

Session 2.5: Protected and certified cultivations

Key learning points



- Poly-tunnels and glasshouse production
- Mulching techniques
- Hydroponics
- Organic production and environmental biodiversity

Main objectives of the session

By the end of the session participants will be better able to:



- Grow plants and seedlings in protected environments
- Economically appraise and select appropriate protective structures
- Use cultivation mulches
- Understand the principles and evaluate the economic effectiveness of using hydroponic growing technologies
- Consider biodiversity issues in vegetable production
- Understand the background to and principles of organic production
- Identify organic certification bodies
- Understand organic accreditation procedures and legislation
- Understand the steps required for converting to organic production

2.5.1 Poly-tunnels and glasshouse production

More precision and control are possible when plants are raised under protection. Protected cultivation (against low or variation in temperatures) is practically synonymous with cultivation under plastic or glass.

The increasing availability of plastics and low cost of frame materials (generally wood) have largely contributed to the rapid development of protected cultivation under plastic over the past 25 years and in particular in southern Europe. At the same time glasshouses have reduced in numbers largely due to the overall cost of installation and maintenance.

However protected cultivation is not evenly distributed throughout Europe. In Italy, 60% of the total area of protected cropping is in the south and in Sicily; in Spain, plastic houses are to be found mainly along the southern coast (Almería); in France, the centre of vegetable production is the Provence region; in Greece, 50% of the production originates from Crete; and in Portugal a similar proportion is to be attributed to the Algarve region.

Low tunnels are mostly used for the cultivation of small-volume vegetables (such as, lettuce, strawberry, melon or watermelon); they are also used for the initial growing stage of taller species (such as tomato and peppers). Mobile protection is ideal for plant raising since they can be moved of the plants so that the growth can be slowed and plants hardened before planting. However both greenhouses and walk-in tunnels can also be used for the complete cultivation of vegetables and flowers.

Greenhouses must ensure easy access so that produce can be carried out rapidly and without obstruction. Larger greenhouses are often divided by a central path and with wide entrance/exit doors equipped with simple closing devices that can be operated both from the outside and the inside. A warehouse is normally a part of a greenhouse so that fertilisers, machinery and plant protection products can be stored. A shed separate shed also allows the handling and packing of the produce when these operations are carried out by the grower and can also be used for storing plant protection equipment, irrigation apparatus and fertilizer distributors.

Greenhouse work may be conducted by hand but a wide variety of small machines are also commonly used and designed to fit the special dimensions of greenhouse plots. These include, motorised cultivators and hoes and two/four-wheeled tractors (power range between 2 and 20 HP) specially designed with a short turning radius and equipped with different tools such as ploughs and rotary cultivators or to haul trailers.

Insect and disease pest problems in protected production are similar to those of field production, yet unique because of the modified enclosed environment. Fortunately, great strides have been made in recent years in developing effective greenhouse IPM programmes and researchers have developed the use of many control tactics for greenhouse pests. Physical barriers such as insect screens may be used to prevent some types of pests from entering a greenhouse. It is helpful to remove infested material from the greenhouse to physically reduce pest populations. Screening air intakes to the greenhouse is also effective. Several natural predators can be obtained and released to reduce pest numbers to acceptable levels.

Exercise: Greenhouse production

Can you list what are the main advantages and disadvantages of greenhouse production?

