

GOOD AGRICULTURAL PRACTICES, POST-HARVEST HANDLING AND TRADE REQUIREMENTS IN CHILLIES, HERBS AND SPICES VALUE CHAINS IN KENYA



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**GOOD AGRICULTURAL PRACTICES, POST-HARVEST HANDLING AND TRADE
REQUIREMENTS IN CHILLIES, HERBS AND SPICES VALUE CHAINS IN KENYA**

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FOREWORD

The European Union (EU) in partnership with the East African Community (EAC) launched the Market Access Upgrade Programme (MARKUP) to support member countries improve market access of agro-food products to the EU and regional markets. UNIDO is the implementation partner for the Kenya-Partner States Window. The sub-sectors of interest in the MARKUP program include: French beans, groundnuts, macadamia nuts, snow peas and peas, mangoes, passion fruit, chillies, herbs and spices. Recent studies have analyzed the reasons for low productivity and competitiveness in these value chains and among others identified lack of specialized extension services and a diffuse lack of knowledge on appropriate good agricultural practices (GAP). These value chains also lack compliance with market requirements and standards posing a challenge to exploiting potential benefits from the more lucrative export market. The MARKUP project therefore aims at improving the institutional and regulatory framework for better conformity assessment services in Kenya's horticultural sector; increase revenue and MARKUP for Kenya's smallholder producers and enterprises in export-oriented horticulture sectors.

The main purpose of this training manual is to contribute to the economic development of Kenya by increasing the value of both extra and intra-regional export of chillies, herbs and spices. The training focuses on building capacity in good agricultural practices with specific focus on good agronomic practices, integrated pest and disease management, pesticide application, aflatoxin management, and post-harvest management in the chillies, herbs and spices value chains as well as legal and technical requirements for export of these products. In addition, the training aims at building capacity for extension officers and producers in spraying regimes with a view to promoting economical and safe use of pesticides in order to support safe trade of chillies, herbs and spices both locally and internationally. Through this initiative, extension officers and producers will be trained; after which they will be expected roll out the learned knowledge to other extension officers and producers through in situ trainings in the major chillies, herbs and spices producing counties. Selection of the initial trainees (Master Trainers) is be based on good understanding of food safety; production; application of pesticides; post-harvest management; aflatoxin management; and export of chillies, herbs and spices; as well as ability to mentor others. Overall, this training endeavors to contribute to production of high quality chillies, herbs and spices that are compliant with market requirements under the MARKUP project in order to enhance Kenyan exports and increase market access. To achieve this, the training aims at increasing the number of extension officers and growers of chillies, herbs and spices at county level to be part of suppliers' control and monitoring plans.

At the initial stages, the trainees will be mentored by experts through a practical on-site training session followed by an independent implementation phase during which the mentee will be supported remotely. It is anticipated that the mentees will train other extension officers and farmers leading to an increase in yield, improved quality of chillies, herbs and spices, enhanced compliance with market requirements and ultimately an increase in domestic, regional and international trade.

Director General, AFA

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EXPECTED LEARNING OUTCOMES

- **Extension agents are expected to:**
 - Effectively train farmers on good agricultural practices in production of chillies, herbs and spices.
 - Effectively train chillies, herbs and spices farmers on integrated pest management and pesticide application.
 - Effectively train farmers on proper harvesting and drying of chillies, herbs and spices.
 - Effectively disseminate information on aflatoxins and their management in chillies, herbs and spices value chains to farmers and other value chain actors.
 - Effectively train farmers on post-harvest handling of chillies, herbs and spices including storage, transportation and marketing.
 - Effectively train chillies, herbs and spices farmers on practices that promote compliance with market requirements and quality standards at pre-harvest and post-harvest stages.
- **Producers are expected to:**
 - Have an in-depth understanding of good agricultural practices in production of high quality chillies, herbs and spices.
 - Have an in-depth understanding of good harvesting and drying practices for chillies, herbs and spices.
 - Have a good understanding of integrated pest management and pesticide application in production of chillies, herbs and spices.
 - Understand pre-harvest and post-harvest practices that reduce the risk of aflatoxin contamination in chillies, herbs and spices.
 - Understand the role of compliance with quality standards on trade and health in relation to chillies, herbs and spices.
 - Understand practices that contribute to compliance with market requirements and quality standards at pre-harvest and post-harvest stages.
- **The Regulators/Inspectors are expected to:**
 - Have a good understanding of pesticides and pesticide residues, and their effects on health and trade in the chillies, herbs and spices value chains.
 - Effectively inspect for pesticide residues in chillies, herbs and spices value chains.
 - Definitively explain the steps towards compliance with standards set for chillies, herbs and spices by local, regional and international markets.
 - Positively identify chillies, herbs and spices contaminated with aflatoxin producing moulds.

ABBREVIATIONS AND ACRONYMS

AFA:	Agriculture and Food Authority
ASTA:	American Spice Trade Association
BEPI:	Business Environmental Performance Initiative
BRCGS:	British Retail Consortium Global Standards
BSCI:	Business Social Compliance Initiative
CAN:	Calcium Ammonium Nitrate
CFU:	Colony Forming Unit
COMESA:	Common Market for Eastern and Southern Africa
CSR:	Corporate Social Responsibility
DAP:	Diammonium phosphate
EAC:	East African Community
EC:	European Commission
e-COI:	Electronic Certificate Of Inspection
EQS:	Export Quarterly Returns
ETI:	Ethical Trading Initiative
EU:	European Union
FAO:	Food and Agriculture Organization of the United Nations
FAOSTAT:	Food and Agriculture Organization Corporate Statistical Database
FPEAK:	Fresh Produce Exporters Association of Kenya
GAP:	Good Agricultural Practices
GFSI:	Global Food Safety Initiative
GGN:	Global-GAP Number
GMS:	General Marketing Standards
HACCP:	Hazard Analysis Critical Control Points
HCD:	Horticultural Crops Directorate
IFS:	International Featured Standards
IPM:	Integrated Pest Management
ISID:	Inclusive and Sustainable Industrial Development
ISO:	International Organization for Standardization
KEBS:	Kenya Bureau of Standards
KEPHIS:	Kenya Plant Health Inspectorate Service
KESWS:	Kenya National TradeNet System
KHCP:	Kenya Horticulture Competitiveness Project
KIFWA:	Kenya International Freight and Warehousing Association
KRA:	Kenya Revenue Authority
MARKUP:	Market Access Upgrade Programme
MRL:	Maximum Residue Level

NPPO:	National Plant Protection Organization
PCPB:	Pest Control Products Board
PPB:	parts per billion
PPE	Personal Protective Equipment
RASFF:	Rapid Alert System for Food and Feed
SDGs:	Sustainable Development Goals
SIFAV:	Sustainability Initiative for Fruits and Vegetables
SMETA:	Sedex Members Ethical Trade Audit
SQF:	Safe Quality Food
TRACES:	Trade Control and Expert System
UN:	United Nations
UNECE:	United Nations Economic Commission for Europe
UNIDO:	United Nations Industrial Development Organization
USAID:	United States Agency for International Development
VAT:	Value Added Tax
WHO:	World Health Organization

CHAPTER 1: GOOD AGRICULTURAL PRACTICES AND POST-HARVEST HANDLING IN PRODUCTION OF CHILLIES

1.1 General aspects of chillies

Chilli (*Capsicum* spp.) is a plant of tropical and subtropical regions that is grown for its fleshy fruits. The plant belongs to solanaceae family, the same family as Irish potato and tomato. Chilli is consumed fresh, dried or in processed form as a table vegetable or spice. The fruit is rich in potassium, magnesium and iron and it is a good source of Vitamin A, C and B6. Chilli produces a pungent chemical called capsaicin. Scoville scale is used to measure pungency with sweet peppers being classified as mild and Cayenne as scorching. Capsaicin possesses anti-bacterial, anti-diabetic, anti-carcinogenic and analgesic properties.



Figure 1. 1: Sweet (A, B) and hot (C, D) chillies

1.1.1 Status of chilli production in Kenya

Chillies are grown for local consumption and for the export market. Locally, chillies are grown mostly for their fresh fruits used to flavour soups and stews and for seasoning and making sauces. The leading export markets for chillies grown in Kenya are: Belgium, Djibouti, Germany, France, Middle East, Netherlands, Russia and United Kingdom. In 2019, Kenya produced 2,490 tons of chillies from an estimated area of 1959 hectares representing a production decline of about 8% compared to 2018 values (FAOSTAT, 2019).

1.1.2 Common chilli varieties grown in Kenya

Some of the common chilli varieties grown in Kenya include: African Bird's eye (ABE Chilli), Short Bullet, Jalapeno, Long Cayenne, Serenade, Fresno, Rocket and Anaheim (Figure 1.2).

1.1.3 Climatic requirements

Chillies grow at altitude ranging from 0 to 1500m above sea level. They require medium rainfall ranging from 600 to 1200mm per annum. Excess rainfall causes leaf shedding and rotting; while extreme water deficit can result in stunted growth, flower abortion and dropping of fruits. The crop grows in warm regions at temperature ranging from 15 to 30°C; with 20-30°C being the optimum temperatures for growth and fruit set. Night temperatures below 16°C and day temperatures above 32°C can however prevent/reduce fruit set. Indeed, low humidity and high temperatures cause abscission of buds, flowers and fruits. The major chilli growing regions in Kenya include: Embu, Kajiado, Kirinyaga, Kilifi, Kwale, Laikipia, Machakos, Makueni, Meru, Naivasha, Nyandarua, Siaya and Taita Taveta (Figure 1.3).



Africa Bird's Eye



Long Cayenne



Jalapeno



Demon F1

Figure 1. 2: The major chilli varieties grown in Kenya

PC: Photo Credit



Figure 1. 3: Map of Kenya showing the major chilli production regions, highlighted in red

1.1.4 Key challenges in the chilli value chain

Some of the challenges affecting chilli production in Kenya include:

- Limited access to clean seed
- High prevalence of pests and diseases
- Inadequate knowledge on postharvest handling
- Lack/inadequate market access

1.2 Production of chillies

1.2.1 Soil requirements

- Chillies grow best on well drained light loamy, non-acidic soils, but with proper soil management chilli can grow in a wide range of soil types
- Soil testing should be conducted to determine the level of nutrients in the soil
- The optimum pH for production of chillies is 6.0 and 6.5 although pH of 4.3-9.7 is well tolerated

1.2.2 Pre-planting activities

Chillies are first established in a nursery before transplanting to the main plot.

1.2.2.1 Nursery establishment

- Nursery site selection** - The site should have well drained soil. In addition, the site should be near a source of water, away from trees (shade) and should be protected from animals.
- Nursery preparation and management**
 - Make raised beds, 1m wide and of convenient length
 - Apply manure and work these into the soil
 - The seeds should be sown at a depth of 1.5cm and a spacing of 15-20cm between plants
 - Sow seeds and cover lightly with the soil
 - Mulch the beds lightly and water regularly
 - The mulch should be removed as soon as the seeds start germinating and replaced with a temporary shade above the seedbed using grass mulch or shade net
 - The nursery should be watered once in a day preferably early in the morning or late in the evening
 - Always check soil moisture before the next watering to avoid excessive water
 - Control pests and diseases as need arises
- Seedling trays** - Raising chilli seedlings on trays is alternative that offers more uniform germination and growth. The seedlings are raised on a special planting medium like coco peat, peat moss and/or vermiculite.

