Milestone report

Availability of knowledgeable personnel and improved laboratory capacity for assessing commercial agricultural products

Project

Institutionalization of quality assurance mechanism and dissemination of top quality commercial products to increase crop yields and improve food security of smallholder farmers in sub-Saharan Africa – COMPRO-II

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1 Introduction

In COMPRO-I, we demonstrated that less than 5% of all commercial products tested were of high quality and effective. High quality agricultural inputs are crucial for sustainable increase in crop production, environmental health, and farmer trust. Quality control is therefore very important. However, at the beginning of COMPRO-II, most of the national partners did not have enough laboratory capacity (i.e. material and human resources) to effectively conduct quality control of the commercial products of interest. There was a need to enhance the capacity of national laboratories and regulatory systems for quality assessment of the products.

In the context of COMPRO-II the focus was on bio-fertilizers and bio-pesticides. The common products were identified in collaboration with national partners to prioritize on capacity building. The priority products were rhizobia, *Azotobacter*, *Azospirillum*, arbuscular mycorrhizae fungi (AMF), phosphorus solubilising bacteria (PSB), and trichoderma. Standard operating procedures (SOPs) for these products were developed under Objective 2 i.e. *training manuals for screening products published, applicable to all countries*. A gap analysis was conducted in each participating laboratory to determine the available and missing equipment for the implementation of the SOPs. The training of laboratory staff and procurement of equipment were done accordingly. In each project country, one qualified laboratory was selected in collaboration with the competent regulatory body to benefit from the capacity building.

2 Type of products

The bio-fertilizer products mainly included rhizobia, AMF, PSB, *Azotobacter*, and *Azospirillum*, whereas for bio-pesticides the scope was limited to trichoderma. The training and the equipment acquisition was centered around these products. Standard operating procedures were applied in the training particularly for rhizobia, AMF, and trichoderma.

3 Standard operating procedures

In total, six SOPs have been developed i.e. an SOP for each product type of interest (rhizobia, AMF, PSB, *Azotobacter*, *Azospirillum*, and trichoderma). Based on the importance of the product in the marketplace, most of applications have been on rhizobia, AMF, and trichoderma.

4 Equipment

The list of equipment was prioritized based on the specific need in each participating laboratory and the available budget. The participating laboratories in the six project countries were Ethiopian Institute of Agricultural Research (Ethiopia), Kwame Nkrumah University of Science and Technology (Ghana), Egerton University (Kenya), Institute for Agricultural Research at Ahmadu Bello University (Nigeria), Sokoine University of Agriculture (Tanzania), and Makerere University (Uganda). In total approximately US$330,000 was spent on equipment. Equipment purchased for each of the laboratory are listed in Table 1.

5 Technical staff training

In 2012 i.e. beginning of the project technical staff in participating laboratories East Africa were trained in the IITA laboratory in Nairobi (Table 2; Plate 1). Later on technical staff in Ghana were sent to IITA laboratory in Ibadan for training (Table 2), and staff at the Institute for Agricultural Research - Ahmadu Bello University (IAR/ABU; Nigeria) were trained in their own laboratory after reception of the equipment purchased by the project (Table 2). At IAR/ABU graduate students took advantage of the training (Plate 2), which was mainly focused on AMF. The project also trained selected regulatory officers from the Kenya Plant Health Inspectorate Services (KEPHIS) and the Department of Crop Protection in the Ministry of Agriculture, Animal Industry and Fisheries in Uganda in microbial research and techniques related to quality control (Table 2).

Table 1 Equipment purchased by COMPRO-II in each project country

#	Equipment	Ethiopia[a]	Ghana	Kenya[b]	Nigeria	Tanzania	Uganda
1	Aquarium pump						X
2	Self-refilling syringes						X
3	Balance		X				X
4	Toledo PL202-S Classic balance						X
5	Stainless Steel Beads						X
6	UV water sterilizer						X
7	Latex tubing						X
8	Erlenmeyer with screw cap						X
9	Growth pouches				X		
10	Vortex		X			X	X
11	Industrial blender				X		
12	Assorted glassware		X	X			X
13	Test tubes	X					X
14	Microcentrifuge tubes						X
15	Petri dishes						X
16	Magnetic stirrer						X
17	Water distiller	2X	X	X		X	X
18	FlipStrip rack with lid						X
19	Cryogenic vial printed graduation sterile						X
20	Storage box, cryogenic vial						X
21	Autoclave	X	X	X			
22	pH meter	2X	X				
23	Laptop(s)	X		X	X		
24	Scanner	X					
25	Printer			X	X		
26	Laminar flow hood		X	X		X	
27	Colony counter and pointer		X	X		X	
28	Auto-dispenser			X			
29	Tissue grinder			X			
30	Compound/stereo microscope	X	X		X	X	
31	Microscope camera			X	X		
32	Dissecting microscope					X	
33	Refrigerator		X				
34	Centrifuge		X				X
35	Water bath		X				X
36	Thermal cycler system						X
37	Plate-96-well polypropylene for PCR clear						X
38	Tube with clear cap polypropylene for PCR						X
39	Sub-Cell Model 96 Cell						X
40	PowerPac TM HC Power Supply						X
41	Hot air oven		X				
42	Incubator		X	X			
43	Rotative incubator			X			
44	Liquid N container			X			
45	Oven			X			
46	Ultra low freezer (-80^{o}C)		X	X	X		
47	Fitoron model SGC 120				X		
48	Filtration system				X	X	X
49	Sintered funnel base					X	
50	Bucher flask					X	
51	Clips					X	

