FOODLAND

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

OSMOTIC DEHYDRATION AND DRYING SYSTEMS

Practical Training on osmotic dehydration and solar drying

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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

Osmotic dehydration and drying systems

Practical Training on osmotic dehydration and solar drying

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D5.1

Practical Training on osmotic dehydration and solar drying

(Product: tomatoes)

INAT

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INTRODUCTION

The drying system is a technological innovation, beneficial for farmers (fishermen) and consumers alike. It has many advantages:

- The valorization of the agricultural and fishing products
- Butter value perishable products
- Diversifying the diet of the local population, which can access all types of products outside the production season.
- The enhancement of the local population by creating employment for the rural unemployed youth and women

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Provisions regarding the quality of fresh tomatoes

1. Minimum quality characteristics of the raw material

The tomatoes must be whole, fresh in appearance, healthy, clean and practically free from visible foreign matter, abnormal external moisture and pests.

2. Category

The tomatoes must belong to either the extra-category or the class 1 –category.

3. Size

The accepted size of tomatoes is :

- Size 3: from 40 mm to 46 mm.

- Size 4: from 47 mm to 56 mm

- Size 5: from 57 mm to 66 mm.

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4. Color

The color of the accepted tomatoes is either:

- red: if more than 60%, but not more than 90% of the fruit is pink or red.

- Ripe red: if more than 90% of the surface of the fruit shows a red color.

5. Defects and tolerance

The maximum tolerances allowed in relation to the above specifications shall not exceed 20% of the delivered lot.

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Production process of dried tomatoes

1.Receipt and unloading of fresh tomatoes

Received raw materials shall be :

- Inspected to ensure compliance with raw material quality criteria.
- Sorted to eliminate all foreign bodies, tomatoes that are damaged, spotted and those that do not have the typical red color of ripe tomatoes.
- Calibrated and classified in lots according to the diameter of the fruit and put in clean boxes.

2.Temporary storage

Upon receipt, fresh tomatoes are unloaded in a clean, ventilated area and should not be exposed to direct sunlight. Storage of fresh tomatoes should be done in a way that prevents physical damage to the tomatoes.

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3.Waching and rinse cycle

The washing of tomatoes allows to remove all foreign bodies (leaves, sand, ..) and to ensure the disinfection with bleach, this operation must be done the following way:

- Fill the two stainless steel tanks with water up to the level of 50 L of water each.
- Add 0.03 L of bleach (12° hydrochloric acid) to the first wash tank,
- Empty up to 2 boxes of fresh tomatoes into the basin,
- Let it work for 10 minutes, then put the tomatoes in the second basin for rinsing.

4. Cutting

The fresh tomato is cut lengthwise into two equal halves on the middle of the longitudinal axis. The cutting operation is carried out with a stainless, sharp and clean instrument.

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5. Drying

- Put the cut tomato quarters back on the drying racks and distribute them evenly.
- The racks are then weighed to determine the quantity of tomatoes per rack.
- Follow the drying process by rotating and swapping the racks after three hours of drying.
- Monitor the temperature of the drying racks during the drying cycle.
- Remove the product after reaching the calculated theoretical drying weight and put the product immediately into the packing room.
- The target value of drying is to have a final moisture content of 15% (W/W)

The technical parameters of drying are determined in the chapter Solar drying technique

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6. Sorting of dried tomatoes

After drying, let the dried tomato carts cool down in the packaging room until they reach room temperature. A sorting is carried out before the conditioning to eliminate the tomatoes presenting defects of color, aspect and shape as well as the pieces of tomatoes which are not sufficiently dry.

The dried tomatoes are sorted on a stainless steel table and classified into categories.

7. Packaging

After sorting the dried tomatoes, the quality pieces are packed. The packaging is done in food quality vacuum bags with a maximum weight of 5 KG.

8. Storage

The use of a refrigerated room is essential for the storage of dried tomatoes in controlled conditions (temperature and humidity). The packaged product is stored at a temperature of 4°C.

