat of the chicks in the confined space helps to keep them warm. Farmers can brood up to seventy chicks in one brooder without a mother hen. As a result, farmers can raise a larger flock of chickens, allowing for efficient vaccination and flock husbandry. The brooder boxes are easy to construct with local materials and are cost-effective (~US\$10 per box) to produce. Since 2012, 78 farmers have reared at least 3,000 chicks using the technology.

## **8) Producer business group model for value addition**

*John K. Mutunga*<sup>1</sup>

<sup>1</sup> Kenya National Farmers Federation (KENAFF), Kenya

A new approach to aggregating farmers into common interest groups (CIGs), producer business groups (PBGs) and Community Based Enterprises (CBE) enables them to collectively bulk, grade, add value and sell produce (milk and maize).

PBGs consist of around five agri-entrepreneurial groups (each consists of around 30 farmers). Three PBGs then form a community-based enterprise (CBE) that bulks and stores produce, and four CBEs constitute an agro-enterprise agency, which

undertakes processing, branding and marketing of produce to rural and urban markets. The agribusiness enterprise model benefits the farmers/producers, allowing them to engage in value addition so as to increase market access and value and benefit from higher commodity prices. By the end of June 2013, the Kenya National Farmers Federation (KENAFF) had 63 PBGs, 38 of which have been registered as cooperatives or CBEs. A total of 461 CIGs have been sensitised.

## **9) Cassava steam dryer**

*Samuel EB Nonie<sup>1</sup>, Braima D James<sup>2</sup>, and Samuel J Alpha<sup>3</sup>*

<sup>1</sup> Fourah Bay College, University of Sierra Leone, Sierra Leone

<sup>2</sup> International Institute of Tropical Agriculture, Sierra Leone

<sup>3</sup> J&M Engineering Services, Sierra Leone

The traditional production of cassava flour involves sun-drying, which is slow, unhygienic and impractical for year-round drying. But high-end, motorised dryers are unaffordable for smallholder farmers to buy and maintain. A prototype steam dryer has been developed by the University of Sierra Leone and IITA to address these constraints. It comprises a steam-generating boiler connected to 1-4 drying chambers. Copper coils take steam from the boiler and circulate it through the drying chambers, releasing heat which dries the cassava products. With two drying chambers containing 11 trays operating for 8-10 hours, one dryer with a surface area of 17m<sup>2</sup>, manned by two people, is able to produce about 350 kg of dried cassava per day. It is expected that when organised into associations, smallholder cassava factories could produce 1-3 t of flour each day. This innovation removes drying as a major bottleneck in the production of quality cassava flours in commercial quantities by small-scale factories. It appears to work faster in the rainy season.

## **10) An oyster mushrooming business**

*Choice Agaba<sup>1</sup>*

<sup>1</sup> National Agricultural Research Laboratories, Uganda

Growing oyster mushrooms in Uganda is already a flourishing activity. In Kampala alone, it is estimated that 4,500 smallscale farmers, especially women, are cultivating mushrooms and earning up to US\$150 per month. Requiring little space or inputs and easy to establish, the enterprise is a source of food and income. The mushrooms are grown on pasteurised substrates using local

materials such as sawdust, millet straws, bean trash, dry banana leaves or cotton seed hulls, which are compacted into black plastic bags perforated with holes for aeration. Mushroom seed is purchased from the National Agricultural Research Laboratories (NARL) at a minimal price and harvest takes about two weeks, requiring little labour. Most farmers have 20-100 fruiting bags at a time, yielding an average of 1-2 kg per day. Mushroom marketing is generally informal, conducted by the roadside or in urban centres. Fresh mushrooms are sold for US\$2/kg and dried at US\$10-20/kg. As Ugandan traders are importing mushrooms from Kenya and South Africa, there is potential for small-scale farmers with little land.