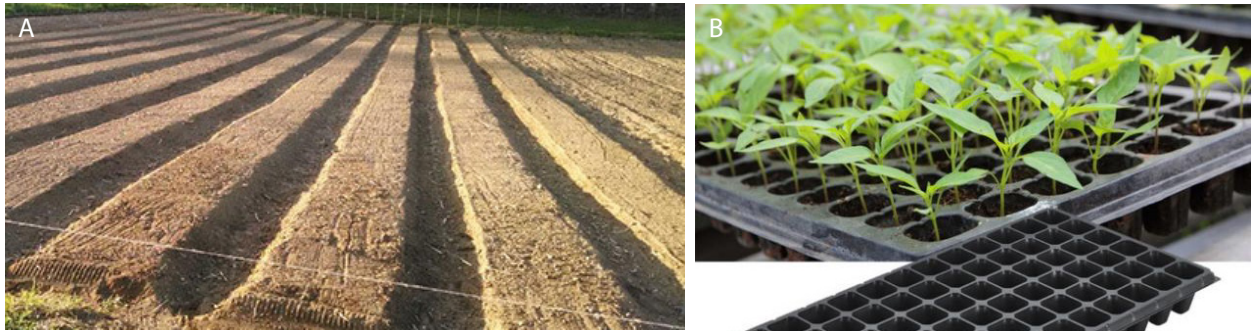


Figure 1. 4: A nursery for establishment of chillies (A) and chilli seedlings planted in a tray (B)

Photo Credit: A -Johnny's; B - Aqua Hub Kenya

1.2.2.2 Crop rotation considerations

- Chilli should not be grown after other solanaceous plants in the same field
- Rotate chilli with other crops such as tubers and legumes (cassava, sweet potatoes, beans, soya, groundnuts and bananas)

1.2.2.3 Field selection and land preparation

- The field selected for production should not have had any solanum related crops (potatoes, tomatoes, brinjals tobacco) for the past at least one year
- In addition, the site should not be prone to flooding or water logging
- Land should be prepared by ploughing and harrowing to a clean and fine tilth
- Remove any debris from previous crops, gravel, stones and other such unwanted material from the production site

1.2.3 Transplanting of chillies

- Transplanting is done 5-6 weeks after emergence when the seedlings are about 8-10cm high with 4-6 true leaves
- To harden the seedlings, reduce watering and remove mulching a week before transplanting
- Water nursery beds before lifting the seedlings from the nursery
- Also water the main plot thoroughly before transplanting
- The seedling should be planted in the field as soon as possible to avoid drying out of the roots
- Transplant either in the morning or late afternoon

1.2.4 Planting: Spacing and seed rate

- The recommended spacing for chillies is 45cm (within rows) by 60 (between rows) in the greenhouse and 60 * 60cm in the open field
- Plant seedlings to a depth of 25cm
- The seed rate is about 75g/acre. About 20 grams of seed should give at least 500 good plants

1.2.5 Manure and fertilizer requirements

- Soil analysis is recommended to form basis of deciding on the type and quantity of fertilizer to apply
- As a general rule, apply well decomposed manure at the rate of 10 tons per acre or 30 grams per planting hole (2 handfuls per planting hole)

- In addition, DAP or N.P.K 23:23:0 fertilizer at a rate of 100kg per acre or 5g per plant may be applied during transplanting
- Ensure that the manure or fertilizer are thoroughly mixed before transplanting
- Top-dress with 80 kg/acre CAN when plants are about 15 cm (2 weeks after transplanting) or 5gm per plant and repeat after 4 weeks at a rate of 160 kg/acre
- Other nitrogen-based fertilizers such as urea can be applied too
- Foliar fertilizers can also be applied at flowering and fruit stage

1.2.6 Water and irrigation requirements

- When growing chillies under irrigation, ensure you use uncontaminated water
- Before use, it is therefore recommended to analyze the irrigation water to confirm its quality and purity
- Irrigate early in the morning or in the evening
- When grown in open fields, chillies require rainfall ranging from 600 to 1200mm per annum that is well distributed during the production period

To keep soil moisture to the correct level for optimum chilli production, the following guideline can be used by small-holder farmers in cases where they do not have easy access to extension service:

- Week 1 - 2:** 10-15 mm water 2-3 times a week. Make sure the soil does not get dry. If it gets dry, irrigate more often. If it gets water logged reduce the amount applied each time
- Week 3 - 5:** Irrigate 1-2 times a week
- Week 6 - 8:** Apply about 35-40 mm water weekly
- Week +8:** Apply about 25-35 mm water weekly

It is possible to farm chillies without irrigation but this results in lower yields.

1.2.7 Weed management

- Chilli fields should be kept free of weeds to avoid competition for sunlight, water and nutrients
- Weeds may also host pests and diseases that may affect chillies
- Remove weeds before planting and during crop growth
- Weeds can be controlled through hand weeding or using herbicides

1.2.8 How to obtain high quality chillies during production

Production of good quality produce depends on a number of factors:

- Selection of a good production
- Proper preparation of the seed bed
- Use clean/certified seed
- Use the recommended spacing
- Ensuring regular watering
- Use of the recommended manure and fertilizers at recommended rates

- vii. Ensuring the production field is free of weeds
- viii. Timely and effective control of pests and diseases

1.3 Major pests and diseases of chillies and their management

The common pests and diseases of chillies, their key symptoms and control options are outlined in Table 1.1.

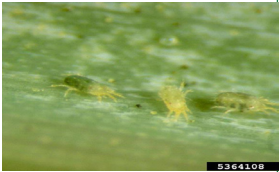
Table 1. 1: Common insect pests and diseases of chillies, their symptoms and management practices

A. INSECT PESTS				
Pest	Description	Key symptoms	Management practices	Image and photo credit
Thrips <i>(Scirtothrips dorsalis)</i>	- Thrips are small, slender, brown and yellowish insects - They feed by puncturing their host and sucking the sap - They mostly affect the flowers - Females lay eggs that hatch into larvae on flower buds	- Upward curling of the leaves - Stunted growth - Silver or grey-white spots on the leaves, flowers or fruits - Severe infestation can lead to leaf curling, wilting and distortion of young shoots	- Ploughing and harrowing to expose and kill the pupae in the soil - Grow resistant varieties (if available) - Practice crop rotation with non-solanaceous / non-host crops - Spray insecticides containing Imidacloprid, Spinosad and Lambda cyhalothrin	 <i>Adult Thrip</i> PC: Lance Osborne  <i>Thrips infested flower and thrips damaged pepper plant</i> PC: Plant Village

White flies (<i>Aleurotrachelus trachoides</i>)	• They are white winged insects • Adult and immature whiteflies feed exclusively on leaves, especially on the undersurface • They are found in groups and quickly fly in small white clouds upon disturbance • They also spread viruses	• They suck plant sap causing yellowing and downward curling of leaves • Presence of white, waxy material • Presence of sticky honeydew around and below the whitefly infested area • Presence of black sooty mold	• Keep the field clean of weeds as they act as alternate host • Mount yellow sticky traps to capture the adults • Practice crop rotation with non-host crops • Spray insecticides containing Imidacloprid, alpha-cypermethrin and Lambda-cyhalothrin	 <i>White flies on the lower side of the chilli leaf</i> PC: Planet Natural
Aphids (<i>Myzus persicae</i>)	• They are soft bodied green, black or brown insects • They form clusters on stems, leaves and pods where they suck plant sap • They produce sticky honey dew which attracts molds that cause darkening of leaves • They generally will not move quickly when disturbed	• Aphids produces honey dew which promotes growth of sooty molds which reduce photosynthetic efficiency and reduce quality of the produce • Sucking plant sap leads to stunted growth and malformation of infested parts	• Practice crop rotation with non-host plants • Timely weeding to remove potential hosts • Use resistant varieties (if available) • Use biopesticides like neem sprays • Biological control using lady bird which controls several aphid types • Use of insecticides such as Acetamiprid and Imidacloprid	 <i>Aphids at the bottom of the chilli leaf</i> PC: W. Cranshaw

Leafminers (<i>Lyriomyza</i> spp.)	• Adult leafminer is a small black and yellow fly which lays its eggs in the leaf • The larvae hatch and feed on leaf interior • Insect larvae tunnel inside plant leaves • Mature larvae drop from leaves into soil to pupate	• Thin, white, winding trails on leaves • Heavy mining can result in white blotches on leaves and leaves dropping from the plant prematurely • Early infestation can cause reduction in fruit yield	• Maintain field sanitation by removing crop debris and weeds that may be used as alternative hosts • Use of biocontrol agents such as parasitoid wasps • Spray general insecticide on the affected plants	 <i>Leafminer trails on pepper leaves</i> PC: Plant Village
Cutworms (<i>Agrotis ipsilon</i>)	• Some feed just below the soil, and some climb into the plant • The adult moths are harmless to plants, but the larvae can be very destructive • During the day, cutworms hide in plant debris and wait until night to start feeding again • Cutworms generally feed at night at the soil line	• Young plants are cut from the lower part of the crop • A cutworm curls its body around the stem and feeds on it, cutting it off at the soil surface	• Remove alternative hosts like weeds • Hand picking - Go out at night with a flashlight and gloves; pick the cutworms and drop into soapy water; repeat this every few nights • Apply a <i>Bacillus thuringiensis</i> (bt) insecticide Late in the evening. The bacterium affects soft-bodied insects and their larvae • Birds are a natural predator to cutworms • Drench the soil with appropriate insecticide • Use insecticides containing Imidacloprid and Lambda cyhalothrin	 <i>A cutworm</i> PC: Infonet Biodivision  <i>A plant damaged by a cutworm</i> PC: J. Obermeyer

Spider mites (<i>Tetranychus urticae</i>)	• Spider mites thrive in dusty conditions • Water-stressed plants are more susceptible to attack	• Leaves stippled with yellow • Leaves may appear bronzed • Webbing covering leaves • Mites may be visible as tiny moving dots on the webs or underside of leaves • Leaves turn yellow and may drop from plant	• Remove and destroy old crop and infested plants and weeds • Use of predatory mites like Phytoseilus and Amblyesius • Use insecticidal soap to plants • Spray with insecticides that contain Abamectin and Amitraz • Note: certain chemical insecticides may actually increase mite populations by killing off natural enemies and promoting mite reproduction	 <i>Spider mite damage on under surface of pepper leaves</i> PC: Yuan-Min Shen
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Broad mites (<i>Polyphagotarsonemus latus</i>)	• They are minute gray, yellow to whitish insects • They feed on the leaves	• They feed on the leaves causing curling, distorted, crinkled leaves • Stunted growth • In older plants, the blooms abort • Plant growth is stunted when large populations are present	• Practice crop rotation with non-host plants • Spraying water thoroughly can wash off mites and reduce build-up of mite population • Use available biological controls like predatory mites and neem-based formulations • Apply insecticides that contain abamectin and Amitraz	 <i>Mites</i>; PC: F. Peairs  <i>Leaf curling caused by broad mites</i> PC: Tsatsia & Jackson
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B. DISEASES

Disease	Description	Key symptoms	Management practices	Image and photo credit
Damping-off (<i>Pythium</i> spp. and <i>Rhizoctonia solani</i>)	- This is a seedling disease - Disease can be spread in infected soil and irrigation water - Disease emergence favored by overcrowded plants and excessive nitrogen fertilization	- Seeds do not germinate - Seedlings become shriveled, collapse, and die - Water-soaked lesions develop on stems and roots - Dark stems which are shriveled near the soil line - Water-soaked discolored roots	- Avoid planting in poorly drained and overly wet soils - Planting in raised beds will help with soil drainage - Establish seedlings in a disease-free plot - Avoid excessive fertilization and watering to young seedlings while still at nursery bed - Seed treatment with fungicides could prevent infection - Drench soil with Metalaxyl-M + Mancozeb	 <i>Damping off disease of seedlings</i> PC: Seif & Varela
Leaf curl virus disease	The disease is vectored by white flies	- Affected leaves roll downwards and wrinkle - Leaves become pale colored - Plant become stunted - Fruits are small and distorted	- Uproot the affected plants and dispose by burning or burying away from the field - Control whiteflies to prevent disease spread - Apply insecticide that contain Abamectin	 <i>Leaf curl virus disease</i> PC: Plantix

Mosaic (Cucumber mosaic virus, CMV and Potato virus Y, PVY)	• Transmitted by aphids • Weeds can act as a source of inoculum • Insecticides are not effective due to the speed with which aphids can transmit the virus	• Alternating light and green areas or mosaic patterns on the leaves • Leaves distorted and curled • Slow plant growth	• Keep the field weed-free • Use reflective mulches to deter aphids from plants	 <i>Cucumber mosaic virus symptoms on pepper foliage</i> PC: Florida Division of Plant Industry Archive
Anthracnose (<i>Colletotrichum</i> spp.)	• Anthracnose affects fruit and seed quality • Infection often occurs during warm and wet weather. Leaf wetness is an important factor for infection • The pathogen may infect all plant parts • It causes both pre and post-harvest fruit decay	• Symptoms are mainly observed on the fruits as circular lesions that are sunken with concentric rings of acervuli, periodically enlarge and merge together • Besides fruit rot, it also causes leaf spots, dieback on stem, seedling blight, or damping off	• Use pathogen free seed • Practice crop rotation • Mulching to minimize water splash • Use resistant cultivars (if available) • Spray fungicide during favorable environmental conditions	  <i>Anthracnose symptoms on chilli fruits</i> PC: P. Taylor

Phytophthora (Late) blight <i>(Phytophthora capsici)</i>	• Disease highly water dependent • Spores can be spread by water splash • Disease spreads fast	• Black lesions on stems • Wilting plant • Circular gray-brown lesions on leaves • Dark lesions on fruit which may be covered in white sporangia	• Practice crop rotation with non-solanaceous crops • Plant disease free transplants • Manage water carefully as pathogen depends on water for survival • Apply appropriate fungicides	 <i>A field of pepper plants infected with Phytophthora wilt</i> PC: Gerald Holmes
Downy mildew <i>(Peronospora spp.)</i>	• The disease causes yellowish-green spots on the leaves between the leaf veins which eventually turn brown • The plant cannot photosynthesize on these yellow or brown spots	• Yellow spots on the upper leaf surface between the leaf veins • These spots spread everywhere but the veins and eventually turn brown • Under severe infection leaves die and fall off • If the plant loses too many leaves, the plant dies • Under conditions of high humidity, blue to violet eruptions are observed on the lower surface of the leaves	• Remove and destroy infected crop debris • Scouting and roughing of infected plants and their proper disposal • Practice crop rotation • Practice proper spacing of crops to allow for good aeration • Mulching • Avoid/minimize overhead irrigation • Use resistant varieties (if available) • Spray Copper fungicides	 <i>Yellow spots caused by downy mildew</i> PC: McCoy & Bosland