2.5.2 Mulching techniques

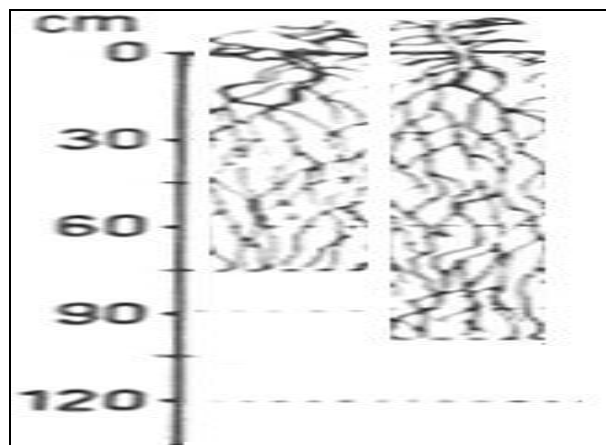
Mulch can be defined as any substance such as hay, sawdust, wheat straw, plastic sheets, that are spread on the ground to protect the roots of plants from heat, cold or drought, or to keep the fruit clean (such as strawberry, lettuce or melon). Mulching techniques to improve growing conditions is a growing practice that dates back 300 years or more. Plant residues and animal manure were the first mulching materials to be used. But during the late 1920's asphalt and paper became more extensively used and mulching developed noticeably after 1950 when polyethylene film became available. Soil temperatures can be raised by as much as 6-8C moisture is conserved and weed growth suppressed.

Mulches may be grouped into natural materials and man-made artificial products. Natural materials include wood products (such as sawdust), peat, animal manures and plant residues such as hay, straw or composts. Man-made (artificial) materials include paper, plastic sheets, paper-plastic combinations, aluminium foils and asphalt spray emulsion. Some mulches have been designed to be degradable within 30-130 days usually in response to bright sunlight.

When plastic/polythene is used it is normally black and seedlings and plants are grown through it. Uninterrupted coverage of large areas will require some kind of drip irrigation under the sheeting. The sheets are rolled up at the end of the season to allow the soil to be cultivated or left down for up to three years.

The field to be mulched needs to be ploughed, fertilised and prepared in the normal way. Mulch should be applied when soil conditions permit, i.e., when it is neither too dry nor too wet. Early mulch application has the advantage of warming the soil prior to planting. Mulch laying and removal machines are available and are able to bury the sides of plastic into planted beds.

Mulch changes the plant environment significantly and influences crop development during the periods when growing conditions are less favourable. It may help alleviate plant stresses caused by poor rainfall and low air and soil temperatures. Mulch also helps to control weeds, evaporation, soil compaction and leaching. Mulching affects quality, yield and time of production. Higher temperatures, better moisture and light conditions, higher CO₂ concentration and better soil structure all contribute to improved growth of plants. Plastic mulching proves particularly beneficial to crops that are shallow rooted and/or whose roots benefit from higher temperatures, higher soil oxygen or abundant moisture in the surface soil. Climbing and trailing plants show more response to mulching than any other crop. In tomatoes, the roots turn downwards and soon fill the soil on all sides of the plant down to 90 cm or deeper (see below)

Figure: Muskmelon tomato under mulch compared to non-mulch

(Source : Nozioni pratiche di agronomia, Edagricole, 1984)

On the other hand, cucurbits have a very extensive well-branched root system that spreads laterally throughout the surface not deeper than 10-20 cm, with very few important roots going deeper than 40-50 cm.

2.5.3 Hydroponics

A hydroponic system is a cultivation method in which plants are grown not in soil but in nutrient solutions composed of water and dissolved mineral salts. This is possible because the solution contains all of the chemical elements necessary for the proper growth of the plants, which subsequently mature and produce flowers and fruit just like those that are traditionally grown in soil. As hydroponics are technologically advanced and controlled cultivation systems, the results in productive and qualitative terms of hydroponic vegetables are normally superior to those being obtained with similar crops grown in open fields or in protected environments.

Hydroponic crops are expanding greatly largely due to:

- ❑ Enabling effective environmental protection control, through the introduction of closed cycle or modified open cycle techniques
- ❑ Increasing automation of systems
- ❑ Lower operational costs compared to traditional greenhouses
- ❑ A cleaner (no dirt) and wholesome product with excellent flavour and aroma
- ❑ Increased productivity
- ❑ A smaller requirement for chemical products for plant protection and no requirement for herbicides
- ❑ An absence of problems connected with soil exhaustion, chemical pollution or contamination of the soil

Despite the relatively high cost of hydroponics, these advantages have convinced many growers to convert their greenhouses into hydroponic systems. Some more specific hydroponic methods have been created for certain crops (such as, strawberries, string beans or lettuce), although the most common methods allow for the growing of a wide variety of vegetables.

