SYNERGIZING FERTILIZER MICRO-DOSING AND INDIGENOUS VEGETABLE PRODUCTION TO ENHANCE FOOD AND ECONOMIC SECURITY OF WEST AFRICAN FARMERS

NEARLY 340,000 FARMERS DEMONSTRATE BUSINESS CASE FOR GROWING AND PROCESSING MORE INDIGENOUS VEGETABLES

WHAT CANADIAN – BENINESE - NIGERIAN COLLABORATORS DISCOVERED:

✓ A proven scale-up approach (the MicroVeg Innovation Platform)
✓ Increased yields of indigenous vegetables
✓ Higher incomes from fresh and processed vegetables, and value-added products
✓ Optimum practices for fertilizer rates, water management, planting spacing, and seed population
✓ Reduced post-harvest losses and extended shelf life for vegetables
✓ More cultivated land, especially by women
✓ Young champions in vegetable production and processing
✓ Equipment and methods for drying and incorporating indigenous vegetables into food products for sale and household consumption
✓ Indigenous vegetable extracts to fortify products (e.g., local foods, juices, and pastries)

BY THE NUMBERS

• 337,931 farmers reached (50% female) with new technologies and improved practices
• Average land area under vegetable production in Benin increased 768% in Nigeria (from 9,105 ha to 79,110 ha), and 161% in Benin (from 985 ha to 2,575 ha). People who were farther away from a water source, and therefore less likely to grow vegetables, were able to increase their farm size by over 350% (0.02 ha to 0.71 ha)
• Production of indigenous vegetables doubled as a result of fertilizer micro-dosing
• Incomes from indigenous vegetable enterprises increased more than three-fold, from about $700 to $2,100 weekly at the peak (dry) season
• Revenue from marketing indigenous vegetables increased by about 119.7% in Nigeria and 90.1% in Benin, with the primary beneficiaries being women
• More than 600 distribution points established to market packaged frozen vegetable leaves
• Up to 10 million people in Nigeria and 8 million people in Benin reached through a media campaign that used radio, TV, newspapers and magazines to promote the importance and opportunities of indigenous vegetables
• 1.2 to 7.4 million litres of water/ha saved in a growing season through use of capillary irrigation system for nurseries and production plots
• Household dependency ratio (% of dependent people at home, e.g., youth) reduced from 4 people to 3 people
• 82,713 students at 124 schools in Nigeria (51% female) and 30,157 students at 57 schools in Benin (41% female) joined new Young Vegetables Scientists Clubs (YVSC)
• 10,000 youth of the Osun Youth Empowerment Scheme (OYES) program integrated into the vegetable value chain; many are now successful vegetable producers
• 600 inmates (10% female) at the Ilesha Prisons trained on vegetable production technologies; inmates are now producing and earning income from vegetables
• 5,466 people (69% women), plus 100 bakers were trained on value addition innovations, including fortification and business opportunities
THE IMPACT:

The project worked with nearly 340,000 farmers to demonstrate that cooperation with various players in the value chain is the most effective way to scale up simple and affordable technologies and approaches proven to increase yields, incomes, and the consumption of indigenous vegetables. This Innovation Platform model addressed concerns that matter most to farmers, notably women farmers: little or no production during the dry season, lack of high quality seeds, poor access to land, lack of organized transportation, pest and disease problems, and poor fertilizer supply. Solutions such as fertilizer micro-dosing and fortification, as well as improved marketing, demonstrated that indigenous vegetables can be economically and sustainably produced, processed and marketed to improve the diversity of foods and nutrition as well as incomes for resource-limited farmers, their families, and rural communities in West Africa.

THE CHALLENGE:

Smallholder rural farmers in Nigeria and Benin Republic, particularly women, rely on indigenous vegetables loaded with key vitamins and nutrients to complement their families’ daily diet. But poor soil fertility, land degradation, and water scarcity have conspired to keep yields and quality low, which limits economic opportunities and threatens food security. Two previous CIFSRF-supported projects (106511 and 106516) developed several farmer-friendly and affordable solutions, including new technologies to improve farming practices (e.g., fertilizer micro-dosing and water management) and post-harvest handling of these underutilized vegetables, as well as food processing and value-added innovations that create new business opportunities for rural residents. What was needed was a proven approach to accelerate the large-scale adoption of these solutions to improve the production, marketing, and consumption of healthy indigenous vegetables.

TRANSLATING RESEARCH INTO ACTION

New and improved agricultural technologies and practices

“Education is good. It is not only in the classroom that people learn new things. We are learning new things on our farms here. I never believed that we could use such small quantity of fertilizer to produce very good crop of vegetables. The scientists taught us the methods and it is just like magic to reduce production cost and make better profit”

Mrs. Bourin’doro Derou, a 74-year old woman vegetable farmer from Sokounon, in Parakou, Benin

- Fertilizer micro-dosing, when combined with organic manure at a rate of 5 tonnes/ha, was shown to produce enough macronutrients in the soil to sustainably produce vegetables
- Demonstrated improved practices for optimum yield of vegetables, including planting spaces, seeding rate, fertilizer rates, harvesting schedule, and water management
- Disseminated a seed production technology package which includes: seed production and handling, seed quality control, seed storage, and seed packaging
- Developed and successfully tested an innovative capillary irrigation system. For traditional leafy vegetable nurseries, the system saved 1.2 to 7.4 million litres of water/ha in a growing season and highly enhanced seed germination and early growing.

