Training course packages targeting food operators on the adoption and management of the technological innovations

AQUACULTURE SYSTEMS

Use of waste water from fish production systems to promote vegetable growing

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1. FoodLAND technical innovation for local food supply chains: concepts and approaches

The FoodLAND project has the ambition to impact on a large number of supply chains and communities, hence the process of food operators' capacity development has to be tailored and as much participative as possible. Accordingly, one of the assumptions of FoodLAND is that sustainable and nutrition-responsive farming systems can be achieved basically by strengthening the capacity development, and specifically by **a)** empowering farmers and processors through the implementation of capacity building processes and concrete opportunities; **b)** creating or consolidating cooperation and shared knowledge to overcome the lack of coordination among food operators; **c)** addressing the inefficient use of resources; **d)** trying to address and build resiliency to the high vulnerability of food systems to climate change; **e)** enhancing the integration of supply chains by creating commercial and stakeholders' networks; **f)** improving the responsiveness of the production sector to the market demand.

To implement these elements of capacity development, FoodLAND proposed the adoption of specific innovations, among which the organizational ones, to create strong and responsive links between producers and encompassing all the intermediate actors along the food value chain, such as researchers, SMEs, NGOs, local and national authorities. In order to ease the creation of those links and guarantee the sustainability over time of the results, 14 Food Hubs will be created in 6 countries as part of the organizational innovations. Food Hubs are conceived as multi-actors centers of innovation where to develop or enhance the organizational and operational conditions enabling local food supply chains (D3.6).

Functional to the implementation of the Food Hubs and of the innovations, the training courses were designed – in form of capacity development activities – as a two-phase process. Firstly, a training session focused on general, preparatory

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topics was provided to farmers as described and reported in D3.5 (“Group Introductory Training”, GIT). According to the project GA, GIT broad set of goals were: to enhance the knowledge of consumers’ nutritional needs and market opportunities, and to boost the notions about climate change, sustainability, resilience, and food culture. Secondly, a specific training session were organized to provide food operators with practical information on the adoption and management of the innovations tested at lab / small scale level and to contribute to validating them at appropriate scale.

However, as the whole approach has been designed by FoodLAND to ensure the inclusion of the local actors from the first moment, both the training sessions were set up accordingly. Indeed, yet in the inception phase of the project, an assessment on participatory methods has been run and Participatory Learning and Action (PLA) approach has been eventually assessed as the best one to ensure the inclusion of multiple perspectives. The main purpose of PLA is to support people within communities to analyze their own situation, rather than have it analyzed by outsiders, and to ensure that any learning is then translated into action (Gosling and Edwards 2003). In addition, a gender-sensitive approach has been applied to the trainings that have been designed considering gender roles and power relations; they have provided equal opportunities to participate in the process by caring to times, venues and use of local languages.

The GITs have been conceived as the first step towards the innovation validation and aim at involving the producers, yet from the inception phase. They are just the first step in a sequence of 6, summed up in **Table 1**. After the GITs, where farmers and processors meet and share their vision and goals for the Food Hubs and exchange information about specific topics, the Food Hubs were created and the innovation tested (first in pre-test, then in pilot phase). The constant iteration between researchers and local actors is a key feature of the project: specifically, the practical trainings focused the single innovations (step 5) are aimed at validating the innovations at adequate scale and planned to trigger feedback loops of control and improvement involving developers and adopters.

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Table 1. Activities with farmers and food processors (SMEs) and participatory approach

Step	1	2	3	4	5	6
Task	**T3.3**	**T3.3**	**T3.4**	**T4.1¸T4.5**	**T5.1¸T5.5**	**T5.1¸T5.5**
Activity	Group introductory training	Food Hubs creation	Innovation undertaking	Innovation tests	Individual and group practical training	Innovation pilot and validation

2. FoodLAND practical training: aims and scope

According to the project bottom-up and participatory approaches, following the courses on introductory topics GIT organized in the early project phase (T3.3), and as component creating / strengthening the Food Hubs as local innovation centres, FoodLAND has organized a second set of training activities with food operators based on active learning methods and gender equality principle (Task 5.1-5.9). In this regard, specific mechanisms (being aware of the gender roles and power relations; providing equal opportunities to participate in the process by putting attention to the times, venues, use of local languages, etc.) will be lifted to ensure women's participation. These training packages are aimed at providing the local farmers and food processors with operational instructions on the adoption and management of the validated innovations.