Fusarium wilt <i>(Fusarium oxysporum)</i>	• This is a soilborne disease mainly spread by irrigation water • Disease emergence favored by high soil moisture content	• Yellowing of the leaves and ultimately wilting of the entire plant • Wilting begins from lower leaves and extends to the whole plant • The center part of the stem usually has reddish-brown discoloration	• Remove crop debris and infected plants • Practice crop rotation • Grow chillies in well-drained soils • Avoid growing chillies in water logged fields • Plant certified seed • Disinfect tools and machinery • Plant resistant varieties • Biological control using <i>Trichoderma</i> spp • Spray fungicides that contain azoxystrobin or prothioconazole	 <i>Pepper plant affected by Fusarium wilt</i> PC: A.M. Varela
Powdery mildew <i>(Leveillula taurica)</i>	• It primarily affects leaves of chilli plants but stalks and fruits are occasionally affected • Although the disease commonly occurs on older leaves just before or at fruit set, it can develop at any stage of crop development • Disease spreads most rapidly in humid conditions	• White powdery fungal growth on the lower leaf surface of the leaves • Yellow to brownish spots on the upper leaf surface • Later on, the whitish powdery spots may also develop on the upper leaf surface • Leaves curl upwards and fall off • Defoliation expose fruits to sun burns	• Remove and destroy infected crop debris after crop harvest • Practice crop rotation • Plant crops with sufficient spacing to allow for good aeration • Practice field hygiene • Use resistant varieties (if available) • Spray with fungicides containing Sulphur or triflumizole	 <i>Powdery mildew symptoms on chilli leaves</i> PC: McCoy & Bosland

PC: Photo Credit

1.3.1 Guidelines on pesticides: Types, proper usage and storage

1.3.1.1 Types of pesticides

A pesticide refers to any substance or mixture of substances intended for preventing, destroying or controlling any pest. There are several classes of pesticides and the classification is based on the type of pests that they control:

- i. **Herbicides** control unwanted plants, mainly weeds
- ii. **Insecticides** control insects
- iii. **Fungicides** control fungal disease
- iv. **Bactericides** control bacterial diseases
- v. **Rodenticides** control rodents such as rats and mice
- vi. **Biopesticides** are made of living things, come from living things, or they are found in nature
- vii. **Nematicides** control nematodes
- viii. **Miticides/acaricides** control mites

1.3.1.2 Proper use of pesticides

When handling, mixing or applying pesticides, the following should be observed:

- i. Do not eat or smoke while mixing or spraying pesticides
- ii. Use the proper Personal Protective Equipment (PPE)
- iii. Measure accurately when mixing pesticides as per the instructions on the label
- iv. Always mix or dilute the pesticide outdoors or in a well-ventilated area
- v. Read the label carefully and follow the “Directions for Use”
- vi. Treat small areas as much as possible; and whenever possible, only treat infested/infected plant(s) rather than treating all plants
- vii. Alternate pesticides with different active ingredients and modes of action to minimize development of resistance for the targeted pest
- viii. Mix only the amount that you need for each application
- ix. Keep children, pets (including birds and fish), and toys away from areas where you mix and apply pesticides

1.3.1.3 Proper application of pesticides

- i. Do not apply pesticides on a windy day
- ii. Use coarse droplet nozzles on your sprayer to reduce misting; larger droplets help prevent drift
- iii. Spray as close to the target crop as possible to get good coverage
- iv. Do not apply pesticides on very hot days. The active ingredients in some pesticides can vaporize and drift onto non-target surfaces
- v. Do not over apply pesticides:
 - Excessive application could cause the pesticide to run off or seep into water

- supplies and contaminate them
 - Excess spray may leave harmful residues on your produce
 - Could affect other plants, wildlife and fish
- iii. Read the label to determine if the pesticide should be watered-in by irrigation

1.3.1.4 Practices after applying pesticides

- i. Always follow proper cleaning procedures of the tools and equipment used after applying pesticides
- ii. To remove pesticide residues, use a bucket to thoroughly rinse tools or equipment used when mixing the pesticide
- iii. Wash non-absorbent gloves and rubber boots thoroughly with hot soapy water:
 - To prevent exposure to the hands, wash your gloves prior to removing them
 - To prevent tracking pesticides inside, remove and/or rinse your boots or shoes before entering your house
- iv. Wash any parts of your body that may have come in contact with the pesticide with soapy water
- v. Do not mix contaminated clothing worn during pesticide application with other family laundry
- vi. Wash all protective equipment as soon as possible following each use

1.3.1.5 Storage of pesticides

- i. Do not store pesticides in food containers such as empty soft drink or milk containers
- ii. Keep pesticides in their original container with the label intact
- iii. Provide adequate ventilation in the pesticide store

1.4 Harvesting

1.4.1 Timing and harvesting

Chilli is ready for the first harvest three months after transplanting. The following practices should be observed during harvesting and drying of chillies:

- i. Chillies are harvested when they turn red in colour
- ii. However, for sweet pepper, harvesting time is usually determined by the fruit colour required by the market
- iii. The fruits are ready for first picking between two and a half to three months after transplanting
- iv. Picking continues for 3 to 6 months
- v. It is recommended to harvest all the ripe chillies as soon as they appear
- vi. Harvesting should be done once per week to prevent over-ripening of fruits

- vii. Harvesting should be done early in the morning after dew evaporates from the plant
- viii. Avoid harvesting during rains as wet peppers spoil easily. Muddy fields can lead to increased contamination of the fruit
- ix. Picking of chillies should be done with clean buckets or baskets
- x. Chillies are labor-intensive crops with high-quality requirements
- xi. Make sure that the pickers wash their hands with soap and sufficient water before and after picking
- xii. Yields range from 4,000 – 6,000kg per acre

1.4.1.1 Handling chillies immediately after harvest and drying

- i. Place the chillies in the shade immediately after harvest to prevent shriveling. Do not expose the crates to direct sunlight for long periods
- ii. Fruits should be handled with care to avoid bruising
- iii. Chillies can be stored at a temperature of 7 - 13°C to maintain freshness in cartons and plastic crates
- iv. Damaged, overripe or green chillies should be handled separately
- v. Dry chillies in open air, spread on well aerated polysacks on raised racks. Solar cabinets can also be used. Do not use metallic/iron sheet
- vi. Avoid drying chillies directly on the ground
- vii. Dry chillies to a moisture content level of between 8 and 10 percent to avoid growth of aflatoxin producing fungi



Figure 1. 5: Drying of chillies on tarpaulin placed on the ground (A); and drying chillies in solar cabinets (B)

Photo Credit: C. Bertello

1.4.1.2 How to maintain quality of chillies at the first collection point

- i. Use field crates or shallow boxes for carrying chillies
- ii. Avoid damage or injury on the chilli fruits
- iii. Keep the produce under a shade to prevent sunburns and shriveling
- iv. Chillies should be free from diseases or serious deterioration which appreciably affects their appearance, edibility and keeping quality
- v. Chillies should be free of visible soil, dust, chemical residue or other foreign matter

- vi. Chillies should be of acceptable firmness depending on the commercial type and the marketing stage

1.5 Post-harvest handling

1.5.1 Grading and packaging

- The fruits are graded on the basis of color, size, condition and destination market
- Damaged, discolored and immature fruits should be removed depending on the market demand
- Packaging material should ensure product safety and integrity
- Poor packaging may cause deterioration during transportation and distribution
- Packages should be free from any foreign matter and the material should preferably be recyclable
- Wrapping in perforated plastic film is effective, as chillies easily become shrivelled and shrink

1.5.2 Drying

- Chillies should only be picked when they are physiologically mature
- Drying is done in open air in raised racks and spread on well-aerated polysacks for up to 3 to 4 days during the hot days or by use of special enclosed solar cabinet dryers to ensure fast and absolute hygiene
- The moisture contents of Chili when stored should be 10- 15% to prevent mold growth
- With lower moisture content (< 10 %), pods may be so brittle that they shatter during handling
- This causes losses and the release of dust, which is irritating to the skin and respiratory system
- A Relative Humidity of 60 - 70 % is desirable

1.5.3 Processing and value addition

Chillies can be consumed in various forms:

- **Fresh chilli** can be consumed directly after harvesting. Pickled tea (tea salad) processors use fresh chilli in their product. Fresh chilli is also used in restaurants and private households. Fresh chilli has a lower storage life.
- **Whole dried Chilli** is dried and sold whole. This form of chilli does not contain preservatives as the drying extends the shelf-life. The whole dried chilli is processed to further products like chilli powder or flakes.
- **Chilli powder /flakes** is produced through grinding whole dried chilli. Often the chilli is roasted prior to grinding. The processing can be done for home consumption or on an industrial level for reselling it locally. Some processors also extract the red color for use as food color.



Figure 1. 6: Different forms of chilli products

Photo Credit: Premier Seeds, Kenya

1.5.4 Storage at warehouse

Chillies should be handled and stored appropriately to maintain quality:

- i. Chillies are pre-cooled to 7 – 10 °C
- ii. They can be stored for 3 weeks at of 7 – 10 °C and relative humidity of 90 – 95 %
- iii. Store the chillies in gunny bags in a dry, well-ventilated room
- iv. Clear labelling should be done before storage
- v. Stack the bags at 50-60 cm from the wall
- vi. Storing chillies for a long period may lead to quality deterioration
- vii. However, if cold storage facilities are used, the product may be stored for 8-10 months
- viii. Insects, rodents and other animals should be effectively prevented from getting access to the premises where chilli is stored



Figure 1. 7: Gunny bags used for storage of chillies

Photo Credit: Shutterstock

1.5.5 Transportation

- Transport fresh chillies in plastic crates to avoid mechanical damage and that allow adequate air circulation
- Chillies should be kept in a cool environment and not be exposed to direct sunlight during transportation
- The mode of transportation should protect chillies from adverse weather conditions
- The crates should not be stacked more than ten boxes high to avoid damage



Figure 1. 8: A plastic crate recommended for transportation of chillies (A); and chillies being transported in an open truck (B)

Photo Credit: Julia Grabianowski

1.5.6 Market for chillies

- Chillies can be sold locally and internationally
- In Kenya, chili production does not satisfy the market demand
- Farmers in the value chain but are sparsely populated find it difficult to transport their produce to the collection centres for export
- Usually, the market demands a high-quality and consistent product
- You are advised to get insights from an experienced farmer or an expert. This will help you understand the requirements of the market in terms of quality, quantity, and period
- Chillies can be sold to consumers for direct consumption of can be processed and blended with other spices

1.5.7 How to maintain quality of chillies during post-harvest stages

The following principles should be observed to maintain quality of chillies at post-harvest stages:

- i. Use clean containers for picking
- ii. Wash hands with soap and water before and after picking
- iii. Hair of the personnel doing harvesting, grading and packaging should be covered
- iv. Keep the chillies clean, practically free of any visible foreign matter
- v. Chillies should be free from blemishes, areas of discoloration or spread stains. Such should not cover more than 5 per cent of the surface of the produce
- vi. Chillies should be free from damage caused by pests, including the presence of dead insects and/or mites, their debris or excreta
- vii. Chillies should be free from mold filaments visible to the naked eye
- viii. They should be free of abnormal external moisture
- ix. Chillies should be free of foreign smell and/or taste
- x. They should not be washed after harvesting, as wet fruits spoil easily
- xi. Store the harvested chillies in a cool place to maintain turgidity

1.6 Risk of aflatoxin contamination of chillies

1.6.1 Aflatoxin producing fungi and risk of contamination of chillies

Aflatoxins are a family of naturally-occurring mycotoxins produced by fungi in the genus *Aspergillus* mainly *Aspergillus flavus* and *Aspergillus parasiticus*. These fungi live naturally in soil, as well as in dead and decaying plant material in fields. When they colonize chillies, there is a risk of contamination of the fruits with aflatoxins. This can occur when the crop is still in the field, at harvest, during post-harvest stages or in storage. In hot and humid agricultural regions, aflatoxin contamination can result in serious loss of value of chillies and other crops.

Aflatoxins are regularly found in improperly stored commodities such as chilli peppers, cassava, maize, cotton seed, millet, peanuts, rice, sesame seed, sorghum, sunflower seed, tree nuts, wheat, and a variety of spices. When contaminated chillies are consumed, aflatoxins enter the general food supply where they contaminate human foods.

1.6.2 Aflatoxin predisposing factors and strategies for reducing aflatoxin contamination

- For chillies, the degree of aflatoxin contamination depends on temperature, humidity and storage conditions
- The most effective way to control aflatoxin contamination in susceptible crops is controlling the growth of the causative fungi during production
- This can be achieved by adopting good agricultural practices as well as good harvesting, drying and storage practices
- Pest management is also important since insects expose susceptible plant tissues to colonization by the aflatoxin-producing fungi

1.6.3 Implications of aflatoxin contamination of chillies on trade

Different countries have established acceptable limits of aflatoxin contamination of the products which they import. For example, the European Union allows no more than 10 parts per billion (ppb) for total aflatoxins in chillies, while the limit for aflatoxin B1 is 5 ppb. The United States of America has a maximum allowable limit of 20 ppb for total aflatoxins; while the threshold set by the Kenya Bureau of Standards (KEBS) for total aflatoxins in chillies is 10 ppb. Farmers, processors and exporters should therefore take precaution to avoid aflatoxin contamination of either fresh or processed chillies. Contaminated consignments with higher than the acceptable threshold for aflatoxin are rejected by the importer and at times the suppliers/exporters are blacklisted or fined.

