



Food and Agriculture Organization
of the United Nations

Accelerated vocational training in agriculture
curriculum of module on
apple harvest and post-harvest practices



Accelerated vocational training in agriculture
curriculum of module on
apple harvest and post-harvest practices

Required citation:

FAO. 2021. *Accelerated vocational training in agriculture curriculum of module on apple harvest and post-harvest practices*. Beirut.

The designations employed and the presentation of material in this information product do not imply the expression of any opinion whatsoever on the part of the Food and Agriculture Organization of the United Nations (FAO) concerning the legal or development status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. The mention of specific companies or products of manufacturers, whether or not these have been patented, does not imply that these have been endorsed or recommended by FAO in preference to others of a similar nature that are not mentioned.

The views expressed in this information product are those of the author(s) and do not necessarily reflect the views or policies of FAO.

© FAO, 2021



Some rights reserved. This work is made available under the Creative Commons Attribution-NonCommercial-ShareAlike 3.0 IGO licence (CC BY-NC-SA 3.0 IGO; <https://creativecommons.org/licenses/by-nc-sa/3.0/igo/legalcode>).

Under the terms of this licence, this work may be copied, redistributed and adapted for non-commercial purposes, provided that the work is appropriately cited. In any use of this work, there should be no suggestion that FAO endorses any specific organization, products or services. The use of the FAO logo is not permitted. If the work is adapted, then it must be licensed under the same or equivalent Creative Commons licence. If a translation of this work is created, it must include the following disclaimer along with the required citation: “This translation was not created by the Food and Agriculture Organization of the United Nations (FAO). FAO is not responsible for the content or accuracy of this translation. The original [Language] edition shall be the authoritative edition.”

Disputes arising under the licence that cannot be settled amicably will be resolved by mediation and arbitration as described in Article 8 of the licence except as otherwise provided herein. The applicable mediation rules will be the mediation rules of the World Intellectual Property Organization <http://www.wipo.int/amc/en/mediation/rules> and any arbitration will be conducted in accordance with the Arbitration Rules of the United Nations Commission on International Trade Law (UNCITRAL).

Third-party materials. Users wishing to reuse material from this work that is attributed to a third party, such as tables, figures or images, are responsible for determining whether permission is needed for that reuse and for obtaining permission from the copyright holder. The risk of claims resulting from infringement of any third-party-owned component in the work rests solely with the user.

Sales, rights and licensing. FAO information products are available on the FAO website (www.fao.org/publications) and can be purchased through publications-sales@fao.org. Requests for commercial use should be submitted via: www.fao.org/contact-us/licence-request. Queries regarding rights and licensing should be submitted to: copyright@fao.org

Contents

Acknowledgements.....	iv
Introduction	1
Educational guidelines	1
Didactical tools.....	2
Evaluation of professional competencies	3
Chapter 1: Apple fruit harvest (15 hours)	4
Chapter 2: Postharvest practices (transportation, cooling, packaging) (17 hours).....	5
Chapter 3: Food losses resulting from harvesting and post-harvest practices and the most prominent solutions (8 hours).....	6

Tables and boxes

Table 1: The competency of the units and its stages	2
Table 2: Didactical tools and materials	3
Box 1: First phase of competency.....	4
Box 2: Second stage of competency.....	5
Box 3: Third phase of competency.....	6

Acknowledgements

This curriculum was prepared in participation with the agricultural technical schools teachers and trainers of the Ministry of Agriculture-Lebanon for use in agricultural technical and vocational training programs

Educational development and supervision: Welfare Association for Research and Development (WARD)

Technical review: Ministry of Agriculture

This curriculum was formed within the framework of the accelerated agricultural technical and vocational training for youth from 14 to 25 years (Lebanese and non-Lebanese) within the framework of the Food and Agriculture Organization of the United Nations (FAO) project "Upgrading the technical agriculture education system in Lebanon", funded by the Kingdom of the Netherlands. The training was implemented by the schoolteachers, trainers and Association of Volunteers in International Service (AVSI).

This project, led by FAO is implemented in cooperation with the Ministry of Agriculture, United Nations International Children's Emergency Fund (UNICEF), International Labour Organization (ILO), AVSI and WARD. It aims to upgrade the management and services of the agricultural technical schools of the Ministry of Agriculture in a sustainable manner to provide high-quality agricultural technical training to Lebanese and Syrian youth for increasing their employability skills. It also aims to review and update the Agriculture Baccalaureat Technique (BT) program and curricula following competency based training (CBT) and labour market needs along reviewing and updating its related institutional arrangement.

