2016 International Award for Young Agricultural Researchers

Production of Vermicompost and Vermiwash Bio-fertilizers from Food Waste

Dr. Musaida Mercy MANYUCHI
Researcher
Harare Institute of Technology, Zimbabwe

Reason for the Award

The study conducted by the prizewinner relates to the treatment and composting of food waste by using earthworms. This study was appreciated because of the unique perspective of its research theme and of the utility in developing an inexpensive, diffusible, and practical technology as an alternative to the use of expensive chemical fertilizers. In addition, the prizewinner was appreciated for her excellent research ability because she has conducted her research despite insufficient experimental equipment and reported her findings in a number of high-quality technical papers.

Outline of Research Achievements

Food and agricultural waste is being generated in huge quantities and in most cases are being left to rot, resulting in increased greenhouse gas emissions. However, these food wastes have the potential to be vermicomposted to produce biofertilizers in solid (vermicompost) and liquid form (vermiwash). During vermicomposting, the earthworms feed on the food waste and excrete them as fertilizers.

Table 1: Nutrient composition of vermi-products

Nutrient composition (%)	Vermicompost	Vermiwash
Nitrogen	4.19	1.58
Phosphorus	1.15	7.53
Potassium	6.18	1.26

Main Publications:

(1) **M. M. Manyuchi**, Production of Bio-Fertilizers from Vermicomposting of Waste Corn Pulp Blended with Cow Dung as a Solid Waste Management Approach, ISBN: 9781627723985, PublishAmerica, 2013.
(2) **M. M. Manyuchi.**, T. Chitambwe., A. Phiri., P, Muredzi and Q, Kanhukamwe, Effect of Vermicompost, Vermiwash and Application Time on Soil Physicochemical Properties, International Journal of Chemical and Environmental Engineering, 4 (4), 216-220, 2013.
(3) **M. M. Manyuchi** and E. Whingwiri, Effect of Vermicomposting Period, Substrate Quantity, Cow Dung Composition and their Interactions on Eisenia Fetida During Vermicomposting, International Journal of Current Microbiology and Applied Sciences, 3 (8), 1021-1028, 2014.

2016 International Award for Young Agricultural Researchers

Novel Approaches for the Improvement of
Yam Germplasm Conservation and Breeding

Dr. Gezahegn Girma TESSEMA
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International Institute of Tropical Agriculture (IITA)

Reason for the Award

Although yam, which is the topic of this research, is an important crop in developing countries, the plant has not yet been subjected to genomic research because of considerable challenges in handling owing to biological limitations such as the lack of flowering and vegetative propagation. In this scenario, the prizewinner has conducted research on yam including an evaluation of its genetic diversity and the identification of candidate genes involved in sex determination. Such original and high-quality research, which may form the basis for the development of selective breeding, was highly appreciated because it may contribute to the breeding of yam in the future.

Outline of Research Achievements

Regardless of the huge benefit yam is offering to humankind and its wide distribution and cultivation, the crop has been neglected and treated as an orphan crop. Evidently, minimal efforts have been done to support conventional taxonomic identification to understand the taxonomy of yam. Moreover, the extent of genetic diversity has not been well investigated. In addition, very little is known regarding which genes are responsible for key traits in yams and there is almost no report on polyploidy and its effect on phenotypic performance.

The research achievements addressing these gaps include the establishment of a DNA barcoding system that supports conventional taxonomic identification, understanding the extent of genetic diversity among cultivated guinea yams and wild relatives based on next-generation sequencing based genotyping techniques, understanding the effect of polyploidy on aerial tuber production, and the discovery of novel candidate genes implicated in flowering and sex determination.

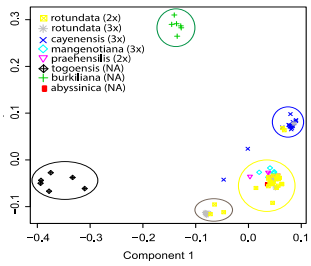

Fig. 1. MDS of *Dioscorea spp.*

Fig. 2. As the leaf gets roundish the number of aerial tuber and ploidy level increases.