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CHAPTER 2: GOOD AGRICULTURAL PRACTICES AND POST-HARVEST HANDLING IN PRODUCTION OF HERBS AND SPICES

2.1 General aspects of herbs and spices

Herbs and spices describe plants or parts of plants used for medicine, cooking and pleasure all over the world. Herbs are the green, leafy parts of plants while spices are derived from any part of a plant that is not a leaf. Herbs are plants with savory or aromatic properties that are used for flavoring and garnishing food for medicinal purposes or for fragrance. On the other hand, spices are usually used in small amounts, are best used dry and most grow in subtropical or tropical climates. A single plant can be both a herb and a spice. For example, aromatic seeds like dill are a spice while dill leaves are a herb.

Herbs grow well in greenhouses but can also be cultivated in kitchen gardens or in the field and can be enjoyed fresh all year-round. They can also be frozen or dried and kept for use over a longer period. Herbs are classified into three groups:

- i. **Annual** herbs produce leaves, flowers and seeds within one growing season and then dry up e.g. Basil, dill and coriander.
- ii. **Biennial** herbs take two seasons to produce flowers and seeds e.g. Sage, parsley and celery.
- iii. **Perennial** herbs grow for more than two growing seasons e.g. rosemary, mint, thyme, fennel and oregano.

2.1.1 Status of herbs and spices production in Kenya

The most common herbs and spices grown in Kenya include basil, chives, coriander, dill, lavender, mint, oregano, parsley, rosemary, sage, tarragon and thyme. The major Counties where herbs and spices are grown in the country include Busia, Kajiado, Laikipia, Meru, Nyandarua, Nakuru and Siaya (Figure 2.1).



Figure 2. 1: Map of Kenya showing the major production regions for herbs and spices, highlighted in red

2.1.2 Key Challenges in the herbs and spices value chains

Some of the major challenges in the herbs and spices value chains in Kenya include:

- Availability of quality planting materials
- Inadequate knowledge on good agricultural practices
- Disease and pests problems
- Lack of reliable markets

2.2 MODULE 1: BASIL

2.2.1 General aspects

Basil is an annual herb and a member of the mint family (Figure 2.2) that is grown for its tender fragrant leaves. In Kenya, the herb is mainly grown for export mainly to Denmark, France,

Germany and Netherlands; and only about 10% of basil is consumed locally. The herb grows up to 130 cm tall and the leaves vary from light green to purple. Basil takes about 42 days to mature. Sweet basil is the most preferred variety. The other common varieties include: Camphor, African blue, lemon, cinnamon, purple and Thai.



Figure 2. 2: Basil growing in a greenhouse

2.2.2 Climatic requirements

Although basil can be grown in open fields, growing it in a greenhouse ensures good quality that meets market requirements. The herb grows well in warm climates and does not tolerate frost. Optimum temperature during the growth period ranges from 7 to 27°C and requires up to 8 hours of sunlight daily, although it can perform well in partial sun, too. Basil requires about 700mm of rainfall annually. Ample sun implies fewer diseases and sturdier plants.

2.2.3 Soil requirements

- Basil thrives in a moderately fertile soil that is moist but well-draining
- The herb grows well at a slightly acidic pH ranging from 6 to 7.5
- Before production, a soil test is recommended to indicate nutrient levels and consequently inform decision on appropriate fertilizer regimes
- Basil grows best in raised beds as these allow for better drainage

2.2.4 Propagation

- Basil seed should be obtained from a reputable source to ensure that the seed is true to type
- Basil can either be direct seeded or raised in a nursery and then transplanted into the field
- However, it is common practice to raise seedlings in a nursery or a tray and then

transplant the seedlings (Figure 2.3)

- The seeds take up to 7 days to germinate

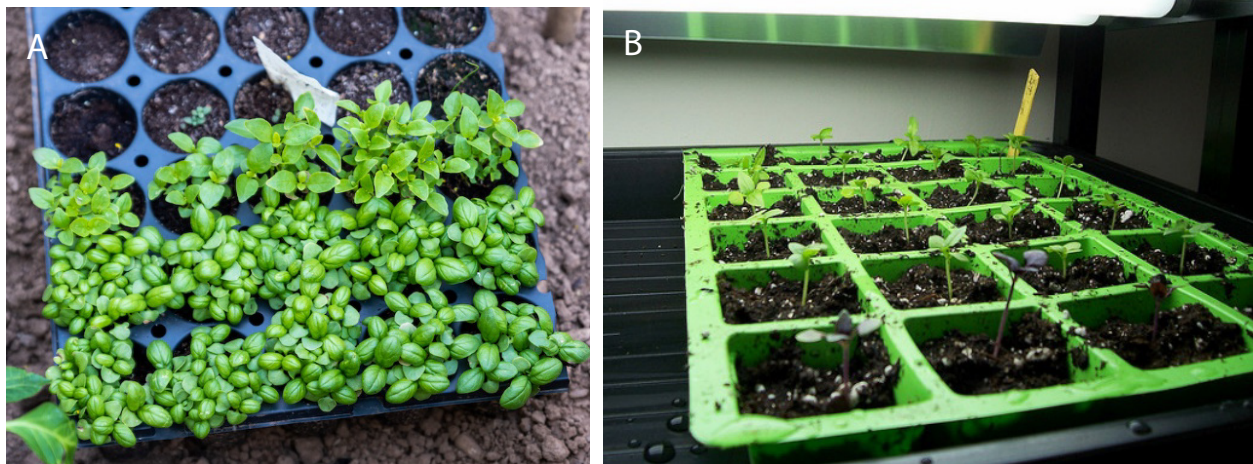


Figure 2. 3: Basil germination tray (A) and basil seedlings in a germination room (B)

Photo Credit: D. Calde

2.2.5 Land preparation, direct seeding, transplanting and spacing

- The field where basil will be planted should be well cultivated through ploughing to a fine tilth
- Mix manure with soil thoroughly
- In case of direct seeding, the seeds are planted at a depth of 3 to 6mm
- Thinning is encouraged after emergence to attain a desirable crop stand
- Transplanting is done when the seedlings are at least 3 inch tall and have two sets of true leaves
- The seedlings should be hardened prior to transplanting to reduce shock
- Basil plants are spaced at 15-30cm within the row and 50cm to 1m between rows

2.2.6 Water requirement and irrigation

- Basil should be watered on a regular basis but it is important to ensure that the soil is well-drained
- Watering can be done through overhead or drip irrigation
- Drip irrigation is preferable as the plants are less likely to be exposed to foliar diseases
- For overhead irrigation, watering should be done at the base of the crop to prevent infection by downy mildew
- Avoid over-watering as this can lead to loss of flavor
- Mulching can enhance water management and promote production of clean leaves



Figure 2. 4: Cultivation of basil in a tunnel under drip irrigation

2.2.7 Pruning and weed control

- Pruning is done by pinching when the seedlings have attained six leaves
- Pruning promotes branching (Figure 2.5).
- Weeds compete with basil for nutrients, water and space
- Manual weeding is done taking care not to injure the roots
- Mulching can minimize weeds

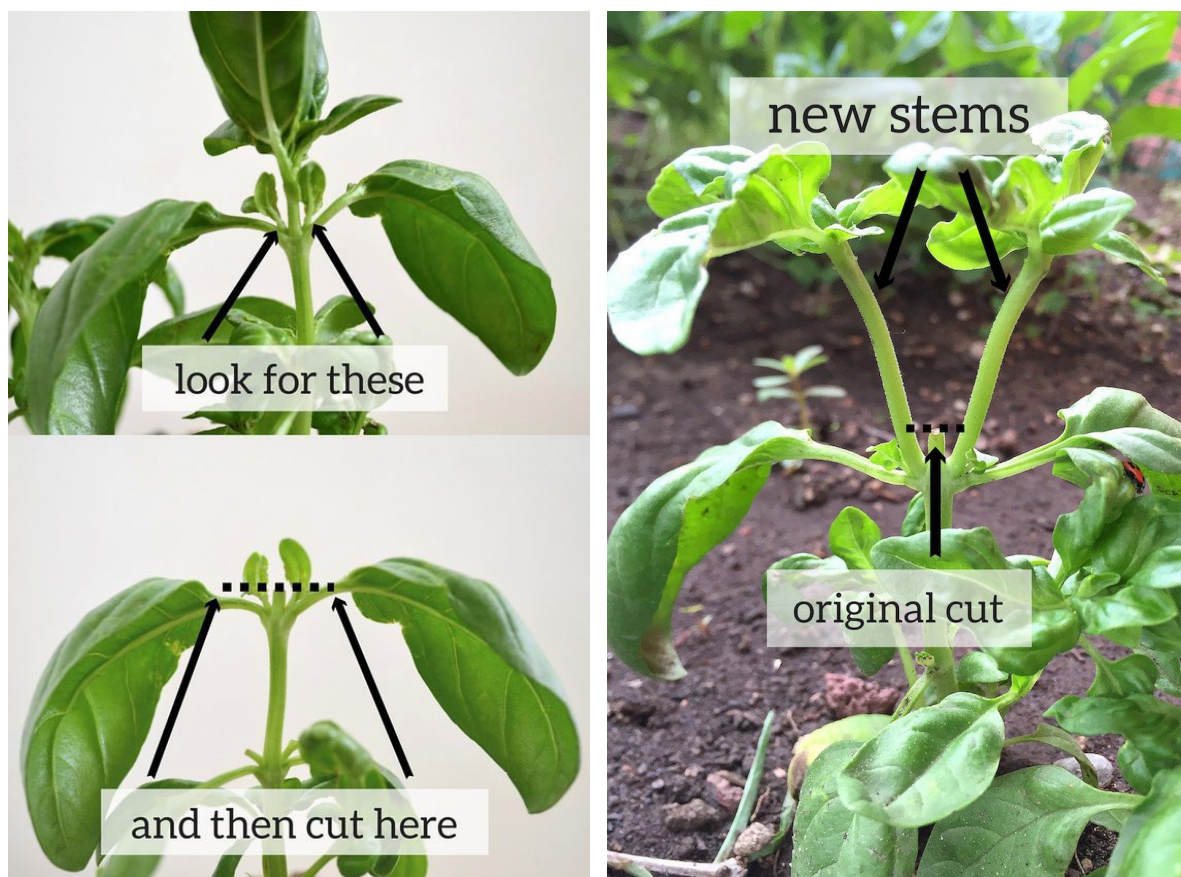


Figure 2. 5: Illustration of pruning basil and the resultant branching

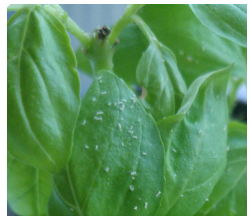
Photo Credit: <https://plantinstructions.com>

2.2.8 Common pests and diseases of basil and their management

The common pests and diseases of basil are outlined in Table 2.1. Nevertheless, the most common pests of basil are aphids, cutworms, beetles, slugs, spider mites, whiteflies and leaf miners. Aphids are the major pest especially where plants are grown in a greenhouse environment; while beetles and slugs are a major challenge outdoors, creating holes in the leaves.

The common diseases of basil include damping off, powdery mildew, downy mildew, fusarium wilt, bacterial leaf spot and grey mold (Table 2.1).