### **11) Botanical extracts for controlling cowpea pests**

*Roger Ahouansou<sup>1</sup>, Charles Agl<sup>2</sup>, Marcelline Montcho Dededji<sup>1</sup>, Pelagie Agbobatinkpo<sup>1</sup>, and Alice Koubourath Djinadou<sup>1</sup>*

<sup>1</sup> Details not given

<sup>2</sup> PRONAF, Benin

In Benin and other parts of West Africa, cowpea is a staple crop. Farmers often resort to using chemicals to fight pests, but these have an adverse effect on human health. PEDUNE and PRONAF developed botanical extracts from neem, hyptis and papaya. These were not widely adopted because of the labour involved. To overcome this constraint, a team of researchers, working together with cowpea farmers, has developed a mechanical extractor, with a capacity of 50 kg/h, compared to 3.11 kg/h when pounding with a mortar. A technique to conserve the extracts, ensuring they remain an efficient treatment for up to two years, was also developed. Nearly 87% of farmers who have been introduced to this technology have adopted it, and 500 farmers now use it. The cost of 33 cl of extract is 69.11 FCFA (€0.1). More farmers are now producing, stocking and selling botanical extracts, thereby improving cowpea yields and reducing risks to the environment.

### **12) Local fertilizer for soil fertility**

*Francis Chilenga<sup>1</sup> and Franklin Msiska<sup>2</sup>*

<sup>1</sup> Ministry of Agriculture and Food Security, Malawi

<sup>2</sup> Catholic Development Commission, Malawi

In Karonga district, northern Malawi, lead farmer Chinadango Mhango has developed, through experimentation in his maize fields, a highly productive fertilizer, *Chinadango* manure, made

from a combination of organic and inorganic material. This fertilizer has boosted his maize productivity and improved soil structure and water holding capacity while enabling him to produce a crop even during dry years and periods of erratic rainfall. The fertilizer largely consists of locally available resources, combining 40kg of maize or rice bran with 40kg of organic compost (made from farmyard manure, groundnut straw or cassava peelings), 40 litres of water and 5kg of inorganic fertilizer – either urea for top dressing or NPK fertilizer for basal dressing. A 50kg bag of *Chinadango* manure costs US\$ 8 as opposed to US\$ 50 for a bag of inorganic fertilizer. 1000 farmers have adopted the fertilizer, and are either making their own or buying from Mhango.

### **13) “Freshing Packaging”**

*Genevieve Ashimwe*<sup>1</sup>

<sup>1</sup> Managing Director, FLORADATUM Foundation, Rwanda

In Rwanda, horticultural crops are generally packed in bamboo baskets or nylon sacks for transportation, or are transported without any packaging. At retail level, plastic used to package fresh produce is often unsuitable, having poor moisture and gas permeability, and leading to deterioration of the produce. Post-harvest losses range from 24-40%. Smallholder farmers and retail traders cannot afford cold storage facilities due to the high capital and operating costs. ‘*Freshing Packaging*’ is a recent innovation of the FLORADATUM Foundation, which provides training to smallholder farmers and sellers on both the theory and practice of post-harvest crop handling for various commodities from field to market, and sells a range of low-cost, specially designed, innovative packaging materials and post-harvest equipment. Over 130 farmers and traders are using the knowledge gained and packaging material to improve quality and reduce post-harvest losses.

### **14) Solar irrigation pump**

*Quentin Baynes and Toby Hammond*<sup>1</sup>

<sup>1</sup> Directors, Futurepump Ltd, UK

With the potential to pump over 12,000 litres a day, sufficient to irrigate 0.5 acre, the Sunflower pump uses solar energy to power a water pump. Relying on unpredictable rainfall is a major constraint for many smallholder farmers. Manual irrigation is labour intensive, whilst diesel and petrol pumps require maintenance and fuel,

which can be costly. The Sunflower is a simple, easily maintainable solar irrigation pump, which has been under development by the PRACTICA Foundation since 2004. In 2010, field trials were conducted in Ethiopia, which showed the increased, year-round crop production under irrigation leading to a doubling of household income based on 600m<sup>2</sup> growing area. Farmers were observed making adaptations to the technology using PVC pipe and were able to perform simple repairs and maintenance without any training. The cost is currently US\$400.