Increasing the nutritional and economic value of indigenous vegetables

- Developed a low-cost (~CAD $15/unit) sun-drier and charcoal-powered oven to convert fresh leaves into dried leaves (50 kg in an hour) with storage life of 12 months for use in soup. 17 drying units were installed and used by farmers and can be readily adopted in rural areas.
• Developed an evaporative cooling system for preserving indigenous vegetables in a natural state for at least 7 days.
• Developed a new technology for packaged boiled-frozen vegetable leaves that has been adopted by third parties using existing distribution channels (fish and meat) to provide access to refrigerated and frozen vegetables in Benin.
• Developed a protocol for extracting and producing polyphenol from leafy vegetables. The dried concentrate was successfully used to fortify local foods, juices, and pastry products. Fortified “green bread” and pineapple juice have been particularly popular with consumers. Protein concentrate powders can be purchased and mixed with beverages and hot cereal foods.
• Demonstrated the ability of polyphenol concentrates (PC) in animal tests to reduce blood pressure and inhibit digestive enzymes related to obesity and diabetes, as well as optimal dosage amounts (1 gram of PC is the equivalent of consuming 21 grams of fresh leaves daily).
• Research showed potential of PC in fighting viral infections such as flu and diarrhea (the “trypsin inhibition”)
• Developed innovative recipes for fortified food products that were well accepted by taste panels.

**Scaling up solutions proven to work**

“I used to think indigenous vegetables were not economically relevant so I never considered growing them. After our school encountered MicroVeg in June 2016 and with MicroVeg's persuasion, we reluctantly started planting these vegetables in our school garden. Now, our school has daily income and provide nutritious vegetables for public, just like magic. It is more than unbelievable.”

Olu Oyeleke, Teacher, Baptist High School, Ede, Nigeria

• Of the 2 scaling up models tested, the Innovation Platform (IP) performed better than the traditional Satellite Dissemination Approach (SDA) (which relies on the extension system for training, demonstration trials and community-based outreach). The IP involves coordination and cooperation between farmers, marketers, processors, input sellers, transporters, extension, policymakers, and financial institutions. IP benefits included:
  o Nearly 80% of farmers were reached through the IP in Benin and up to 85% in Nigeria
  o Three times more women than men adopting micro-dosing technology
  o Average land devoted on micro-dosing was 3 to 4 times higher on farms reached through the IP than those reached via the SDA.
• 112,870 YVSC members trained in vegetable science and production technologies; also trained 881 teachers (46% female) in Nigeria and 76 teachers (38%) female in Benin. Total revenue generated by the YVSC was CAD$3,105 in Nigeria and USD$2,810 in Benin. The 181 schools have since adopted YVSC as policy in their curriculum of activities.
• Negotiated preferred credit terms for value chain actors with the LAPO Microfinance Bank (e.g., 3.6% interest compared to 19%). For farmers, CAD$47,514 in loans were provided for vegetable production.
• Developed and distributed 30 Sale Counter Kits to indigenous vegetable marketers in Benin.
• Partnered with OYES to train 10,000 OYES members and provide agricultural inputs, which resulted in the OYES earning profits of 100-300% from sales of vegetables. The Osun state government in Nigeria has since committed more funding and land to the OYES program and pledged to adopt vegetable policies.
• Developed an online GIS-based reference map (http://webgis.usask.ca/microveg) and a profit calculator (http://webgis.usask.ca/microveg/newProfitCalc.html) to estimate fertilizer and water needs as well as profitability for any site in Benin and Nigeria.

**WHAT’S NEXT?**

The project team is seeking new funding to further ensure the Microveg model by focusing on: certifying and training seed producers; more scientific research, including human trials, on polyphenols; and, longer term tracking of vegetable
production and water quality. The web-based GIS product requires further management; it could also be adapted for a smart phone app to provide farmers and non-government organizations with information on market prices and extension agents. A process has begun with the Standards Organization of Nigeria to establish the Nigerian Standard for green pastry products, and a policy to speed certification of these products. In Benin Republic, the project has established a partnership with the Direction de l’Alimentation et de la Nutrition Appliquée (DANA) to begin certifying the value-added products.

LEARN MORE ABOUT THIS PROJECT:


**Project website:**  [http://www.microveg.org / https://microveg.nicanveg.org/content/welcome](http://www.microveg.org / https://microveg.nicanveg.org/content/welcome)

KEY OUTPUTS

ACADEMIC PAPERS:


https://academicjournals.org/journal/JAERD/article-abstract/9C51C5355989


IN THE MEDIA


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QUICK FACTS

Project location(s): Benin, Nigeria

Institutions: University of Saskatchewan; University of Manitoba (Canada); Université de Parakou (Benin); Osun State University; Obafemi Awolowo University (Nigeria)

Project duration: March 20, 2015—March 20, 2018

Project budget: CA$ 4,455,540

Project number: 107983

THE CANADIAN INTERNATIONAL FOOD SECURITY RESEARCH FUND IS JOINTLY FUNDED BY GLOBAL AFFAIRS CANADA AND THE INTERNATIONAL DEVELOPMENT RESEARCH CENTRE.