Table 2. 1: Common insect pests and diseases of basil, their symptoms and management practices

A. PESTS				
Pest	Description	Key symptoms	Management practices	Image and photo credit
Aphids (<i>Ocimum basilicum</i>)	- They are small soft bodied insects that feed on underside of basil leaves sucking the sap - They are usually green or yellow in color, but may be pink, brown, red or black depending on species	- Yellowing leaves - Curled leaves - Stunted shoots - Distorted leaves - Aphids secrete a sticky, sugary substance called honeydew which encourages the growth of sooty mold on basil plants	- Proper spacing and pruning - Planting companion crops - use tolerant varieties if available - Use insecticidal soaps - Natural predators and beneficial Insects such as lady bird beetle, small parasitic wasps - Natural sprays and neem oil	 <i>Aphids on the lower side of a basil leaf</i>
White flies (Various species)	- They are white winged insects - Adult and immature whiteflies feed exclusively on leaves, especially on the undersurface - They are found in groups and quickly fly in small white clouds upon disturbance - They spread viruses	- Yellowing leaves - Leaves that dry up and fall off - Black sooty mold on basil leaves	- Keep the field clean of weeds as they act as alternate host - Mount yellow sticky traps to capture the adults - Practice crop rotation with non-host crops - Spray insecticides containing Imidacloprid, alpha-cypermethrin and Lambda-cyhalothrin	 <i>White flies on basil leaves</i> PC: Planet Natural

Leafminers (<i>Liriomyza</i> spp.)	• Adult leafminer is a small black and yellow fly which lays its eggs in the leaf • The larvae hatch and feed on leaf interior • Insect larvae tunnel inside plant leaves • Mature larvae drop from leaves into soil to pupate	• Thin, white, winding trails on leaves • Heavy mining can result in white blotches on leaves and leaves dropping from the plant prematurely	• Remove crop debris from soil immediately after harvest • Only use insecticides when leafminer damage has been identified as unnecessary spraying will also reduce populations of their natural enemies	 <i>Leafminer damage on basil leaf</i> PC: Charles Olsen
Cutworms (<i>Agrotis</i> spp.)	• The larval stage is the destructive stage of cutworms in basil • They mostly hide under litter or soil during the day and come out in the dark to feed on the plants	• The early stage larvae feeds on terminal clusters • Later stage larvae skeletonize the leaves • They also cut the seedling stem near the base resulting in heavy losses	• Remove and destroy weeds and crop residues • Hand picking - Go out at night with a flashlight and gloves; pick the cutworms and drop into soapy water; repeat this every few nights • Spray biocontrol agent (bacteria/ virus) to kill cutworms • Drenching an appropriate insecticide in the soil preferably in the evening • If infestation is severe, spray suitable insecticide	 <i>A cutworm larvae on a basil leaf</i>  <i>A basil leaf damaged by a cutworm larvae</i> PC: Plant Village

Spider mites (<i>Tetranychus urticae</i>)	• They are tiny reddish yellow pests usually found on the undersides of the leaves • They suck out vital plant juices from basil • Mites often target water-stressed plants	• Feeding can cause tiny, light spots on the leaves • As the juices are drained, the leaf curls up and turns yellow or bronze • Damaged leaves may fall off the plant • If infestation is severe, the basil plant loses vigor and its leaves turn dull • They form webs in cases of heavy infestations	• The crop should not be water stressed • Use beneficial insects e.g. lady beetles, thrips and lacewings • Use predatory mites • Apply insecticidal soap or neem oil	 <i>Basil leaves infested by red spider mites</i> PC: Green Fingers
Flea beetle (<i>Phyllotreta</i> spp.)	• The beetles are often shiny in appearance • They are small (1.5–3.0 mm), dark colored and jump when disturbed • Young plants and seedlings are particularly susceptible	• Small holes or pits in leaves that give the foliage a characteristic “shothole” appearance • Young plants and seedlings are more susceptible to flea beetle damage than older ones • Plant growth may be reduced • If damage is severe, the plant may be killed	• Early planting • Plant trap crops - cruciferous plants are best • Application of a thick layer of mulch may help prevent beetles reaching the surface • Use white sticky traps to capture flea beetles as they jump • Application of oils such as neem oil • Application of insecticides containing carbaryl, spinosad, bifenthrin and permethrin	 <i>Flea beetle and associated damage on a basil leaf</i>  <i>Flea beetle damage to basil leaves</i> PC: Plant Village

Slugs and snails (Different species)	• Slugs are dark gray to black in color and can range in size from 2.5 to 10 cm (1-4 in) • Garden snails are generally smaller and possess a rounded or spiral shell • Slugs and snails prefer moist, shaded habitats and will shelter in weeds or organic trash • Adults may deposit eggs in the soil throughout the season	• Irregularly shaped holes in leaves and stems • Flowers may also be damaged if present • If infestation is severe, leaves may be shredded • Slime trails present on rocks, walkways, soil and plant foliage • Damage to plants can be extensive	• Practice good garden sanitation by removing trash, weeds and plant debris to promote good air circulation and reduce moist habitat • Regular hand picking at night or early morning to reduce population • Trapping using shallow dishes filled with beer into the soil to attract and drown the molluscs • Chemical control using metaldehyde or carbaryl	 <i>Grey garden snail</i> PC: Cheryl Moorehead  <i>Holes caused by slugs on basil leaves</i> PC: Wine Box Gardener
Nematodes (<i>Meloidogyne</i> spp.)	• Galls can appear as quickly as a month after to planting • Nematodes prefer sandy soils	• Galls on roots which can be up to 3.3 cm (1 in) in diameter but are usually smaller • Reduction in plant vigor • Yellowing plants which wilt in hot weather	• Fallowing • Crop rotation • Plant resistant varieties if nematodes are known to be present in the soil • Solarizing soil	 <i>Galls associated with the root system caused by root-knot nematodes</i> PC: David B. Langston

B. DISEASES

Disease	Description	Key symptoms	Management practices	Image and photo credit
Damping-off <i>(Rhizoctonia solani and Pythium spp.)</i>	This is a seedling disease caused by several fungal pathogens mainly	- Seedlings become shriveled, collapse, and die - Water-soaked lesions develop on stems and roots - Fuzzy whitish mold on the soil surface and girdles succulent stems of newly germinated plants - The stem develops black spots, shrink and eventually fall over	- Avoid planting in poorly drained and overly wet soils - Establish seedlings in a disease-free plot - Avoid excessive fertilization and watering to young seedlings while still at nursery bed - Seed treatment with fungicides could prevent infection - Drench soil with Metalaxyl-M + Mancozeb	 <i>Damping off disease of seedlings</i> PC: Wisconsin Horticulture Division of Extension
Cercospora leaf spot <i>(Cercospora ocimicola)</i>	Fungal disease that mostly affects leaves	Circular to irregular dark spots on leaves with light centers	- Avoid overhead irrigation - Water plants from the base - Apply a layer of mulch around the plants to reduce water splash - Remove and destroy any symptomatic leaves - Minor infections can be controlled by spraying weekly with a fungicide containing potassium bicarbonate	 <i>Cercospora leaf spot symptoms on basil</i> PC: Scot Nelson

Downy mildew (<i>Peronospora belbahrii</i>)	• Yellowing leaves may be mistaken for nutrient deficiency • Can be spread by contaminated seed	• Yellowing leaves • Discoloration often begins around middle vein and spreads outwards • Gray fuzzy or downy growth on lower surface of the leaves • Brown to black angular necrotic patches on the plant	• Ensure good air circulation around greenhouse grown plants • Use drip irrigation to avoid wetting foliage • Grow tolerant varieties • Apply protective fungicide	 <i>Downy mildew symptoms on basil foliage</i> PC: Bruce Watt <i>Dark-colored fungal growth (sign) on the lower surface of a basil leaf opposite the chlorotic patches on the upper surface of a leaf with downy mildew</i> PC: Scot Nelson
Fusarium wilt (<i>Fusarium oxysporum fsp basilici</i>)	• This is a soilborne disease mainly spread by irrigation water • The disease can also be spread through infected seed • Disease favoured by warm, wet conditions	• Yellow, wilting leaves • Brown streaks on lower surface of leaves • Stunted growth • Death of plant	• Use only disease free seed • Treat seeds with hot water to kill fungi prior to planting • If present in the field, rotate crop every 2-3 years with crops other than basil or mint	 <i>Symptoms of Fusarium wilt on basil</i> PC: Andrea Minuto

Root rot <i>(Rhizoctonia solani Pythium spp.)</i>	• Disease favoured and promoted by high humidity and poor air circulation	• Failure of seeds to germinate • Germinated seedlings collapsing • Brown, shriveled area at base of stem • Roots brown and water-soaked	• Plant seeds in a field with no history of root rot • Plant basil in well-draining soils	 <i>Root rot symptoms on basil</i> PC: www.amazingherbgarden.com
Gray mold <i>(Botrytis cinerea)</i>	• Disease promoted by high humidity and poor air circulation	• Dense, brown to gray fuzzy growth on stems and leaves and fallen plant debris • Leaves dying and dropping from plant • Severe lesions on stem may cause plant death	• Avoid working in field in rainy conditions • Remove infested leaves and/or plants • Avoid overhead irrigation • *No chemical treatment available •	 <i>Wilted foliage on cankered stem at left due to grey mold infection</i> PC: Bruce Watt

PC: Photo Credit

2.2.9 General approaches in the management of basil pests and diseases

- A simple control of basil pests is to spray a soap solution of 3 teaspoons of dishwashing liquid in 5L of water
- To control pests of basil, it is recommended to use biological control options - when available. When basil is grown in the field, there is generally a healthy population of beneficial arthropods such as parasitic wasps, spiders and other general predators which can help keep pest populations to moderate levels. Growers should learn to recognize both pests and beneficial insects and regularly monitor populations of both
- In cases of high pest infestation, use recommended insecticides

The following practices generally contribute to successful management of basil diseases:

- Removal of crop debris from the field after harvest

- ii. Crop rotation
- iii. Planting of clean certified seeds
- iv. Removal of all infected plants
- v. Spraying with the recommended pesticides

2.2.10 Harvesting of basil

- Basil is ready for hand harvest from about 30 to 35 days after planting
- Start picking basil leaves as soon as the plants are 6 to 8 inches tall
- Leaves are cut at least 10-15 cm above the ground to allow for regrowth of the next crop (Figure 2.6)
- Leaves are harvested before flowering for up to five times in a season
- Harvesting should be done in the early morning, when leaves are at their juiciest
- Basil leaves should be picked regularly to prevent flowering and seed setting; and encourage growth and improve the plant's vitality

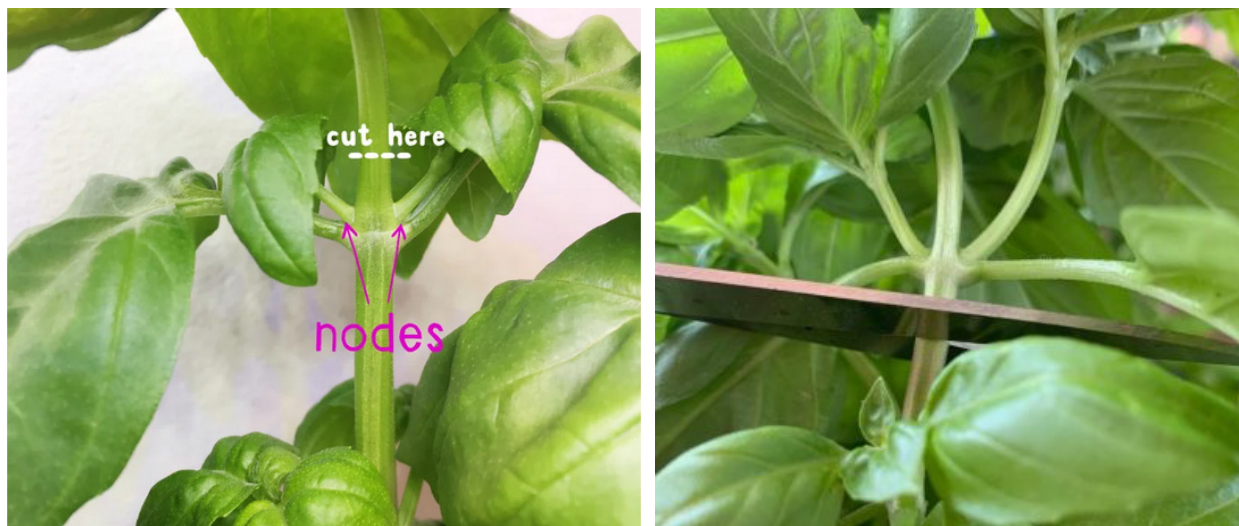


Figure 2. 6: Illustration of harvesting basil by cutting the stem $\frac{1}{4}$ " above the nodes

Photo Credit: Gardenuity

2.2.11 Post-harvest handling of basil

- Basil leaves should be washed by dipping in cool water to remove soil debris, insects, and weeds
- Drain off the free water prior to packing the product
- Keep the harvest under a shade until transportation to the market
- Fresh basil is prone to damage by rough handling, dehydration and chilling
- Packaging is done in small containers depending on the target market (Figure 2.7)
- Basil leaves can be dried or frozen for use after harvest
- For dried product, basil is dried under a warm ventilated place to maintain the green color
- Dried basil is convenient but at the cost of some flavor; while frozen basil has a stronger flavor than dried but at the cost of texture



Figure 2. 7: Basil packaged in a flow pack (A) and a box (B)

Photo Credit: Subati Herbs

2.2.12 Storage and transportation of basil

- The shelf life of basil is relatively shorter compared to other herbs such as rosemary, oregano and thyme
- Basil is susceptible to chilling injury and should not be stored below 5°C for extended periods
- Basil that has been damaged by cold (chilling injury) turns black and is rendered unsuitable for sale
- Store and ship fresh basil at 5 to 13°C and 95 percent relative humidity
- Diseases affecting basil in the field will likely reduce the shelf life of the harvested product
- Basil for export must be carefully inspected before packing to help ensure that it is free of live insects which will result in non-compliance with regulations in the importing country

2.2.13 Other post-harvest tips on harvesting and handling basil

When harvesting and handling basil, the following practices should be observed:

- Harvest early in the morning when temperatures are lower
- If packaged in bags to reduce moisture loss, maintain at a constant temperature to prevent condensation
- Packages may be perforated for ventilation or may be made of a polymer which is partially permeable to water vapor
- Do not store or ship basil with fruits or vegetables that release ethylene

2.3 MODULE 2: MINT

2.3.1 General aspects

Mint is a perennial herb grown for its aromatic leaves (Figure 2.8). Mint is used fresh or dried in tea, jam or dessert. It also provides essential oil that is used as a flavoring in toothpaste, mouth washes, ice-cream, confectionery, soft drinks and chewing gum among others. Some

of the common varieties of mint grown in Kenya include: apple mint, pineapple mint, corsican mint, pennyroyal, peppermint, citrus mint and spearmint. Mint plants are fast growing and can be very invasive. They reach heights of 60–90 cm and will continue growing for many years once established.



