Accelerating capacity building in Latin America and networking analytical laboratories[1]

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Abstract

Latin America and the Caribbean (LAC) have the highest surplus in food trade across all regions[1] and the highest average water availability[2]. Food exports are effectively transferring water across regions—"it takes 20 tons of water to make one pound of coffee"[3]. The current high demand for food and biofuels provides a more equitable return to primary producers and a delivery mechanism for achieving the Millennium goals[4]. On the other hand, higher food and energy prices create problems for the poor that require safety nets. In the longer term, a sustainable increase in production could lift many out of poverty[5]. Solutions exist such as stubble retention to reduce soil erosion and using herbicides to control weeds[6]. Minimum/no-tillage systems combined with integrated plant nutrient systems and integrated pest management provide a way to minimize the environmentally detrimental effects of agricultural production[7] and a more holistic farm-to-fork approach that emphasizes prevention at the source rather than relying solely on expensive end-product testing. Sustainable development is a pre-requisite, especially in the humid tropics where intensive agricultural systems are far more vulnerable to pest outbreaks than those in temperate regions[8]. Pesticides offer a means to manage pest outbreaks but sometimes at a cost—resistance (re-emergence) of main pests, emergence of secondary pests, negative health effects on applicators and downstream effects. Pesticides can be hazardous to human health and toxic to many non-target organisms. There are potential hazards associated with their manufacture, distribution and application that require a coordinated effort to address[9]. For example, PAHO estimates that 50% of all acute pesticide poisoning occurs in less developed countries, though the quantity of pesticides used is less than in the developed world[10]. Progress in information and communications technology is helping provide relevant information[11].

The issues are not always clear cut and sometimes require difficult choices—too frequently without the benefit of local data about pesticide risk indicators[12]. In the case of malaria, some success has been achieved by selective use of DDT[13]. Neglected tropical diseases like Chagas' will require a similar multi-pronged approach to be brought under control, including use of insecticides to interrupt the vector *Triatoma* (kissing-bug)/human transmission[14]. A major problem around the world is the diversion of public health pesticides to the private sector, primarily agricultural[15]. Individuals using diverted pesticides are probably untrained in the appropriate application technique and unaware of mitigation precautions,

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including the health, environmental impact or likelihood of pest resistance. In addition, such use may affect agricultural exports that are still recovering from a series of "food safety" incidents and collateral damage[16]. Increasingly, sophisticated analytical techniques such as liquid chromatography-mass spectrometry are used routinely to detect minute quantities of pesticides in imports and enforce maximum residue limits (MRLs), which are sometimes set on a national or regional basis at concentrations lower than the Codex MRLs. This creates pressure to divert non-compliant products to the domestic market or to ban pesticides that cause detectable residues in exports leading to the possible use of more toxic alternatives with higher acute mammalian toxicity and potential environmental impact.

Good agriculture practice (GAP) offers a way forward. However, GAP systems such as EurepGAP/GLOBALGAP require evidence of residue testing through national government laboratories accredited on the basis of a laboratory quality standard, such as ISO17025, as well as traceability requirements related to the farm on which the product was grown. It also requires that farmers have access to the necessary institutional infrastructure to verify the input quality, output quality and source of the agricultural commodity. Poor farmers, especially those in developing countries, may not have access to these types of services[17].

In 2005 a LAC network of nine laboratories was formed to monitor indicators of good agricultural practice at a microcatchment scale and to address sustainability issues affecting the laboratory. The project formally commenced in 2006 when the necessary research tools became available to accelerate capacity building. We define accelerated capacity building as a step-by-step approach to meet the demand for trained laboratory staff, especially in developing countries. The focus is on "training-the-trainers" and "learning-by-doing", i.e., 1) taking part in eLearning courses and exams, 2) participating in hands-on training workshops/courses, and 3) passing knowledge on to national and regional colleagues, mentoring and using standard training materials at seminars and/or workshops. Elements of the regional project monitoring indicators of GAP include:

- selecting a "representative" microcatchment;
- monitoring before and several times throughout the spray season with at least one upstream reference point and one downstream sampling point;
- defining roles and responsibility for the analytical laboratory and local stakeholders;
- feeding back analytical results to stakeholders;
- utilizing an integrated multi-disciplinary approach: first-tier risk assessment to target agrochemicals with high impact rating, using advanced, but robust and simple, analytical methods combined with bioassays and bioindicators;
- deploying, where appropriate, nuclear techniques such as isotope-labelled compounds and mass spectrometry to provide reference data and confirmation of residues;
- offering unrestricted training opportunities via eLearning courses; and
- georeferencing samples.

Initially the regional project used a "black box" approach: checking the water inputs (reference site) and outputs (contributions from the monitored land use) without considering the actual mechanisms and interactions within the microcatchment. A second project phase, which commenced in 2009 with 18 laboratories, attempts to estimate stream flow/pesticide load and possibly the relative importance of run-off and spray drift. Linkages were also established with FAO's microcatchment initiative[18]. This second phase should enable scale-up of the results to the national level using GIS approaches.

Several lessons were identified, including the need to:

- work with stakeholders with a commitment to GAP, ideally those already employing IPM or area-wide IPM incorporating the sterile insect technique for the major pest to demonstrate impact;
- ensure close proximity/coupling between the water monitoring points and the land use;
- choose a location not too far from the laboratory/field station to facilitate sampling;

- ensure that sampling points include worst case situations yet do not overstretch available resources;
- use small ad hoc working groups to solve implementation issues;
- utilize laboratory "twinning" missions and training opportunities to "exercise" the network;
- harmonize analytical methodologies as broadly as possible, including LIMS and inter-laboratory exercises;
- combine chemical with bioassay/bioindicators to provide more complete, complementary data;
- transfer relevant technologies in sufficiently small steps to ensure objectives are met;
- utilize accredited regional laboratories, where possible, and focus on training-the-trainer;
- create a regional isotope "bank" and regional demonstration/reference site to enhance training opportunities.

The concept of accelerated capacity building has clear benefits while placing demands on training organizers and end-users. Benefits include sharing and focusing resources and using them more efficiently. However, teamwork, close cooperation and coordination are essential. Similarly, a strong commitment of individual end-users and their management is necessary to allow efficient utilization of available training opportunities and contacts with regional training centres and mentors. The aim is not to create new specializations, rather to establish a common understanding and basis to negotiate partnerships necessary to best utilize scarce national resources. This requires a glossary of terms[19] in Spanish and field-guides that are useful for analysts[20].

Critics argue that the strategy is relevant only for Costa Rica. We believe accelerated capacity building and laboratory networking provide the opportunity for a multiplier effect that helps foster sustainability and decentralization as well as empowering partner laboratories and the regional network. By providing relevant performance indicators, strengthening local/regional institutions and becoming a reference point for farmers, the laboratory becomes a central and critical point in fostering GAP regionally.

The views expressed in this publication are those of the authors and do not necessarily reflect the views of the Food and Agriculture Organization of the United Nations/the International Atomic Energy Agency or the other authors' institutions.

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