2.5.4 Organic production and environmental biodiversity

Growers that want to farm organically and to do it correctly and profitably must start from the presupposition that they will be using a method that is based on the improvement of the organic, physical and microbiological fertility of the soil and management of the farms ecosystem.

Organic fruit and vegetables intake is growing as consumers move into the new millennium more informed and conscious about the types of fresh produce they eat and the way that is grown. The rise of the organic industry has been swift. Over 3 million hectares of land is currently devoted to organic fruit and vegetable production in Europe and around 120,000 companies are involved in the industry, according to recent estimates. Organic production comprises 3% of total food sales in 2003 and this figure is forecast to rise even further in the next decade although at a lower rate of growth as many products struggle to replace traditional supplies. At present fresh fruit and vegetables have the highest proportion (18%) of total organic food sales.

About 25-30 years ago the first natural food stores were founded and mainly carrying organic products and in the early 1990s major supermarkets entered the field. The supply of organic fruit and vegetables at wholesale and retail level is currently very varied with more than 100 different vegetable products offered throughout the year and with the most popular organic vegetables being, potatoes, carrots, onions, cabbage, tomatoes, zucchini, cucumbers, cauliflower, broccoli and lettuce.

The most popular organic fruits sold are, apples, kiwis, avocados, lemons, pears, nectarines, peaches, raisins, strawberries, cherries and plums. The most popular tropical organic fruits are bananas, coconuts, mangoes and pineapples

Organic horticulture is best known as a growing method where no synthetic (man-made) fertilisers and pesticides are used. However, according to the definition of the Codex Alimentarius, organic agriculture is “a holistic production management system which promotes and enhances agro-ecosystem health, including biodiversity, biological cycles and soil biological activity. It emphasizes the use of management practices in preference to the use of off-farm inputs, taking into account that regional conditions require locally adapted systems. This is accomplished by using, where possible, agronomic, biological and mechanical methods, as opposed to using synthetic materials, to fulfil any specific function within the system.”

Several national governments and a multitude of private certification and grower organisations have also defined organic agriculture and horticulture. In the past, the differences in these definitions were not so significant, but the demand for consistency by the traders has led to greater uniformity in recent years. One of the essential elements distinguishing organic horticulture from other forms of sustainable horticulture is the existence of production standards and certification procedures, although there are no universal standards for production and handling of organic fruit and vegetables. Initially organic standards were developed by private associations entitling members to use the organic brands and labels of the association when marketing their products.

The International Federation of Organic Agriculture Movements (IFOAM), a non-governmental organisation promoting organic agriculture internationally has also established guidelines that have been widely adopted for organic production and

processing. These guidelines are commonly considered as "minimum standards" and leave room for more detailed requirements, depending on regional or local situations.

As organic agriculture has become more widespread, most countries have defined their own organic standards. Since the early 1990s, EU countries have endorsed a common organic standard and this is spelled out in Regulation EEC 2092/91. The regulation determines the minimum requirements for organic farming in all the member states and is a directly applicable in law. It contains standards for production, processing, imports, inspection and certification, marketing and labelling of organic products. In 1999 the Committee on Food Labelling of the FAO/WHO Codex Alimentarius Commission also adopted "Guidelines for the production, processing, labelling and marketing of organically produced foods". Many of these organic standards are usually similar as they mostly derive from the IFOAM's guidelines for organic production.

In all cases the use of methods that contribute to maintaining or enhancing soil fertility are included and in most cases natural inputs are approved and synthetic inputs are prohibited. Nevertheless, there are exceptions in both cases. Certain natural inputs which various certification programmes determine to be harmful to human health or the environment are prohibited in some regulations and in others certain synthetic inputs are allowed. For example, EU Regulation 2092/91 allows, when required, the use of specific fertilizers and plant preservatives. All certification programmes maintain lists of specific approved synthetic inputs and prohibited natural inputs.