Figure 2. 8: Mint in the field (A) and a crop of mint growing on raised beds under drip irrigation (B)

2.3.2 Climatic requirements

- Mints grows in a wide range of climatic conditions but ideally, they require plenty of sun. Mint grows at temperatures between 20 to 40°C; but the ideal growing temperatures are warm sunny days (25°C) and cool nights (15°C)
- Therefore, mint generally grows better in hotter climates. Mint requires about 1000 mm of rainfall per year

2.3.3 Soil requirements

- Mint grows in a range of soils but develops the best foliage in nutrient-rich, well-drained loam or sandy loam soils at a pH of 6 to 7
- Although mint does not grow well on clay soils, incorporation of organic manure could improve the soils
- A high water requirement means that soils must be deep and well drained while holding plenty of water
- Liming is recommended for soils with pH below 5.5
- Soil tests should be done to establish the fertility levels before planting

2.3.4 Propagation

Mint is readily propagated from seed, cuttings or by dividing an established plant. The best and easiest way however is by taking cuttings from the desired plants, whereby the established mint plant is divided for transplanting by taking some branches along with a portion of root. These cuttings are planted horizontally in the soil. Where mint is propagated through seed, transplanting is done when the seedlings have at least two sets of true leaves. Pinching of the stem is done to encourage shorter and bushy growth. Where propagation is through seed, seeds should be sown to a depth of 6 mm. Seeds sprout within 10-15 days at room temperature or slightly warmer temperature.

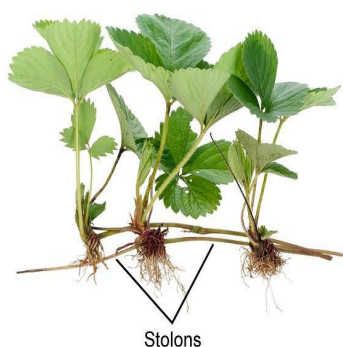


Figure 2. 9: Demonstration of mint propagation from stolons

Photo Credit: Grin USDA

2.3.5 Land preparation and fertilizer requirements

- The field should be well cultivated by removing all weeds and other debris and ploughing to a fine tilth. Mix manure with soil uniformly
- Phosphate fertilizer can also be applied and mixed with the soil to enhance fast crop establishment
- Nitrogen based fertilizer should be applied frequently throughout the growing season to enhance growth of foliage and improve flavor and quality of mint and the oil

2.3.6 Planting and watering

- Young cuttings/stems of mint are spaced at 40 to 90 cm between rows and 45 to 60 cm within rows; and lightly covered with soil
- An acre can accommodate from 22,000 to 30,000 plants
- Plants should be watered regularly to keep the soil evenly moist
- Irrigation can be used to supplement rainfall where the crop is grown in an open field

2.3.7 Thinning, pinching, pruning and mulching

To achieve higher mint yield, the following practices are recommended:

Thinning - Seedlings should be thinned after emergence such that the plants are spaced 45-60 cm apart.

Pinching - the stems should be pinched back in order to encourage shorter, bushier growth. Flowers should also be removed as they appear.

Pruning - mint is very vigorous and should be pruned regularly to keep the plants in check. Any unwanted runners should be removed.

Mulching - this helps to keep the soil moist and keep the leaves clean. It also suppresses growth of weeds as well as releasing nutrients into the soil once the mulch decomposes.

2.3.8 Weed control

- Mint fields should be kept weed-free to reduce competition for water, nutrients and to remove alternate hosts for pests and diseases

- Weeds also affect flavour of the mint
- Critical periods for weed control are between 4 and 14 weeks after transplanting
- Hand weeding is encouraged to prevent disturbance of the root system
- Effective weed control can be achieved by combining mechanical, manual and chemical methods
- Mulching can also reduce weeds

2.3.9 Major pests of mint and their control

The common pests that attack mint include cutworms, loopers, mites, aphids, and grasshoppers.

To control them:

- Use biological control options whenever available
- Keep the field free of weeds and other alternate hosts
- For high pest infestation, use recommended insecticides

2.3.10 Major diseases of mint and their management

- Mint is susceptible to diseases such as wilt, leaf spot, anthracnose, powdery mildew, and rust. Mint diseases can be controlled by:
 - Practicing crop rotation
 - Removal of volunteer mint plants
 - Use of resistant/tolerant varieties
 - In case of high infection, spray the crop with recommended pesticides

2.3.11 Maturity and harvesting

- Mint is ready for harvesting about 60-90 days after sowing or transplanting depending on the variety and environmental conditions. At this point, the plants have reached 8 - 10 cm in height
- Harvesting should be carried out in a dry, sunny day in the morning when mint is free of dew
- Frequent harvesting encourages more growth
- Harvesting is done using scissors or a sharp knife
- Although young leaves have more flavour than old ones, mint can be harvested as soon as it comes up
- The stems are cut before flowering, 1 inch from the ground, and one mint plant can be harvested two or three times in a growing season
- Individual leaves can also be picked as needed
- Any damaged or withered leaves should be removed and discarded. They should not be stored with the good ones



Figure 2. 10: Illustration of the correct way of harvesting mint (A) and bunches of freshly harvested mint (B)

Photo Credit: MasterClass (B); Infinite (B)

2.3.12 Post-harvest handling

- Mint is extremely perishable and has a short shelf-life
- Mint is highly susceptible to accelerated senescence, accompanied by loss of freshness, chlorophyll and culinary quality; after harvesting, during handling and transportation
- Use a sorting table to sort out impurities from the fresh harvest material
- Mint should be kept under cool conditions of between 6 to 10°C to prevent weight loss and quality deterioration
- Fresh mint can be packaged in a plastic container
- Fresh mint leaves can be air dried or frozen in bunches
- To air-dry mint, the stems are hanged upside down in small bundles or spread loosely in a tray
- When the stems and leaves are brittle, the leaves and flowers are removed and stored in airtight containers
- Alternatively, the dried mint can be ground to mint powder



Figure 2. 11: Packaging mint ready for transportation (A), fresh mint packaged in a plastic container (B) and mint powder (C)

PC Herbs unlimited (A), Infinite (B) and Raj foods (C)

2.4 MODULE 3: THYME

2.4.1 General aspects

Thyme is a perennial evergreen herb with many branches and pink flowers. It is grown for its medicinal, culinary and ornamental value. It contains essential oils, vitamins, minerals among other nutrients. It has a distinct smell and its flowers, leaves and oil are commonly used to flavor foods. Thyme contains chemicals which are antioxidants. In Kenya, the herb is mainly grown for the export market especially to the European countries. However, the main challenge in the thyme value chain in Kenya remains meeting the quantity demanded by the importing country alongside quality attributes as per the market specifications.



Figure 2. 12: Two varieties of thyme growing in the field (A and B) and dried thyme (C)

Photo Credit: University of Illinois Extension (A), Jamesmcq24 (B), and Plantech Kenya LTD (C)

2.4.2 Climatic requirements

- Thyme grows in varied climatic conditions and does well in arid and semi-arid areas
- The herb grows best in full sun with ideal exposure for 6 to 8 hours
- Thyme requires annual rainfall ranging between 500 and 1000mm

2.4.3 Soil requirements

- Thyme requires soil that is well drained with a slightly alkaline pH of 7 to 8
- It can grow well in coarse rough soils that would be unsuitable for other plants
- Cultivation in heavy soils lowers the aromatic quality of the herb
- Before planting thyme, soil test should be conducted to establish the nutrient levels

2.4.4 Propagation

- Thyme is propagated from seeds, stem cuttings and layering
- Seeds take about 12 weeks to germinate
- Seedlings can also be raised in a nursery to be transplanted when ready
- While thyme can be grown from seed, it is much easier to grow it from cuttings
- As thyme gets older, it can become woody and should be renewed every few years by severely cutting it back
- This will encourage the production of young, tender stems
- Where seeds are used for propagation of thyme, germination of the seeds requires technical attention

The following are key steps involved in germinating thyme seeds:

- i. Gently scatter seeds over the soil in the container or bed
- ii. Gently scatter soil over the seeds
- iii. Water thoroughly
- iv. Cover with plastic wrap
- v. Place the container in a warm location
- vi. Seeds will germinate in 12 weeks

2.4.5 Land preparation and planting

- The field should be ploughed well, and all weeds and other debris removed
- Add manure and mix with the soil
- Phosphate fertilizer or rock phosphate can also be applied and mixed with the soil to enhance fast crop establishment
- Row cropping is recommended to ensure that the crop is well exposed to sunlight for good quality leaves
- Thyme is planted at a spacing of 20-30 cm within a row and 30-60cm between rows
- Transplants and cuttings can be established in 1.2m wide beds with 3 rows on each bed

2.4.6 Fertilizer requirements

- A basal fertilizer application consisting of nitrogen, phosphorus, potassium and sulphur is applied annually based on soil analysis
- Additional nitrogen is recommended after each harvest to enhance shoot growth
- Excessive nitrogen application causes plants to become slender and weak and affects the quality of essential oils

2.4.7 Water requirements and irrigation

- Thyme is a hardy herb and requires less water compared to other herbs
- However, constant supply of water is important for better performance
- Drip or overhead irrigation can be used with the former being preferred as it minimizes leaf-based fungal infections

2.4.8 Weed control

- Keep the field weed-free throughout the growing period
- Hand weeding is recommended; however, care should be taken not to disturb or injure the roots
- Use of organic mulches also prevents growth of weeds in thyme fields

2.4.9 Major pests of thyme and their management

- The common pests of thyme are aphids, spider mites and white flies
- The volatile oils from thyme repel some pests
- Use beneficial predators where available
- For severe infestation, a broad-spectrum insecticide can be used

- For white flies, plant mint on the field borders. Since whiteflies prefer feeding on mint, they will crowd there from which “spot spraying” can be done

2.4.10 Major diseases of thyme and their management

- Some of the common diseases of thyme are: root rot, stem rot, rust, Alternaria blight, botrytis, and leaf spots.
- The following general practices are important in managing these diseases:
 - i. Regular monitoring for diseases in order to initiate timely control measures
 - ii. Use clean (non-infected) planting materials
 - iii. Ensure proper hygiene on the farm including removal of crop debris after harvesting
 - iv. Appropriate pesticides may be used in case of heavy infections

2.4.11 Harvesting

- Thyme is harvested once per annum for extraction of essential oils
- For dried produce, stems and leaves are harvested just before flowering, which entails cutting the entire plant back to about 10 to 15 cm above the ground
- For fresh produce, harvest only the tips of the branches so that the plants are strong enough to produce enough young shoots
- Frequent cutting with sharp implements is recommended to prevent splitting of stems

2.4.12 Post-harvest handling

- Fresh thyme is packaged in crates for bulk handling or in cleat cellophane bags for retail market
- To store fresh thyme, it should be refrigerated in a plastic bag or container
- To store the herb for over 6 months, it should be frozen
- For dried thyme, the harvested stems and leaves should be dried and then sieved to remove dirt
- Thyme can be sun dried or forced air-flow can be used
- Dried thyme can be sold in boxes, glass or plastic containers



Figure 2. 13: Freshly harvested thyme packaged in a plastic container (A), a bunch of freshly harvested thyme (B), dried thyme (C), and dried thyme stored in bags (D)

Photo Credit: Markup (A and D), Treillage Online (C)

2.5 MODULE 4: CHIVES

2.5.1 General aspects

Chives is a perennial herb that belongs to the onion family. The herb is grown for its leaves that are used for culinary purposes. It grows to a height of about 46 cm. Individual plants are low growing and compact, usually no more than 12 inches wide. Their narrow, hollow leaves are bright in color and they produce striking purple, feathery, round flowers. The crop matures within 45 days and can be harvested for a period of three years. The key export markets for chives produced in Kenya are Europe and the United Arab Emirates (UAE), with demand for the herb growing by 2% annually.



