Good Agricultural Practices (GAPs) principles for greenhouse vegetable production in the Mediterranean Region

M. Qaryouti

National Center for Agricultural Research and Extension (NCARE)
Good Agricultural Practices (GAPs) principles for greenhouse vegetable production in the Mediterranean Region

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Protected Cultivation in the Mediterranean Region

Low tunnels (Jordan)

Walking tunnels (Cyprus)

Jordan

Morocco

Mono-span plastic houses
Protected Cultivation in the Mediterranean Region

Multi-span Greenhouses
Chapter 1. GREENHOUSE SITE SELECTION

Factors affecting site selection (Topography, Local climate, soil quality, ..)
Greenhouse microclimate modification
Greenhouse production strategies
Climatic suitability for GH vegetable production
  Climatic requirements of vegetables
  Obtaining the required climate conditions
  Climate suitability
Factors affecting Greenhouse Design and Covering materials
Main greenhouse types in the Mediterranean basin
Plastic covered industrial-type greenhouses
Glasshouses.

Flat-roof greenhouses in Almeria (Southern Spain)

Venlo-type glasshouses
Chapter 2. GREENHOUSE DESIGN and COVERING MATERIALS
E. Baeza, M. Kacira, J.C. Lopez, J.I. Montero, M. Teitel

Plastic films for covering greenhouses
   Polymers and additives
   Properties of greenhouse plastic covering materials

Insect-proof screens for Good Agricultural Practices
   Effect of insect-proof screens on ventilation
   Photo-selective screens, colour effects and other modifications
   Maximizing the screened area.

Trends in natural ventilation.
   Airflow characteristics under wind driven ventilation

Samples of insect proof screens
Driving forces for greenhouse climate control and sustainable energy use in Mediterranean Greenhouse

Climate Control
- Ventilation, Cooling, Shading & Heating
- CO2 enrichment
- Dehumidification
- Control systems

Rational use of Energy and Renewable Energy Sources
- Rational use of energy
- Energy saving
- Renewable energy sources
Fresh water resources in the region, including internal and external water resources as well as underground water (Abu – Hadid, 2010).
Irrigation Water Quality Parameters
   Physical Parameters
   Chemical Parameters
   Toxic Elements (Ions, Trace Elements And Other Problems)
   Hardness
   Trophic Substances
   Calculated Indices

Irrigation Water Analysis: Units, Terms and Sampling
   Sampling
   Analytical Parameters Measured
   Interpreting A Laboratory Report (Assessment of Results)
Chapter 4. IRRIGATION WATER QUALITY
FOR GREEHOUSE HORTICULTURE

On-site water testing
  General rules for using a pH meter
  General rules for using the EC meter
  Management practices for irrigating with saline or sodic water

Correcting water quality problems
  desalination
  pH correction
  Filtration

Estimating of irrigation scheduling

Improving water use efficiency

Recommendations

Stefania De Pascale, Francesco Orsini, A. Abu Hadid
Chapter 5. SOIL FERTILITY & PLANT NUTRITION

G. Gianquinto, P. Muñoz, A. Pardossi, D. Savvas

Soil fertility

Plant nutrients: demand, resources, uptake, and functions (Nitrogen, Phosphorus, potassium, sulphur, magnesium, calcium, micronutrients)

Seasonal changes in crop nutrient requirements

Assessment of fertilizer requirements based on soil and plant nutrient status

Mineral nutrition and produce quality

Nutrient management and environmental risk

Recommendations

Soil sampling
Characteristics of growing media
   Physical properties
   Chemical properties
   Biological properties

Growing media classification and choice

A brief presentation of the most used substrates
   Inorganic growing media
   Organic growing media
Growing media reuse

Recommendations
Chapter 7. THE CHOICE OF THE SPECIES AND CULTIVARS FOR PROTECTED CULTIVATION

C. Leonardi 1 and A. Maggio

The choice of the crop (factors affects crop selection)
The choice of the cultivar
Traditional versus innovative greenhouse productions
Chapter 8: **QUALITY OF PLANTING MATERIALS**

Chieri Kubota, Astrit Balliu, Silvana Nicola

**Seeds** (Seed source, seed Handling, Seed storage, Seed treatment & Germination)

**Transplants** (Transplants, Grafted seedlings, Purchasing transplants from propagators, Production scheduling, Packing and transportation)
Chapter 8: QUALITY OF PLANTING MATERIALS

Chieri Kubota, Astrit Balliu, Silvana Nicola

Facility and materials to grow plants
(Seedling trays, Substrate, Fertilizers, …. etc.)