It further aims at building linkages for agricultural technical schools with private sector and setting contractual arrangement for work based learning. Also, it seeks to provide a healthy and protective learning environment for youth growth and development through the rehabilitation of school buildings and equipping school laboratories field demonstrations.

A student text book is developed for this curriculum (in Arabic)

Introduction

Unit: apple harvest and postharvest practices

duration: 40 hours

It is estimated that a third of all food is lost or wasted globally every year. Within this total quantity, approximately 20–40 percentage of all fruits and vegetables in developing countries and 10–15 percentage in developed countries are wasted during the post-harvest period of production chain due to lack of technology and poor handling of food crops.

Food loss and waste refer to the shortage of food in different stages of the food supply chain intended for human consumption. This food is lost or wasted throughout the supply chain, from initial production down to final household consumption.

Food loss is defined as "the decrease in quantity or quality of food". It is the agricultural or fisheries products intended for human consumption that are ultimately not eaten by people or that have incurred a reduction in quality reflected in their nutritional value, economic value or food safety.

Loss occurs at different levels starting from the field due to poor farmers' practice, respectively to harvest and post-harvest practices to the final stage reaching the consumer i.e. from farm to fork. Food loss may result from problems in harvesting, storage, packaging, transportation, infrastructure, marketing/pricing mechanism, as well as institutional and legal frameworks.

The deficiency may be accidental or intentional but ultimately leads to a lack of food and becomes unavailable to all. Food that is thrown or spoiled before being converted into a final product or retail phase is called food loss.

Educational guidelines

Accelerated vocational training is based on the principle of free participatory and constructive education. The basis of education is that trainees share their information with each other (no matter what level they are) and build upon them after correction. Trainees' experience is one of the most important pillars that helps them to appreciate themselves and to link what they learn to what is needed in the labour market. On this basis, the training strategy aims to guide trainees and help them enter into a production cycle. It also aims to change their behaviour (especially those who have dropped out of general education or who have different difficulties to prevent their active participation in society) and to ensure a sound and effective integration into the labour market. Therefore, the trainer must be careful to implement the following things/steps:

1. Focus on collaborative work in small groups.
2. Encourage trainees to discuss, dialogue and open exchange of information and experiences.
3. Respect for colleagues at work, employer, public safety laws, rules of health and environmental protection.
4. Give equal opportunities to participate.
5. Adopt the deductive method in education because it is most suitable for this type of teaching.
6. Link practical steps to theoretical steps that is, starting from applied work to the conclusion of theories.
7. Stay away from purely technical information, simplify things, and increase experience.
8. Pay attention to each trainee individually and monitor his/her work and correct what is necessary to maintain his/her safety and the safety of his/her colleagues and his/her work.
9. To consider "class workshop" as one of the most important teaching strategies used in this field, where the reality of work is applied directly to the reality of work or similar to the reality of work, theoretical learning is not separate from the application and the processes of discovery continue.
10. Emphasize that the trainee performs the cleaning and sterilization operations with emphasis on replication with high quality.
11. Consider field training (in practice) as one of the most important learning strategies that can be adopted.
12. Individual follow-up of the trainee during and after the educational process to ensure the achievement of the procedural objectives and acquire the necessary skills as the basis for his/her work in the labour market.
13. To consider the general objectives as the basis for the work of the trainee in the labour market, so it is necessary to verify their acquisition and acquire the necessary skills through the individual follow-up of the trainee during the learning process and during field training.
14. Work to motivate trainees to learn and push them to explore, extract and apply information frequently in order to acquire the required skill and focus using different active and interactive methods. Examples: scientific observation, field visits and projects, as well as experience and practice which are considered the most important elements of training.
15. The use of multiple educational aids to facilitate the absorption process, especially films and computer programs specialized in this area or websites.

Table 1: The competency of the units and its stages

	texts			evaluation mechanism
competency	At the end of this unit, and when facing a problem-a situation, the trainee will be able to propose a solution to this situation and through the use of integrated resources (knowledge, capacities, skills, techniques...) related to method of harvesting of apple fruit, storage and maintaining its nutritional values.			evaluation criteria of a complex situation
competency stages	<p>15 hours</p> <p>At the end of the first stage of competency, and when facing a problem- a situation, it has a meaning for him/her, the trainee will be able to propose a solution to this situation and through the use of integrated resources linked to apple harvest practice.</p>	<p>17 hours</p> <p>At the end of the second stage of competency, and when facing a problem- a situation, it has a meaning for him/her, the trainee will be able to propose a solution to this situation and through the use of integrated resources linked to the different method of transportation, packaging and cooling of apple fruit.</p>	<p>8 hours</p> <p>At the end of the last stage of competency, and when facing a problem- a situation, it has a meaning for him/her, the trainee will be able to propose a solution to this situation and through the use of integrated resources linked to the good practices to reduce the causes of food loss in the apple production value chain.</p>	evaluation criteria of a complex situation

Didactical tools

Learning by experience and class workshop contributes to enabling the trainee to acquire the skills he/she needs. Field training (in fields and farms) is one of the most reliable tools.