### **15) Rural resource centre: community based approach to extension**

*Ann Degrande<sup>1</sup>, Zac Tchoundjeu<sup>1</sup>, Roger Kwidja<sup>2</sup>*

<sup>1</sup> World Agroforestry Centre (ICRAF), Cameroon

<sup>2</sup> Association Nationale des Centres de Ressources en Agroforesterie et Agriculture Durable (ANACRAD), Bangangte, West region, Cameroon

Providing an alternative to existing extension, Rural Resource Centres (RRCs) are training and demonstration hubs that are community-owned and managed by grassroots organisations (local NGOs or farmer associations). The approach focuses on farmer innovation capacity and emphasises access to knowledge, interactive learning and networking. It is particularly relevant for promoting new technologies that are “knowledge intensive” and require farmers to learn new skills. The World Agroforestry Centre (ICRAF) has been using the approach to stimulate farmer experimentation and adaptation of technologies in agroforestry. By the end of 2012, a total of 315 small-scale nurseries were producing improved germplasm of agroforestry species in Cameroon, Democratic Republic of Congo and Nigeria. 5331 farm households were actively involved in domestication nurseries. Farmers have reported improved incomes from nursery sales and have invested in other income generating activities.

### **16) Low cost feed for semi-commercial chicken farmers in PNG**

*Pikah Kohun<sup>1</sup>, Michael Dom<sup>1</sup>, Janet Pandi<sup>1</sup>, Fred Besari<sup>1</sup>, Maima Sine<sup>1</sup>, Workneh Ayalew<sup>1</sup> and Phil Glatz<sup>2</sup>*

<sup>1</sup> Papua New Guinea National Agricultural Research Institute, Papua New Guinea

<sup>2</sup> South Australian Research and Development Institute, Australia



In the last 10 years, livestock feed prices in PNG have increased by 56-110%, due to the high and rising cost of commercial feeds made from imported ingredients (wheat, sorghum, soybean) and feed supplements. Smallholder semi-commercial and commercial broiler farmers produce over 6 million birds a year at a cost of Aus\$54 million (€37.2 million). The National Agricultural Research Institute collaborated with private feed mills, international partners, government agencies and an NGO to develop local alternatives and improve production efficiencies of local blends. Use of local ingredients (e.g. sweet potato, cassava, banana, taro and agro-industrial by-products such as copra, palm and fishmeal) has enhanced the use of locally available feeds. Smallholder farmers supply dried sweet potato and cassava chips to the mini-feed mills. Introduction of the technology has had a significant impact on broiler production and 600,000 smallholder semi-commercial broiler farmers now benefit from the innovation. Feed costs have been reduced by 14-30% and profitability has increased.

### **17) Locally designed cassava planter and harvester**

*Stephanie Lezama-Rogers and Seema Ali<sup>1</sup>*

<sup>1</sup> Arthur Lok Jack Graduate School of Business, Trinidad and Tobago

Facing a shortage of labour, high costs for machinery and raw materials and tiring manual work, 15 years ago, a Trinidadian farmer began modifying machines to support his farming operations. Using scrap metal and parts salvaged from agricultural machinery and other equipment, he has developed a variety of machines including a cassava planter and cassava harvester, and adapted them to perform multiple functions. To maximise its use, the planter has been modified to apply fertilizer when the plants are 0.6m tall and to also plant seed crops. The capacity of the planter is 1.23 ha per hour and the idle time has been reduced. The cassava harvester has been modified to uproot cassava tubers with very little breakage and turn them completely upside-down in rows either to the left or right, making collection easier. The capacity of the harvester is 0.4 ha per hour. With the modified machinery, the farmer is able to cultivate eight times the area and generate twice the yield per hectare compared to other farmers. The machines can be used to plant and harvest other root crops e.g. sweet potato and seed crops e.g. watermelons. As a result, several other farmers have bought machinery to be modified and also rented the machinery from the farmer.