Figure 2. 14: Chives grown in an open field (A) and in a tunnel (B)

Photo Credit: Amber Shidler (A), Phija (B)

2.5.2 Climatic requirements

- Chives grows in varied climatic conditions but thrives best in cool environments at temperature between 15 and 30°C
- It withstands frost but its growth is slowed down during cold weather
- Chives requires annual rainfall of between 500 to 1000 mm
- The herb requires full exposure to sunlight

2.5.3 Soil requirements

- Chives performs best in soils that are fertile and free draining, loamy to sandy soils with pH of 6 to 7
- The soil should be tested before planting the crop
- Over-fertilizing the crop can be harmful to chives. Like many herbs, slower growth that is more compact leads to stronger flavors and healthier plants
- A soil rich in organic matter should provide enough nutrients

2.5.4 Propagation

- Chives can be grown directly using seeds or vegetative materials
- To propagate using plant divisions, gently dig the clump and pull away a smaller clump from the main clump
- The smaller clump should have at least five to 10 bulbs
- Transplant the small clump to the desired location in your field where you will be growing chives
- Seeds can be raised on a nursery, indoors or outdoors prior to transplanting
- Transplanting can be done when the seedlings attain 15cm in height
- The best time to transplant is in the morning or late in the evening



Figure 2. 15: A clump of chives (A), transplanting chives seedlings in the field (B), and a crop of chives growing in an open field (C)

Photo Credit: GrowVeg (A), Kristine Lofgren (B and C)

2.5.5 Land preparation and planting

- Prepare the seedbed well, remove all weeds and harrow the seedbed to a fine tilth
- Incorporate well decomposed animal or compost manure with the soil to increase soil fertility since the crop requires fertile soil
- Phosphate fertilizer can be applied on the planting lines as it will help in rapid root and crop establishment
- Seeds are planted to a depth of 1.3cm in a nursery bed
- The seeds take about 7 days to germinate and are ready for transplanting after 4 weeks
- Plants are spaced 20-30 cm apart

2.5.6 Water requirement and irrigation

- Ensure constant moisture availability around the crop root zone, which calls for regular watering
- Because of this requirement, chives grows best under irrigation and controlled environments
- However, with all growing conditions met, it can thrive well outdoors
- To avoid water wastage, drip irrigation is most preferred
- Overwatering should be avoided.
- Mulch can be used around the plant base to conserve water



Figure 2. 16: Chives production in a tunnel under drip irrigation

Photo Credit: Fresh Plaza and Herbs Unlimited

2.5.7 Key pests and diseases of chives and their management

- The major pests of chives are thrips, aphids, cutworms and onion flies
- Use blue traps or the predatory mite to control thrips
- If the physical control fails, appropriate insecticides might be used sparingly
- The common diseases of chives are damping off, smut, downy mildew, leaf spots, rust, bulb rots and white rot
- To control, these diseases, keep the field clean and remove crop debris after harvest
- Use disease free planting materials
- In case of heavy infection, apply appropriate fungicides

2.5.8 Harvesting

- Chives are harvested 30-45 days after transplanting or 60 days after seeding
- Be sure to cut the leaves down to the base when harvesting
- Harvest 3 to 4 times during the first year
- In subsequent years, cut plants back monthly

2.5.9 Post-harvest handling

- To avoid water loss, the pack house should be maintained at a temperature of about 4 to 6°C and chives should be presented to the packing tables from the cold room in small quantities
- Use chives when they are fresh or frozen
- The leaves should be frozen in an airtight bag
- Dried chives lose their flavor, hence drying should not be done
- Store chives in a cool place in a re-sealable container



Figure 2. 17: Preparing chives for packaging (A and B), and packaged chives (C)

Photo Credit: Jambo Fresh (A and B), Fresh Option (C)

2.6 MODULE 5: ROSEMARY

2.6.1 General aspects

Rosemary is an evergreen essential oil herb that grows to a height of up to 3m. It is a perennial plant that lives for more than 2 years. The stems have numerous slender branches with leathery thick dark green leaves; and produces small bluish-purple flowers. It has a unique aromatic odor and medicinal properties. Rosemary preserves most of its flavor and nutrients when dried. The herb can be grown in the field, pots, greenhouses and back yards. In Kenya, Rosemary is mainly grown in Imenti in Meru, Kikambala in the North Coast, Gilgil and the shores of Lake Nakuru in the Rift Valley, Kiambu and Murang'a in Central region.



Figure 2. 18: Rosemary plants growing in an open field (A), Rosemary flowering with purple flowers (B), and dried Rosemary (C)

Photo Credit: Gardener's Path (A), Encyclopedia Britannica (B), Amazon (C)

2.6.2 Climatic requirements

Rosemary grows well at a temperature range of between 20 and 26°C. It is a hardy plant that is highly adaptable and can tolerate frost as well as grow under dry conditions. It requires about 500mm of rainfall annually. Rosemary grows at an altitude range between 1500 and 3000m above sea level. It requires at least 6-8 hours of daily sun exposure and prefers warm and moderately dry climates. Soil temperatures above 18°C favor growth and regeneration after harvest. However, the plant is resilient and can definitely tolerate lower temperatures as well.

2.6.3 Soil requirements

- Rosemary grows well in well drained sandy loam to clay loam soil with a pH range of 5.5 to 7
- In case the clay percentage of the soil is too high (above 30%), apply gravel stone with a diameter of about 2.5cm before planting
- Use of well decomposed manure is recommended as it improves soil fertility, aeration and water retention
- Conduct a soil test to check the nutrient levels

2.6.4 Propagation

- Rosemary is propagated by means of seeds, cuttings, layering or division of roots
- Seeds germinate slowly and may be affected by cross-pollination
- Cuttings from actively growing stem tips are the best way to propagate new plants efficiently
- Cuttings are raised in a nursery and later transplanted to the main field
- The cuttings are 10-15cm long with the bottom two thirds stripped of leaves
- Insert about two thirds of the length into a proper growing media
- Rooting hormones will assist in root formation within 2 to 4 weeks

2.6.5 Field selection and land preparation

- Rosemary can be grown in the field, greenhouse or in pots
- The herb does not grow well in waterlogged or high clay soils
- The site selected for growing Rosemary should not be shaded and should have access of the sun for at least 6 hours each day
- If you plan to use Rosemary as a perennial plant, choose a site that will not be disturbed by tilling
- It is important to note that herbal and essential oil crops grown on natural soils yield products that are of high quality

Follow these steps to prepare the soil:

- i. Remove all rocks, shrubs, weeds, plant debris and tree roots from the area to be planted
- ii. Plough the land to a fine tilth, remove weeds, rocks and any debris from the previous season crops
- iii. Collect a soil sample and have it analyzed to determine your soil's fertility level
- iv. If needed, fertilize according to the soil test results to supplement the nutrition added from compost or organic matter
- v. If the pH is too low, add lime to make the soil more alkaline
- vi. Raised or slightly mounded beds provide the best drainage for the herb

2.6.6 Fertilizer requirements

- Fertilizer application should be based on the soil test
- Generally, a basal fertilizer containing nitrogen, phosphorus, potassium and sulphur can be applied annually based on the soil analysis

- Additional application of Nitrogen fertilizer after every harvest promotes new shoot growth
- However, excessive use of nitrogen may reduce flowering, fragrance, flavor and the quality of essential oils

2.6.7 Planting

- Rows should be orientated East-West on the land if possible, and on sloped land planted on the warmer slopes facing North and West
- Rosemary is spaced at 40 to 50cm between rows by 25cm to 50cm within rows depending on the variety
- The recommended plant population is from 20,000 to 25,000 plants per acre

2.6.8 Water requirements and irrigation

- When establishing Rosemary, irrigation is needed until the cuttings have developed well i.e. when they have established roots and are growing actively
- Mature plants can cope with dryland conditions as long as the rainfall exceeds 500mm per year
- Do not allow the plants to dry out completely and do not over-irrigate
- When the herb is produced under irrigation, care should be taken not to over-irrigate the crop

2.6.9 Weed control

- Weeds affect the yield and quality of essential oils
- At least 2-3 weedings are required annually
- Care should be taken to avoid damaging the roots. Weeds can be removed by hand or mechanically

The following considerations are important in weed control:

- i. Do not allow weeds to seed in the field
- ii. No-till practices result in fewer weeds
- iii. Ensure the recommended plant density
- iv. Use manual or mechanical weed control

2.6.10 Key pests of Rosemary and their control

- The major pests of Rosemary are spider mites, mealybugs, whiteflies and thrips
- Careful monitoring and crop rotation as well as applying insecticidal soap with lightweight horticultural oil will assist in keeping the foliage free of pests

2.6.11 Key diseases of Rosemary and their control

- Fungal diseases may arise when the plants are over-irrigated
- Powdery mildew and root rot are common in wet soil
- The following guidelines are important for controlling diseases during Rosemary production:

- ⌚ Regular scouting of the crop is needed for disease symptoms
- ⌚ Early detection and management of disease can prevent major problems
- ⌚ Correct identification of diseases is required to inform the appropriate disease control method

2.6.12 Harvesting

- Fields of Rosemary are usually harvested once or twice a year, depending on the geographical area and whether the harvest is for plant material or essential oil
- A first cutting can be obtained in the seeding year; however it is usually delayed until 18 months after seeding
- Rosemary for drying is harvested when the plant begins to bloom
- More often, farmers carry out mechanical harvesting
- The plants then yield more material from frequent regrowth
- The harvested stems should be about 20cm long
- Fresh or dried Rosemary leaves can be kept in plastic containers or plastic bags



Figure 2. 19: Fresh Rosemary packaged in a plastic container (A), and dried Rosemary packaged in a plastic bag (B)

Photo Credit: Tray and Platter Mockups (A), Coprid (B)

There are various harvesting approaches for different Rosemary products:

i. Rosemary for essential oil

- To obtain essential oil of the highest quality, plants should be in bloom and only the flowering tops should be harvested for distillation
- With mechanical harvesting, it is better to cut frequently because yields are higher from rapid regrowth

ii. Dried Rosemary

- The crop is cut frequently before flowering commences, as the dried product contains only leaves

iii. Fresh Rosemary

- For the fresh market, the herb is cut frequently at a young stage as young, fresh shoots are used in culinary preparations; woody stems fetch lower prices
- Fresh Rosemary is harvested early in the morning and cooled at 5 °C before packaging for the market
- With a temperature of 5 °C, a minimum shelf-life of 2 to 3 weeks can be expected
- After temperature, prevention of excess moisture loss is the second most important post-harvest factor affecting the quality and shelf-life of herbs

2.6.13 Post-harvesting handling

- Fresh Rosemary leaves that are clean of soil and other foreign debris are tied together in a bundle and kept in perforated bags
- Dried Rosemary leaves should be kept in airtight containers and transported in cartons
- Ensure thorough drying in order to maintain the material's natural colour and to avoid later microbial contamination
- Re-usable packaging container is a good option for efficient transportation of Rosemary over longer distances. This packaging can also be easily retrieved by the service provider in the local circuit



Figure 2. 20: Freshly harvested batches of Rosemary ready for packaging (A), and packaging of Rosemary in a re-usable packaging container (B)

Photo Credit: Fresh Plaza



Figure 2. 21: Air conditioned store room with dried herbs in bags (A), and a tunnel dryer with an ideal design of the openings for an efficient air flow from the bottom to top (B)

Photo Credit: Boor and Lefebvre, 2021

2.7 MODULE 6: OREGANO

2.7.1 General aspects of oregano

Oregano is a perennial herb with grey-green leaves, rose-purple or white flowers and grows to a height of about 0.5cm. It is used either in fresh or dried form for food flavoring. It also provides essential oils that have medicinal properties.



Figure 2. 22: Fresh and dried oregano

2.7.2 Climatic requirements

- Oregano is hardy and grows well at temperatures of between 16°C and 28°C
- The herb can tolerate heat and even fairly cold temperatures, depending on the variety
- To get strong flavor, oregano requires access to sunlight
- It performs poorly in high humidity conditions

2.7.3 Soil and fertilizer requirements

- The herb grows best in well-drained sandy loam soils with a pH of between 6.5 and 7.5
- If the soil is moist with a lot of organic matter, oregano will not perform as well as it does in well-drained, light, dry soil
- To attain good growth, soil analysis should be done to determine the nutrient requirements
- Oregano typically does not require fertilization, as it can thrive in nutrient poor soils
- In fact, high levels of nutrients, such as nitrogen, can adversely change the flavor of the herb

2.7.4 Propagation

- Oregano is propagated by seed or cuttings
- Seedlings are raised in a nursery for eight weeks and then transplanted to the field
- Seeds should be slightly pressed into the soil, as they need light to germinate
- The seeds or the cuttings should be planted in well-drained soil

2.7.5 Selection of planting site, land preparation and planting

- Oregano should be grown in a field with access to sunlight (no shading) and has lean-to-average soil that is well-drained
- Soil rich in nutrients can dilute the pungency of the herb
- Spacing for oregano plants is about 30cm within rows and 50 cm between rows
- This gives a crop stand of about 24,000 plants per acre

2.7.6 Water requirements

- Oregano only requires about an inch of water per week and is tolerant to moderate drought
- Allow the soil to dry out between waterings
- Over-watering can cause root rot

2.7.7 Pinching, trimming and thinning

- Allow oregano plants to grow to about 4 inches tall and then pinch or trim lightly to encourage a denser and bushier plant
- Regular trimming will not only cause the plant to branch again, but also avoid legginess (long stems, with just a few leaves at the top)
- To ensure the best-quality oregano, thin out plants that are 3 or 4 years old
- Oregano is self-seeding and therefore the plants will easily grow back

2.7.8 Weed control

- Weeds compete with the herb for space, sunlight, water, and nutrients
- Weeds can be removed manually through hand weeding
- Mulching could also prevent weed growth

2.7.9 Harvesting and drying

- Harvest the leaves as you need them
- Harvesting before full bloom enhances flavor and quality of essential oils
- Harvesting is done by trimming all branches and leaving only the lowest set of leaves
- To avoid field heat, it is recommended to harvest in the morning
- After harvesting, the plant will produce more shoots within two weeks
- The leaves can be frozen for later use
- Oregano leaves store well and are easily dried
- Keep them in an airtight container once dried

Harvesting oregano



Freshly harvested oregano



Manual harvesting of oregano



Mechanical harvesting oregano



Figure 2. 23: Different methods of harvesting oregano

PC: Photo Credit



Figure 2. 24: Solar drying of oregano and dried oregano

PC: Photo Credit

2.7.10 Post-harvest handling

- Fresh oregano should be kept in perforated bags in a cool room to prevent excessive moisture loss
- Fresh sprigs can be refrigerated for about a week or frozen for about a year
- Oregano branches are dried by hanging upside down in a dark and dry place with good air circulation
- The dried leaves are stored in airtight, light tight containers
- Dried oregano has a stronger flavor than fresh leaves, and it has a shelf-life of about two to three years



Figure 2. 25: Dried oregano leaves in an airtight glass canister and foil

Photo Credit: Danny Smythe and Getty Images

2.8 MODULE 7: DILL

2.8.1 General aspects

Dill is an annual herb with green aromatic leaves and yellow flowers. The plant can grow up to 1.5 m (5 ft) in height. The soft fiber-like leaves are used fresh or dried in food flavoring. Dill is used either whole or in ground form. The seeds are also used as spice and have medicinal properties.