This second set of training activities has been organised – triggering PLA approach – as individual and group practical (demonstration/capacity building) activities to be conducted in parallel to the implementation of the technological research (where relevant) and of the innovation pilots and validation. These technology-centred trainings aim at strengthening the participants' understanding of novel production and post-harvest techniques, innovative tools and systems (e.g., climate smart/precision agriculture, hydroponics, and integrated aquaculture), new technologies for primary and secondary processing, and supply chain management. Thus they aim at fostering knowledge and operational

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capacity to deploy, manage, and maintain the validated technological innovations – documented by the released guidelines D4.1 ÷ D4.11 (e.g., training pamphlets, user manuals, flow diagrams, and operational recommendations) and practice abstracts D6.5 – validated jointly at appropriate scale.

3. Second training packages on the adoption and management of the tested innovations: an overview

The second training course aimed at consolidating the food operators' knowledge and practical skills to adopt, manage and validate the project innovations and complement the related guidelines. Specifically, the realized training materials provide local farmers and food operators with a set of notions and concrete information on a series of innovative tools and systems as per the following **Table 2**. It is clear that both the contents and formats of the learning packages widely differ across technologies as well as Food Hubs (when the same type of innovation must be validated in different contexts). The diversity that emerges from the proposed solutions reflects the different needs highlighted by farmers and stakeholders as well as the conditions and opportunities characterizing the local communities. Nevertheless, in order to take into due account the existing heterogeneity inside the local communities, the developed learning materials have been let available on the project intranet so as to be used for further training initiatives across the network of Food Hubs.

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4. Second training packages on practical information on the adoption and management of the tested innovations

Aquaculture systems

Use of waste water from fish production systems to promote vegetable growing

Target group: Food hub urban and peri-urban small holder aquaculture farmers

Aim of Training: The aim of this training is to guide urban and peri-urban aquaculture on best management practices in the use of aquaculture wastewater for vegetable production.

Learning Outcomes:

Participants will be able to use aquaculture wastewater in vegetable production for increased income and food security while ensuring environmental sustainability.

Areas of training

Overview of the effect of aquaculture effluents on the receiving aquatic environment and possible remediation fish cum vegetable integration

Design and layout of the fish-cum vegetable integrated production system,

Best Management Practices and guidelines on integrated fish-cum vegetable production

Water quality monitoring and management in aquaculture production systems.

Teaching & Learning Methods:

Practical (hands on), power point presentations, excursion, discussions and brainstorming

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Training materials Description

This material/module emphasises the use of aquaculture effluent waters in vegetable productions, its role in cleaner production, environmental sustainability and contribution to food and nutritional security. Protocols and BMPs of integrated fish-cum vegetable production will be discussed during training in order for the participating farmers to appreciate how integration of fish with vegetable production can contribute to increased production, income, food and nutrition security while ensuring environmental sustainability.

Assessment Methods and duration

Learners demonstrating what they have learned

8hrs: 2 hrs of theory and 6 hrs of practical

Overview/Introduction

Uganda's aquaculture industry is largely composed of smallholder farmers who have from time to time struggled to realize the transformation from small scale subsistence aquaculture to medium and emerging commercial aquaculture. With the dwindling capture fisheries production and increasing demand for fish and fisheries production due to the increasing population, the need for adoption of more intensive aquaculture production systems and transformation from small scale to medium and emerging commercial has become more apparent. This transformation requires adoption of the use of complete diets and artificially formulated feeds if increased fisheries productivity is to be achieved. Increased use of these feeds can lead to excess nutrient loading into the host environment. These nutrients are discharged from fecal waste, uneaten feeds and through excretion. In freshwater systems excess loading of phosphorous can potentially trigger eutrophication in these systems.

Adoption of integrated fish cum vegetable production, where aquaculture effluent wastewater is used as nutrient source for vegetables can play an integral role in reducing the risk of nutrient loading in the host environment. In addition to cleaner

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production. integrated fish cum vegetable production plays a big contributory role to improving income, food and nutrition security of the participating farmers.

As a means of ensuring maximum yield with minimal environmental challenges, Best Management Practices (BMPs) should be adhered to throughout the entire production process. The aim of this training material therefore is to guide prospective adopters of integrated fish-cum vegetable production systems on how to maximize yield while minimizing environmental threats and challenges.