Irrigation and fertigation

Growth control and hardening techniques
(Day-night temperature difference (DIF), Irrigation deficit / water stress, Nutrient deficit, Transplant age)

Physiological disorders
(Nutrient deficiency and toxicity, Pests and diseases, Disorders caused by the growing environments)

Overhead irrigation used for transplant production facility.
Chapter 9. CULTURAL PRACTICES

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SOIL PREPARATION

PLANTING
- Greenhouse crop and occupation index
- Cultivation schedule
- Planting density
- Row orientation

TRAINING AND PRUNING techniques

FRUIT-SETTING
- Mechanical aids
- Bumble bees
- Application of plant growth regulators

INTERCROPPING

MULCHING

HARVESTING

Yuksel Tuzel

High plant density cause severe disease problems and frequent pesticide spraying!

Enough space should be given between the crops!
CHAPTER 10. INTEGRATED PEST MANAGEMENT

A. HANAFI

IPM in protected cultivation
Preventive measures
Host Plant Resistance
Practical Biological control of Insects and Mites
IPM and biological control of insects and mite pests in
Biological control of diseases and IPM
Biological nematode, virus and weed control
Physical control
Mechanical control
Chemical control
Practical rational chemical control of greenhouse pests and diseases
Preharvest factors affecting product quality
   Harvest maturity (Bell peppers, tomatoes, cucumbers, green beans, aubergines (egg plant), melons, lettuce)
   Harvesting operations

Temperature management
   Precooling (Passive room cooling, Pressure (forced air) cooling, Vacuum cooling, Hydrocooling, Ice cooling)
   Storage conditions and temperature (Chilling injury)
   Cool store design
   Minimizing moisture loss in product
CHAPTER 11. HARVESTING AND POST HARVEST MANAGEMENT

Ethylene
  1-methylcyclopropene (MCP)
  Treatments to reduce deleterious effects of ethylene
Sorting and grading
Postharvest pathogen and decay
Sanitation and food safety
GLOBALGAP requirements for food safety
Packaging
Traceability
Transport to market
Supply chains
Chapter 12. Integrated Preventive Environmental Strategy in Greenhouse Production

Assumpció Antón and Pere Muñoz

Introduction to Greenhouse Cleaner Production
Waste reduction.
Non-polluting production
Production energy efficiency
Safe and healthy work environments
Environmentally sound products and packaging

Quality Management Systems

Environmental Management. Life Cycle Assessment
Goal and scope definition
Inventory analysis
Impact assessment
Interpretation
Chapter 12. Integrated Preventive Environmental Strategy in Greenhouse Production

Assumpció Antón and Pere Muñoz

Occupational Health and Safety Management Systems

Pollution prevention
  Air emissions
  Water pollution
  Recycling materials
    Plastics
    Steel
    Substrate
Chapter 13. **LABELING AND CERTIFICATION**

Procedures to get Global GAP certificate

- Documents needed
- Internal Inspection
- External Inspection

External Inspection
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Important of FFV Standards

International Standards
- UNECE Standards
- UE Standards
- Codex alimentarius standards

National Standards

Private standards
- Global GAP
- Tesco, HACCP
Chapter 15 : Soilless culture

Systems and equipment
- How to feed plants in soilless systems
- Open- and closed- loop soilless systems
- Water culture or hydroponic systems
  - Deep Water Culture (DWC)
  - Float Hydroponics (FH)
  - Nutrient Film Technique (NFT)
  - Deep Flow Technique (DFT)

Crop nutrition in soilless culture
- Principles
- Composition of nutrient solution
- Impact of nutrition on yield
- Impact of nutrition on produce quality
- Monitoring and adjusting the nutrient supply
- Nutrient cycling in closed soilless culture systems
Chapter 15; Soilless culture

D. Savvas, A. Pardossi, Y. Tuzel
G. Gianquinto giorgio

Irrigation management in soilless culture
  Irrigation in soilless- vs. soil-grown crops
  Characteristics of irrigation systems
  Delivery Systems (Overhead systems, Drip irrigation, Subirrigation)
  Management of drainage
  Control systems

Irrigation scheduling (Irrigation scheduling approaches, Irrigation decisions)

Impact of irrigation on yield and quality

Soilless cultivation of major greenhouse vegetable crops (Tomato, Cucumber, Pepper, Eggplant, Melon, Zucchini, Bean).
Thank you for your Attention

Petra – Jordan