While many growers do not use synthetic inputs, this alone is not sufficient to classify their products as organic. Many certification programmes require additional environmental protection measures in relation to soil and water conservation, pollution control or the use of biological control agents.

Growers producing organic crops while at the same time growing basic foodstuffs on other areas of the farm and using conventional methods with fertilisers and pesticides that are inadmissible under an organic system, are also at risk of violating the standards, unless effective measures are taken to prevent prohibited substances from passing to the organic plots.

Organic food products originating from non-EU countries may be imported and marketed in the EU with an organic label if it is accepted that the products are produced and certified according to procedures equivalent to those of and approved EU certification authority. Under Regulation EEC 2092/91, there are, in practice, two options to gain authorisation to export organic products to the EU:

- 1) When the import country already has established and implemented organic standards and the certification body is included on *the EU Article 11 list*. Countries on this list can export organic products certified by an approved domestic certification body to the EU without the need for additional certification or accreditation. Each consignment is accompanied by a document certifying that standards and certification measures are equivalent to those applicable in the EU.

In order to be included in the list countries have to provide sufficient evidence that a reliable system of standards and certification procedures exists, and that it is equivalent to the EU system. The European Commission evaluates the country's organic standards

and its certification measures to ensure they are in line with Article 6 of Regulation 2092/91, and certification measures correspond to the measures described in Articles 8 and 9. In order to ensure equivalence in the effectiveness of inspection and certification measures, import country certification bodies must also satisfy the requirements of standards EN 45011 or ISO/IEC Guide 65:1996.

Experience shows that it is a difficult and long process for a country to be included onto the list. In June 2001, only 6 countries had been accepted (Argentina, Australia, the Czech Republic, Hungary, Israel and Switzerland).

- 2) If the exporting country is not on the Article 11 list, the exporter has to ask its importer in the EU country to apply for *an individual permit for import*. The importer applies to the designated authorities in the EU member country for import permission and the application has to be accompanied by documentation on the equivalence of standards and control measures. Both the producer and the exporter will have to be certified in accordance with EU procedures and in co-operation with an EU accredited certification body.

Import permits are issued for a certain amount of specific products from specified countries, for specified importers and are valid for defined periods. Once imported into an EU member country, the products may be marketed freely within the EU. In practice, the duration of the process to obtain an import permit can vary considerably from weeks to months. More than 70 countries export organic food products to the to the European Union using this approach.

Legislation at European Community level dates back to July 1991 when Council Regulation (EEC) 2092/91 on organic production of agricultural products was adopted. This Regulation covers mainly four aspects:

- ❑ Rules concerning production of agricultural products and preparation of foodstuffs;
- ❑ Labelling of organic agricultural products and foodstuffs;
- ❑ Inspection requirements;
- ❑ Equivalence regime for imports from non EU countries.

The EU logo established by Regulation (EEC) N° 331/2000 for organic products is optional (not compulsory) for the operators as an instrument for promoting their products.

To obtain recognition as an organic farm it is necessary to fill out a report for a relevant certification body and send it to the closest regional office of the certification body to where the farm is located. The accreditation body will then send an inspector to inspect the farm, take samples to be analysed for chemical residues, audit farm accounting records, and will need to have free access to all fields and farm buildings. After an inspectors report is completed the farm is defined as “converting to organic farming,” for a minimum period of 12 months for ground crops and two years for arboreal crops. At the end of this period the farm is defined as “organic” and its products as “organically grown.” However, all products from farms in the process of converting to organic farming may still be certified and marketed and specifying as being in the conversion process.

Accreditation bodies check that the methods and production are in conformity with the provisions of Reg EEC 2092/91 the labels of products coming from organic farming crops must show the mark or name of an authorised accreditation bodies recognised by the country of sale.