52	Dessicator vacuum pyrex			X	X
53	Dessicator plate/ techni-dome			X	X
54	Dessicator stopcock				X
55	Tally counter desk				X
56	Wrist action shaker		X		X
57	Soil temperature sensor		X		
58	Hemocytometer/melassez slide	X			
59	Tweezers	X			
60	Morta and pestle	X			

X = COMPRO-II has purchased the equipment for the partner

[a]*Part of the funds was used for the procurement of a field vehicle as it was the only country without a project vehicle and they were in need of one. Interestingly, they had the least lab challenge in terms of equipment required to meet the regulatory requirements. Therefore the decision was quite wise to motivate the partner.*

[b]*Greenhouse was the high priority (constructed) for EgU; they could do the minimal analysis with a few additional items of equipment*

Table 2 Training of technical staff from COMPRO-II partner institutions involved in quality control of bio-fertilizers and bio-pesticides

Name	Country	Affiliation	Position
Rashid Abafita	Ethiopia	EIAR	Senior Lab technologist
Getahun Mitiku	Ethiopia	EIAR	Senior Lab technologist
Jacob Ulzen	Ghana	KNUST	Ph.D. student
Grace Kamau	Kenya	Egerton University	Senior Lab technologist
Grace Kariuki	Kenya	Egerton University	M.Sc student
Joyce Waithera Eunice	Kenya	KEPHIS	Senior Lab technologist
Mellon Kabole	Kenya	KEPHIS	Regulatory officer
Jonah K. Ng'eno	Kenya	University of Nairobi	Ph.D student
Joana K.K. Mutuah	Nigeria	IAR/ABU Zaria	Technologist II
Ibrahim A. Aliyu	Nigeria	IAR/ABU Zaria	PhD Student/Staff-in-training
Suleiman K. Bello	Nigeria	IAR/ABU Zaria	MSc student/Staff
Fatima Abubakar	Nigeria	IAR/ABU Zaria	PhD student/Staff
Alhassan I. Gabasawa	Nigeria	IAR/ABU Zaria	PhD student/Staff
Dr. Consolatha Mhaiki	Tanzania	Sokoine University of agriculture	Senior Lab technologist
Gaitan Malekela	Tanzania	Sokoine University of agriculture	Senior Lab technologist
Stephen K. Serutonji	Uganda	Makerere University	Senior Lab technologist
Aguttu Gorreti	Uganda	Makerere University	Senior Lab technologist
Milka Kizza	Uganda	Department of Crop Protection	Regulatory officer

Plate 1: Participants to the training of participatory laboratories in East Africa (trainers and trainees)

Plate 2 Training of technical staff and selected graduate students at IAR/ABU (Nigeria) in microbial techniques (trainers and trainees)

Concluding remarks

Effective quality control of agricultural inputs requires well-established quality standards, standard operating procedures (SOPs) to verify product quality, well-trained qualified technical staff, and adequate equipment. In the six project countries, staff in the participating laboratories were trained and additional equipment supplied based on the priority SOPs and product type. The focus was limited to five bio-fertilizer types and one type of bio-pesticide. Given the continuous need to upgrade skills as product formulations evolve a lot, future initiatives to support public private partnership for regular staff training will be required. Similarly, to prevent backlog, additional laboratories should be considered for capacity building, which will also ensure cross-validation of laboratory results. Importantly, in the future the capacity of the retooled laboratories should be strengthened to meet international standards for accreditation if the quality control data should be used for legal cases to empower the regulatory bodies for effective enforcement of the regulatory frameworks. Even though the focus was limited to bio-fertilizers and bio-pesticides, evidence from the marketplace has demonstrated that several inputs like conventional herbicides, pesticides, fertilizers and seeds among others are affected by quality issues and should be regularly monitored. As such, the relevant regulatory bodies should consider additional competent laboratories for quality control of most critical agricultural inputs so as to improve soil fertility and crop productivity through use of high quality products.