## **18) Rice weeder**

*M Andriamahery Ravoatra Rarivo, Jean Edouard, Claude Chabaud<sup>1</sup>*

<sup>1</sup> Semis Direct, Madagascar

To overcome weeding problems on rice paddies in Madagascar's rich alluvial soils, the agricultural company SDmad created the scraper, which is similar to the rotary hoe. It is a manual, low-weight (3.5 – 4.0 kg) tool with wheels, designed to weed rain-fed or randomly irrigated rice paddies with poor water control that are sown directly in lines. It is made with simple, local materials so is easy to maintain and can be used by men and women. One unit costs around €15 to construct, and can reduce weeding time by 60% compared to manual weeding, and improve crop yields by 10-15%. The tool can also be adapted to other crops (including vegetables and legumes), as long as they are sown in lines and the distance between lines is respected. Additional yields improve food availability, and good weeding provides a higher quality product. By reducing labour requirements for weeding, farmers are also able to carry out other income generating activities. In 2012, around 100 smallholder and medium to large-scale farmers, including women, were using the scraper.

## **19) More productive local chickens: faster growing, more eggs**

*Julius Kofi Hagan<sup>1</sup>*

<sup>1</sup> University of Cape Coast, Ghana

Local chicken production provides meat, eggs, income and social value. Indigenous chickens in Ghana and other parts of Africa often carry heat tolerant genes (e.g. naked-neck, frizzle, silkiness), which make them tolerant to heat stress. But they are poor producers of eggs and are late maturing, while exotic chickens are more productive but do not cope well with hot and humid environments. Julius Kofi Hagan crossed heat tolerant naked-neck and frizzle chickens with exotic birds to produce fifth generation highly productive and adapted chickens. With funding from a private farmer, eight-week old chicks (cockerels or pullets) were distributed to 50 smallholder farmers for on-farm trials. Results showed a 100% increase in egg production for the layers, which laid between 100 and 120 eggs per bird per year, compared to 50-80 eggs from local chickens. The males were found to be early

maturing and yielded more meat, reaching market weight in 14 weeks, compared to 20 weeks for introduced exotic cockerels. The naked-neck and frizzle birds, which were previously only raised for sacrifices and ritual purposes, now have additional uses for income generation. About 1,000 smallholder farmers in Ghana and West Africa have benefitted and this is also contributing to the preservation and conservation of local chicken genetic resources.

## **20) New rootstock for tree tomato**

*Nicodemus Ndawa Musembi*<sup>1</sup>

<sup>1</sup> Department of Plant Science and Crop Protection, Faculty of Agriculture, University of Nairobi, Kenya

Tree-tomato, also known as tamarillo (*Solanum betaceum*), is native to South Africa but is cultivated and consumed worldwide. The fruits are rich in minerals and vitamins and appreciated for their taste. Despite increasing international demand, the cultivation and commercialisation of this crop are constrained by soil-borne pests and diseases, drought and lack of varietal breeding. However, a wild relative, which is classed as an invasive pest (*S. mauritanum*) has been tested by a Kenyan horticultural researcher in collaboration with smallscale farmers as a rootstock for tree tomato. The benefits include resistance to pests and diseases, a longer taproot to resist drought, larger and more uniform fruits and early maturity. In addition, there is the potential for multiplication of the best tamarillo trees, true-to-type, thus leading to production and commercialisation of the best performing varieties globally. The invasive weed is also a source of fodder for ruminants and can also provide material for fertilizing fish ponds. Many farmers have now converted to using the invasive weed as rootstock for tamarillo.