In addition to the above, it is important that the trainer uses various didactical tools that contribute to reduce learning difficulties and facilitate the learning process of the trainee on the other hand. In this context, it is preferable to use active instructional materials than using the passive ones, because of the nature and type of training, and in accordance with the levels of understanding and knowledge of trainees.

Some of the most important media are:

1. computer, monitor and Internet;
2. television, CD player and specialized films;
3. specialized books and magazines;
4. wall paintings; and
5. various visual and digital tools and materials to facilitate the process of explaining the theoretical content in the classroom and the practical applications in the field (safety masks, gloves, pruning shears, trees, etc.).

Add to that, websites are full of films, videos and information on the subject, which we recommend to use on the one hand and encourage trainees to look at them and search them.

Table 2: Didactical tools and materials

Lesson	Description/ Specification	Quantity for each school	Unit
2	Caliper: 6" adjustable plastic composite, jaw length 3 1/8", one fixed, one sliding jaw with brass tightening screw. Inch scale. 1/16" graduation and cm scale	1	Piece
1	Adjustable straps Fast easy bottom-emptying	5	Pieces
1	FT 327 PENETROMETER	1	Piece
1	Refractometer ATC 0-32%	1	Piece
1	Potassium iodide	10 gr	Sachet
1	Iodine crystals	3 gr	Sachet
1	Digital kitchen food scale(1gr - 5kg)	1	Piece
1	Hand pressure sprayer 1 lit	1 sprayer	Piece
1-2-3	Gloves	100	Pairs
1-2-3	Safety boot	Each student	Pairs
1-2-3	Hat	Each student	Pieces
1-2-3	Protective glass	Each student	Pieces
1-2-3	Protective gloves	Each student	Pairs
1-2-3	Mask	Each student	Pieces
1-2-3	Protective coat	Each student	Pieces
2	Visit to packaging and cooling center	1	Visit
1	Visit to Apple orchard (harvest)	1	Visit

Ideal daytime training time: N/A

Time to start the session (readiness and implementation of practical applications): September

Evaluation of professional competencies

This curriculum is based on two pillars: specific objectives, competencies and their stages.

A- Evaluation of specific objectives

- true / false questions;
- matching questions (here the number of items in the second list must be greater than the number of items in the first list);
- fill in the blank questions;
- multiple choice questions;
- exercises; and
- follow specific implementation stages.

B- Competency and its stages evaluation:

The formative and corrective function of the evaluation is the most important central function, as it allows to valuing achievement and discover the learning difficulties to address them and correct the course of learning through feedback. It also seeks to develop of the higher thinking skills, especially the skill of self-assessment and critical sense and mutual evaluation among trainees, which develop their sense of responsibility. Because the measurement of the development of higher thinking skills can only be achieved by solving the problem of a complex problem or carrying out a complex task¹ in which a number of factors overlap, the trainee is linked, coordinated and separated. Therefore, it is essential that the complex situation be characterized by the following components and characteristics:

Complex situation components¹

- Context describing the environment in which the situation takes place.
- Document which is a set of physical, hypothesis or real elements provided to the student: text, pictures, drawings, and so on. To be used in resolving the situation, the document contains information that may be complete or incomplete, both basic and non-essential.
- The function that determines the purpose of production required, a social function.
- Instruction: A set of work instructions that are explicitly given to the student, which is a translation of the task to be accomplished.

Complex situation properties

The complex situation should be:

- appropriate for any target efficiency;
- specialized resource that employs resources;
- motivating the trainee, meaning that it raises his/her interests.

The standardized evaluation is ideal for verifying the extent to which a trainee acquires competencies and their stages through a complex situation or a complex task. The criteria adopted in this approach are:

- Relevance of the learner's product: meaning match of the production of the trainee with instructions for the task required of the trainee to do, regardless of whether the production is true or not. Did the trainee answer what he/she asked for? Was the answer within or beyond the subject? So on. In other words, the trainee's understanding of the situation in general and of instruction in particular. If the instruction, as it is supposed to be, is composed of a complex procedural act and a cognitive content, the answer is appropriate if procedural action and cognitive content are taken into account.
- Proper use of the tools of the material: the use of concepts, theories and knowledge relating to the question properly.
- Coherence in answers, arguments, and intellectual context. The logical sequence in a trainee's product, the coherence of ideas, and the unit of meaning in a product. Is the answer logical, reasonable, acceptable, or likely to be, even if it is wrong? Is there a contradiction in the trainee's answer? So on.