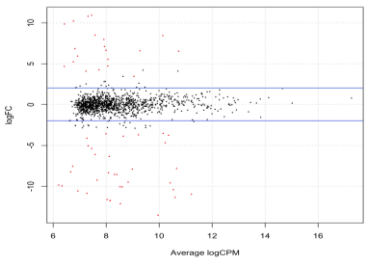

Fig. 3. Differential gene expression between male and female flower

Main Publications:

(1) **Girma, G.,** Spillane, C. and Gedil, M. 2016. DNA barcoding of the main cultivated yams and selected wild species in the genus Dioscorea. Journal of Systematics and Evolution. 54 (3) | 228–237.

(2) **Girma, G.**, Gedil, M and Spillane, C. 2015. Morphological, SSR and ploidy analysis of water yam (*Dioscorea alata* L. accessions for utilization of aerial tubers as planting materials. Genetic Resources and Crop Evolution. doi: 10.1007/ s10722-015-0351-2.

(3) **Girma, G**., K. Hyma, R. Asiedu, S. Mitchell, M. Gedil and C. Spillane. 2014. Next-generation sequencing based genotyping, cytometry and phenotyping for understanding diversity and evolution of guinea yams. Theoretical and Applied Genetics 127: 1783-1794.

2016 International Award for Young Agricultural Researchers

Precision Food Processing: Establishment of Mathematical Models for Microbiological and Physicochemical Food Properties for Food Safety, Food Defense, and Food Quality

Dr. Alonzo Alulod GABRIEL
Professor
University of the Philippines Diliman

Reason for the Award

The research conducted by the prizewinner includes the establishment of models predicting the growth rate and/or inactivation rate of food-derived microorganisms and the provision of general management methods to prevent deterioration of food by harmful microorganisms and to secure food safety. A number of the prizewinner's past achievements are highly appreciated not only from the perspective of academic rigor but also from the perspective of industrial application. In addition, not only the prizewinner's research endeavors, but also his efforts in disseminating his findings and in training students in his role as a university teacher were appreciated.

Outline of Research Achievements

The application of traditional yet effective and affordable thermal pasteurization process to thermosensitive raw materials such as fruit juices results in quality deterioration of the finished product. Therefore, the establishment of a thermal process schedule with the recommended lethality against disease-causing microorganisms, without the undesirable quality changes, is necessary to comply with consumer demand for safety and quality. One significant limitation of thermal processing is the dependence of its efficacy on variations in the characteristics of raw materials, processes, and microorganisms. Therefore, a specific food commodity should have a unique process schedule; otherwise, underprocessing might compromise food safety, whereas overprocessing might result in an unacceptable commodity.

'Precision Food Processing' involves the establishment of process schedules, taking into consideration the specific food, process, and target organism characteristics. In this set of studies, a specific target microorganism was first determined, after which a predictive model for its thermal inactivation rates was established. The model-predicted inactivation rates together with food- and process-related variables were then used to establish a new set of predictive models that estimate deterioration in the Vitamin C, color, and consumer acceptability scores of heat-treated juices. These food safety and food quality models can be used simultaneously to estimate the efficacy of a thermal process schedule against the target organism and the effect of the process schedule on the overall quality of the finished product.

Main Publications:

(1) **Gabriel, A.A.** (2014). Precision Food Processing: Addressing Consumer Demands for Safety and Quality through Predictive Model Building. A peer-reviewed discussion paper published by the Southeast Asian Regional Center for Graduate Study and Research in Agriculture (SEARCA) for SEARCA Regional Professorial Chair.

(2) **Gabriel, A.A.**, Cayabyab, J.E.C., Tan, A.K.L., Corook, M.L.F., Ables, E.J.O., and Tiangson-Bayaga, C.L.P. (2015). Development and validation of a predictive model for the influences of selected product and process variables on ascorbic acid degradation in simulated fruit juice. Food Chemistry 117, 295-303.

(3) **Gabriel, A.A.** (2012). Influences of Heating Temperature, pH, and Soluble Solids on the Decimal Reduction Times of Acid-Adapted and Non-Adapted *Escherichia coli* O157:H7 (HCIPH 96055) in a Defined Liquid Heating Medium. International Journal of Food Microbiology 160, 50-57.