Setting up of an integrated fish-cum Vegetable production system

Carry site capability and suitability studies and analysis to aid fish and vegetable species/strain selection. Selected site should allow for water flow and movement by gravity as a means of minimizing pumping costs

Design of the systems should be based on the nature of bio-physicochemical characterization of the site

Setting out and construction should be climate smart, environmentally and gender responsive

Choice of the fish and vegetables to be adopted should offer economic viability, climate smart and environmentally responsive.

Operations and Management BMPs

Prepare a checklist of materials and requirement needed for setting an integrated Fish cum Vegetable production systems

Select for active, disease and deformity free fish seed and vegetable seedlings from known source

It is important that stocking is done as per the recommended stocking densities of the fish species under consideration

Ensure that vegetables are planted as per recommended spacing for the vegetable under consideration

Initial weight/length measurements of the fish seed and seedlings should be recorded

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The quality of the water in the fish production should be checked to ensure that is within acceptable ranges for targeted aquaculture species of production

It is important that the effluent nutrient load is examined to ensure it is within acceptable ranges for the vegetables without choking before the effluent waters getting connected to the vegetable gardens

Routine water quality monitoring to ensure the bio-physicochemical parameters are maintained within acceptable ranges for the cultured fish species

Carrying out appropriate soil tests to ensure the selection of the best fish and vegetable species/strains to be cultured

Control weeds within the gardens

Ensure proper water management within the irrigated gardens

Use disease free crop planting materials

Manage external run-offs

On the fish production system condition to enable efficient water exchange

Check conveyance structures

Check capacity of the structures

Check drainage structure

Plan for maintenance and repair

Check water control structures

Sampling, grading and sorting

Ensure that the time of restraint is minimized during sampling, grading and sorting

It is important that sampling, grading and sorting are done in the morning, when temperatures are still low

Sampling, grading and sorting material should be friendly and non-bruising on the skin of the fish being graded

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On appropriate feeding

Follow feeding chart to feed

Use complete feeds

Store feeds in appropriate stores and on wooden racks

Check expiry dates of the feeds

Keep feeding records

Manage the feeding rates based on the records generated

Where possible, feeding by response and at libitum is more preferred

It is important that pellet sizes are adjusted according to the fish growth, development stage and mouth gap

BMPs on Use of aquaculture effluents in Vegetable production

Prepare the gardens to be free of weeds

Pre-test the effluent waters for the nutrient content to ensure the available nutrients are at a level which can handled by the prepared vegetable field.

Determine the method of irrigation

Estimate the crop water requirements

Compute the quantity of effluent

Design the systems

Set out the systems

Construct the structures within the two systems

Keep records at all stages

Water quality and nutrient loading monitoring in the fish cum Vegetable production facility

Routine monitoring of water quality parameters (DO, pH, Temperature, Ammonia-Nitrogen) which can cause acute stress and mortality to the fish

Weekly monitoring of water quality parameters (Nitrite-Nitrogen, Nitrate-Nitrogen, and Soluble Reactive Phosphorous) that cause chronic stress to the fish

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It is important that these parameters are measured in the incoming water of the production unit/systems, within the production system and in the effluent water

For monitoring targeting P and N extraction efficiency, water samples for P and N analysis in the incoming waters, within the production gardens and water effluenting the vegetable production gardens should be collected and analysed for P & N levels

Disease control in Vegetable production under Integrated Fish cum Vegetable production systems

Fish seed should be screened for diseases and any abnormalities during stocking

Vegetable seedling should be screened for disease and any abnormalities during selection and planting

Access to the fish cum vegetable production facility should be restricted to only disinfected individuals

Where possible, fish cum vegetable production facility should be housed in a green house setup

It is important that continuous monitoring is done to identify any vegetables with disease symptoms and these should be removed as soon as they are identified

Fish and Vegetable harvesting

It is important that the adopted fish harvesting methods do not cause any physical injury to the fish

HACCAP should be followed while harvesting the fish to keep it safe from any contamination

It is important that any potential contamination sources are avoided during the vegetable harvesting

Any physical injury or damage to the harvested vegetables where possible

All the harvested vegetable should be handled and stored according to the WHO hygienic food handling guidelines

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