Box 1: First phase of competency

First phase of competency (15 hours)

At the end of the first stage of competency, and when facing a problem- a situation, it has a meaning for him/her, the trainee will be able to propose a solution to this situation and through the use of integrated resources linked to apple harvesting practices.

Chapter 1: Apple fruit harvest (15 hours)

Specific objectives: at the end of this chapter, the trainee will be able to:

1. apply the methods for determining the maturity of apple fruits and its indications;
2. use the refract meter to check the product;
3. use the penetrometer;
4. prepare the iodine solution to measure starch; and
5. perform the correct harvesting operations.

Theoretical content:

1. methods to determine the maturity dates (physic-chemical methods - environmental indicators);
2. how to measure hardness;
3. how to use the refractometer;
4. how to prepare iodine solution to measure the level of starch;

¹ Complex and not complicated: "Complex" means that the trainee has all the resources necessary for the solution, and only has to coordinate and connect with each other* to accomplish the solution or task while "complicated" means that resources have not yet been acquired by the trainee

5. harvest timing; and
6. the correct harvesting method.

Practical content:

Exercise 1: check the level of starch.

Exercise 2: using the Refract meter.

Exercise 3: using the Penetrometer.

Exercise 4: implementation of harvesting practices.

Box 2: Second stage of competency

Second stage of competency (17 hours)

At the end of the second stage of competency, and when facing a problem – a situation, it is meaningful for him/her, the trainee will be able to propose a solution to this situation and through the use of integrated resources linked to the different method of transportation, packaging and cooling of apple fruit.

Chapter 2: Postharvest practices (transportation, cooling, packaging) (17 hours)

Specific objectives: at the end of this chapter the trainee will be able to:

1. know the different apple transportation methods;
2. apply initial cooling methods for apple and its importance;
3. apply the rules of cold storage of apples and its targets;
4. choose the appropriate air condition for apple storage; and
5. perform apple packaging stages.

Theoretical content:

1. initial cooling and its importance;
2. initial cooling methods suitable for Lebanese apples;
3. cold storage of fruits;
4. optimum Temperature and humidity for apple storage;
5. objectives of storage process;
6. factors affecting storage;
 - Pre-storage factor factors
 - Factors during the storage period:
 - controlled Air System; and
 - Requirements for controlled fridge weather.
7. packaging centers;
8. best practices in packing centers; and
9. transportation:
 - transportation to local markets; and
 - Transportation to international markets (exportation).

Practical content:

Exercise 1: show presentation on post-harvest practices.

Exercise 2: visit to Apple cooler.

Exercise 3: visit the packaging center.

Box 3: Third phase of competency

Third phase of competency (8 hours)

At the end of this phase and when facing a problem- a situation, the trainee will be able to propose a solution to this situation by using it in a combination of resources related to the good practices to reduce the causes of food loss in the apple production value chain.

Chapter 3: Food losses resulting from harvesting and post-harvest practices and the most prominent solutions (8 hours)

Specific objectives: at the end of this chapter the learner is able to:

1. detect the nutritional value of the apple;
2. discover the causes of food loss;
3. determine the most important diseases and physiological damage that affect the fruits during the period of storage which originates from the orchard and the methods of treatment;
4. determine the most important diseases and physiological damage to fruits during the storage period, which originates from storage rooms and the treatment methods; and
5. discover the high quality marks for all apple varieties.

Theoretical content:

1. definition of food loss;
2. the most important diseases damage that affect the fruits during the period of storage and originated from the orchard;
3. the most important diseases that affect the fruits during the storage period, which originates storage rooms and treatment methods;
4. the most important physiological damages that affect the fruits during the storage period, which originates from orchard;
5. the most important physiological damages that affect the fruits during the storage period, which originates storage; and
6. high quality advantages for all apple varieties.

Practical content:

Exercise: presentation about the world's food losses.



FAO Representation in Lebanon

Email: FAO-LB@fao.org

Website: <http://www.fao.org/lebanon/en/>

Twitter Account: <https://twitter.com/FAOLebanon>

**Food and Agriculture Organization of the United Nations
Beirut, Lebanon**



Ministry of Agriculture



WARD
Welfare Association for
Research & Development



People for development

Funded by:



Kingdom of the Netherlands