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Materials and equipment needed for the dried tomato processing room

-To have a weighing device stamped by the competent services with a valid stamp

-That the equipment or the washing, rinsing and sorting chain are made of materials that do not damage the tomatoes. They must be installed in an independent space where they can be easily controlled and maintained. They must be equipped with the necessary means to drain off waste water

-Have equipment for tomato cutting operations,

-That the air is free of particles and odors that affect the quality of tomatoes in the drying chamber,

-That the air is free of particles and smells that affect the quality of the tomatoes in the drying chamber.

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Materials and equipment needed for the dried tomato processing room

-That the cold rooms have a sufficient capacity, adapted to the production capacity and are equipped with effective tools for the control, the security and a system of follow-up of the temperature.

-Tables for sorting, cutting of fresh tomatoes and packaging of the final product, made of non-oxidizable material,

-Ergonomic stools according to the nature of the work and the number of workers in the sorting, sizing and packaging rooms,

-Raw material washing stations consisting of two tanks with a minimum capacity of 50 liters each in non-oxidizable material.

-A tomato cutting machine in quarters of 04 or 06 according to the size of the tomatoes.

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Solar drying

The drying of tomatoes requires the determination of the temperature and duration of drying,

The speed of drying depends essentially on the quality of the air used, its relative humidity, its temperature and its speed of circulation.

The speed of drying also depends on the thickness of the pieces to be dried and the type of dryer.

Rapid drying is not required for all foods. In the case of tomatoes, drying too quickly can lead to crusting. The food product hardens on the outside while remaining moist on the inside. Further drying is not possible.

- Avoid using high temperatures at the beginning of drying (the first hour), it is recommended to start with a temperature of 40°C (ventilation),

- Increase the temperature to 75°C, for 4 hours,

- Then lower the temperature to 50°C, for 2 hours,

- It is preferable that the cooling is done properly after the drying.

Generally for 100kg of tomatoes we find 94kg of water and 6kg of dry matter (DM), after drying the elimination of 81kg of water is desired to reach a humidity between 11 and 13%.

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Provisions concerning the quality of dried tomatoes

1. Minimum features

In all classes, dried tomatoes must be:

- Intact (only for whole tomatoes and halves); however, slightly damaged edges, slight superficial blemishes or slight scratches are not considered a defect,

- Healthy; products affected by rotting or deterioration such as to make them unfit for consumption are excluded,

- Clean; practically free of any visible foreign matter,

- Sufficiently developed,

- Free from living pests, whatever their stage of development,

- Free from damage caused by pests, including the presence of dead insects and/or mites and their debris or excreta,

- Free from superficial defects of discoloration

- free from mould filaments visible to the naked eye

- Free of fermentation

- Free of abnormal external moisture- Free of foreign smell and/or taste, except for a taste of sodium chloride and a slight smell of preservatives or additives.

- Free of abnormal external moisture / -Free of foreign smell and/or taste

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Provisions concerning the quality of dried tomatoes

2. Water content of dried tomatoes

Dried tomatoes have a different water content defined by their designation, and their texture varies according to their water content

Designation of the water content	Min	Max	Texture
High	25%	50%	Flexible and foldable
Usual	18%	25%	Firm but foldable
Reduced	12%	18%	Very firm
Low	6%	12%	Hard and breakable

3. Microbiological quality of dried foods

The growth of microorganisms is dependent on the activity of water, there is an optimum value of Aw for growth, located between 0.92 and 0.99. Below this optimum, growth is slowed or inhibited.

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Provisions concerning the presentation

1. Homogeneity:

The contents of each package must be uniform and contain only dried tomatoes of the same origin, quality and size (if sized).

- For "Extra" Class, the dried tomatoes must be similar in shape and appearance, and have a distinct uniform color.

- For Class I, the dried tomatoes must be relatively uniform in color.

- The visible part of the contents of the package must be representative of the entire contents

2. Packaging

Dried tomatoes must be packed in such a way as to protect the produce properly.

The materials used inside the package must be clean and of a quality such as to avoid causing any external or internal damage to the produce. The use of materials, particularly of paper or stamps bearing trade specifications, is allowed provided the printing or labelling has been done with non-toxic ink or glue.

Packages must be free of all foreign matter.

3. Presentation

Dried tomatoes after sorting and grading may be presented in rigid or flexible packages. All the packages intended for sale contained in the same package must have the same weight. The empty packages are stored, in separate, non-humid places on pallets and protected from rodents and pests.

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Thank you !

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