Growers adopting organic farming will need to read and adopt procedures carefully if they are to obtain and retain their licence. Farm prepared products from local plants, animals and micro-organisms for pest, weed and disease control are allowed in organic farming but each input has to be evaluated and approved under a controlled certification procedure. For example, temperature control and physical methods for pest, disease and weed management are permitted, but sterilisation of soils to combat pests and diseases may be restricted to circumstances where a proper rotation or renewal of soil cannot take place. Permission is sometimes only given by the certification body on a case-by-case basis.

All equipment from conventional farming systems has to be properly cleaned and free from residues before being used on organically managed areas. The use of synthetic pesticides, growth regulators, dyes and genetically engineered organisms are always prohibited and all permitted products for plant pest and disease control, weed management and plant growth regulation listed by the certification body.

Case studies

1. The “Masserie San Iorio” farm

The “Masserie San Iorio” farm in the province of L’Aquila at the foot of the National Park of Abruzzo is an example of a small organic fruit and vegetable farm. Presently the farm has 3 hectares of fruit and specialises in fruit such as; raspberries, currants, gooseberries, wild strawberries, rose hips, etc. The choice of production was dictated largely by the fact that these fruits typically grow wild in this area. Only 10% of production is sold directly to the market, with 90% being processed at the farm for the production into jams and liqueurs. Organic cultivation methods are used and for control against parasites and diseases beneficial insects are encouraged. Everything is inspected and certified by the Associazione Italiana Per L’Agricoltura Biologica, one of 13 authorised accreditation bodies in Italy.

2. Conerpo

Conerpo is one of the leading organic producers in Italy and established its organic range, “Borgosole Bio”, in 1997. This grower-packer-exporter began trialling organic tomatoes and apricots in the early 1990s and volumes have risen dramatically since then. Borgosole Bio handles around 10,000 tonnes of fruit and vegetables a year and markets 30 products including citrus, stone fruits, courgettes, onions and tomatoes. Borgosole Bio plans to further invest in the sector and is keen to encourage other conventional growers to switch to organic fruit and vegetables production.

3. Pempa Cooperative

Pempa is an Italian co-operative keen to increase its organic volumes. In 1993, they began marketing organic fresh produce under the “Il Salto” label but this was changed to “Vitalia Bio” at the beginning of 2001. Pempa consists of 74 organic growers located

in the Emilia Romagna region and all of its fruit is marketed under the Vitalia Bio label. The group handles stone fruit, persimmons, kiwifruit and top fruit. In 2000 they produced 1,400 tonnes of fruit and vegetables but they hoped to increase this to 2,700 in 2002. Pempas main export markets are the Netherlands, Germany and the UK. Significant quantities are also consumed domestically.

4. Minnaar

Minnaar is a Dutch company that is also reporting strong demand for organics. Minnaar management believes that the European organics market will enjoy further growth as consumers become more food conscious. The Dutch-based fresh produce supplier has been marketing organic products since 1998, offering a range of vegetables including peppers, tomatoes and cucumbers. Their export markets include Germany, the UK, Hong Kong and Canada, they reported a 300% increase in organic intake during 2000. Minnaar is concentrating its efforts on shipping larger volumes to supermarkets, focusing on year-round supply, and building on its price competitiveness.

5. Thames Organic Produce Ltd.

In the UK, Thames Organic Produce Ltd, part of the Thames Fruit group, sources organic produce from a number of countries both inside and outside of Europe and enjoys partnerships with growers in Spain and Italy. The company handles a number of fresh produce items including citrus, apples, pears, peppers and lettuce.

6. Bio-Zeus

In Greece, Bio-Zeus is a network of 800 growers established in the southern Peloponnese. Bio-Zeus exports a range of fruit and vegetables including citrus, kiwifruit, table grapes, melons, peaches, nectarines and cherries. It also ships tomatoes, cucumbers and peppers. Germany is currently Bio-Zeus's largest market but the company is also eyeing new initiatives like the US and the Middle East markets.