Figure 2. 26: A dill crop in the field and freshly harvested dill

2.8.2 Climatic requirements

- Dill requires low rainfall ranging from 650 to 1000mm per annum and temperature ranging from 10 to 27°C
- It also requires full exposure to sunlight as shading can interfere with growth
- Being a short-day plant, it should be planted in places that receive 6 to 8 hours sunshine

2.8.3 Soil requirements

- Dill is adapted to a variety of soils but it grows best in fertile loamy, sandy loam and clay soils
- However, sandy soils are the best resulting in dill with better flavour
- The soil must be free draining
- The ideal pH for growing dill ranges from 4.5 to 6.5
- Conduct soil test to determine the nutrient levels

2.8.4 Propagation and seedbed preparation

- Dill is propagated by seed sowed directly in the field
- Germination takes 10 to 14 days
- The seedbed should be prepared during the dry season
- Land should be ploughed deeply to remove all weeds especially the troublesome perennials
- Remove all residues from the previous crop
- The land should be harrowed to a fine tilth desired for vegetable and herb production
- Well decomposed organic manure should be thoroughly incorporated into the soil and mixed with any phosphatic fertilizer if the soil is phosphorus deficient or its levels are low

2.8.5 Planting

- The crop can be grown under rainfed conditions or can do even better under controlled irrigation
- Dill is propagated using seeds, sown at a spacing of 20 to 30cm within rows and 40 to 50cm between rows
- Dill can be planted in lines or broadcasted in the field
- The herb should not be planted near fields with parsley or carrot as they are related, hence there might be pest and disease control challenges
- The seeds take 10 to 14 days to germinate
- After germination, the plants should be thinned in the next 14 days
- Fertilizer application depends on the results of soil tests but generally, basal fertilizer containing nitrogen, phosphorus and potassium can be applied during planting

2.8.6 Pruning and pinching

- Pruning dill helps encourage growth. However, harvesting takes care of most pruning needs
- Use shears to clip off dill leaves
- You can begin pruning the fern-like dill leaves from your plants once they are about 8 weeks old
- It is also advisable to pinch the top buds if you are not growing the plant for its flowers
- This will ensure potent flavor in the leaves and will keep the plants from getting too tall or leggy

2.8.7 Weed control

- The field should be kept weed free throughout the growing period
- Weeding should be done early enough to prevent competition for water and nutrients
- Hand weeding is recommended

2.8.8 Major pests and diseases of dill and their control

- Dill caterpillar is the main pest of the herb. It strikes during young stages of crop development and may extend to harvesting period. The pest damages the soft tissues especially young leaves
- Cercospora leaf spot is the main fungal disease in dill production although it is rare if field hygiene is observed keenly
- Appropriate pesticides may be applied if the damage caused by pests and diseases is substantial to lower yield and quality attributes

Table 2. 2: Common pests and diseases of dill, their symptoms and management practices

A. PESTS				
Pest	Description	Symptoms	Management practices	Image and photo credit
Aphids [Willow-carrot aphid] <i>(Cavariella aegopodii)</i>	- Small soft bodied insects on underside of leaves and/or stems of plant - Usually green or yellow in color - Their distinguishing features include the presence of cornicles (tubular structures) which project backwards from the body of the aphid - They do not move quickly when disturbed - Willow-carrot aphid also attack parnip, carrot and celery	- If aphid infestation is heavy it may cause yellowing and distortion of leaves, necrotic spots on leaves, and/or stunted shoots - Aphids secrete a sticky, sugary substance called honeydew which encourages the growth of sooty mold on the plants	- Biological control using ladybugs - Use tolerant varieties if available - Spraying with insecticidal soaps or oils such as neem or canola oil - Insecticides are only required if the infestation is high - plants generally tolerate low and medium level infestation	 <i>Carrot-willow aphid colony on dill</i> PC: Whitney Cranshaw  <i>Carrot-willow aphid damage on dill</i> PC: Whitney Cranshaw

Root knot nematodes (<i>Meloidogyne</i> spp.)	• Galls can appear as quickly as a month after planting • Nematodes prefer sandy soils	• Galls on roots which can be up to 3.3 cm (1 in) in diameter but are usually smaller • Reduction in plant vigor • Yellowing plants which wilt in hot weather	• Plant crop rotation • Remove crop debris after harvest • Plant resistant varieties if nematodes are known to be present in the soil • Regular monitoring - check roots of plants mid-season or sooner if symptoms indicate nematodes • Solarizing soil can reduce nematode populations in the soil	 <i>Dill crop showing symptoms of nematode infestation</i> PC: Alamy
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Cutworms (Different species)	• Cutworms have a wide host range • Larvae are 2.5–5.0 cm (1–2 in) in length • Larvae may exhibit a variety of patterns and coloration but will usually curl up into a C-shape when disturbed • Larvae causing the damage are usually active at night and hide during the day in the soil at the base of the plants or in plant debris of toppled plant	• Stems of young transplants or seedlings may be severed at soil line • If infection occurs later, there are irregular holes in the foliage	• Remove all plant residue from soil after harvest or at least two weeks before planting • Hand-pick larvae after dark • Apply appropriate insecticides to infested areas of the field if not growing organically	 <i>Cutworm severing a dill stem</i> PC: Clemson University
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Caterpillars (<i>Papilio polyxenes</i>)	• Caterpillars are the larvae of moths and butterflies • They inflict damage by eating the foliage and stems	• Holes in leaves and chewed leaf edges, as well as leaves that are rolled up or fastened with silk • They are voracious eaters, and can defoliate a plant in a short period of time	• Maintain field sanitation by removing crop debris and weeds that may act as alternative hosts • Hand picking and dropping them in soapy water • Remove rolled or folded leaves that shelter the caterpillars • Natural enemies such as fireflies, ground beetles, soldier beetles, stink bugs, and tachinid flies - they prey upon or parasitize caterpillars	 <i>Caterpillar on dill foliage</i> PC: Savvy Gardening
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B. DISEASES

Disease	Description	Key symptoms	Management practices	Image and photo credit
Damping-off <i>(Pythium spp. and Rhizoctonia solani)</i>	- Mainly caused by <i>Pythium</i> spp. and <i>Rhizoctonia solani</i> - Damping-off diseases favor conditions which slow seed germination - Fungi can be spread in water, contaminated soil or on equipment	- Soft, rotting seeds which fail to germinate - Rapid death of seedlings prior to emergence from soil - Collapse of seedlings after emergence caused by water-soaked reddish lesions girdling the stem at the soil line	- Avoid planting dill in poorly draining, cool, wet soil - Planting in raised beds helps with soil drainage - Plant high quality seed that germinates quickly - Treat seeds with a fungicide prior to planting to eliminate fungal pathogens	 <i>Damping off disease of seedlings</i> PC: Brian Hudelson
Cercospora leaf blight <i>(Cercosporidium punctum)</i>	- Disease can be introduced through infected seed and spread by wind or water splash - Symptoms usually occur on younger foliage first	- Small, necrotic flecks on leaves which develop a chlorotic halo and expand into tan brown necrotic spots - Lesions coalesce and cause leaves to wither, curl and die	- Plant only pathogen-free seed - Practice crop rotation - Remove crop debris from the field after harvest or plough them into soil - Apply appropriate fungicide sprays	 <i>Leaf blight symptoms on dill</i> PC: Cesar Calderon

Downy mildew <i>(Peronospora umbellifarum)</i>	• Disease affects young, tender leaves • Disease infection and spread is favored by prolonged leaf wetness	• Yellow spots on upper surface of leaves • White fluffy growth on underside of leaves • Lesions become darker as leaves mature	• Plant pathogen-free seed • Avoid overcrowding of plants – follow recommended plant spacing • Rotate crops with non-umbelliferous crops such as carrot, parsnip	 <i>Downy mildew symptoms on basil</i> PC: North Carolina State University
Powdery mildew <i>(Erysiphe umbellifarum)</i>	• Fungus can spread long distances in air • Disease emergence is favored by high humidity and moderate temperatures • Infection is most severe in shaded areas	• Powdery growth on leaves, petioles, flowers, stalks and bracts • Leaves become chlorotic • Severe infection can cause distortion of flowers	• Plant tolerant varieties • Avoid excess fertilization • Protective fungicide applications will provide adequate protection • Sulfur application can be used if infection occurs early in the season	 PC: Farm  PC: Pest Encyclopedia <i>Powdery mildew symptoms on dill leaves</i>
Carrot motley dwarf disease (Carrot redleaf virus and Carrot mottle virus)	• Caused by a complex of carrot redleaf virus (CRLV) and carrot mottle virus (CMoV) • Both viruses must be present to cause the disease • Disease transmitted by aphids	• Yellow and red leaves • Stunted plant growth	• Avoid planting dill in close proximity to carrot fields • Timely and effective control of aphids	 <i>Carrot motley dwarf disease symptoms</i> PC: Adrian Fox

PC: Photo Credit

2.8.9 Harvesting

- Dill is harvested 70 days after planting for foliage and 90 days for seeds
- Harvesting is done in the morning and plants are left to dry in the field before threshing
- The leaves should be snipped off for use in soups or salads
- For pickling, cut the whole stalk when the plant is more mature

2.8.10 Post-harvest handling

- Harvested leaves or stalks should be pre-cooled under a shade to remove field heat and to prevent rapid moisture loss especially when meant for pickling/salad making
- Sorting and grading are done to remove overgrown leaves and stalks and those with pest feeding marks as they are of low quality
- In case the dill is meant for export, cold chain and proper packaging will be necessary in order to ensure quality attributes are maintained



Figure 2. 27: Packaging of dill in a reusable packaging container (A), packaged fresh dill (B), and dill seeds packaged in an airtight bag

Photo Credit: Fresh Plaza (A and B), Dreamstime (C)

2.9 MODULE 8: PARSLEY

2.9.1 General aspects

Parsley is an annual herb cultivated for its aromatic leaves. It is used as garnish and the oil derived from dry leaves is used for seasoning. The erect growing parsley has green leaves and greenish-yellow flowers, and reaches a height of 30 to 45 cm. The herb is a rich source of Vitamin C, Vitamin A, iron, and also yields fatty acids and an essential or volatile oil. The essential oil extracted from the leaves is considered superior to that from the seeds and is used in condiments and seasonings. Flat leaved and curly leaved parsley are commonly grown in Kenya.



Figure 2. 28: A parsley production field and freshly harvested parsley

Photo Credit: Gene Castellini Farms

2.9.2 Climatic requirements

- Parsley grows well at temperature ranging from 20 to 24°C
- It grows well at rainfall ranging from 950 to 1000mm
- The crop does well under irrigation for controlled watering, but does not tolerate water logging
- For an ideal crop, full or partial exposure to sunshine for 6 to 8 hours is required
- Parsley grows at altitude of up to 2100m above sea level

2.9.3 Propagation

- Parsley seeds are planted directly into the field
- Germination takes 3-4 weeks, and therefore soaking overnight in warm water is recommended to break seed dormancy
- Parsley seeds can also be established in a nursery then transplanted
- Transplanted plants take less time to mature

2.9.4 Soil requirements

- Parsley grows well in loamy soils that are fertile and well drained
- The ideal pH for growth of parsley ranges from 6 to 7
- Soil test is recommended to determine nutrient level of the soil

2.9.5 Land preparation and planting

- Deep ploughing is recommended since the crop is deep rooted
- Remove previous crop debris, weeds and plough to a fine tilth
- It is recommended to prepare the land during the dry season to give the stubble enough time to dry and rot. This will supplement organic matter in the soil owing that the crop requires fertile soils with high organic matter content
- Application of manure is recommended followed with basal fertilizer containing nitrogen, phosphorus and potassium and micronutrients
- Seeds are planted in single or double rows in raised beds 1-2m wide
- Plants are spaced at 10-15cm within rows and 30-60cm between rows
- Pre-soaking of seeds can enhance uniform emergence

2.9.6 Fertilizer requirements

- The crop requires fertile soil; after land preparation apply well decomposed organic matter and mix thoroughly with the soil
- Plant with a phosphatic fertilizer such as DAP to help in rapid root development and crop establishment
- Apply a complete fertilizer on 35th to 40th day 23:23:23 or 18:18:18 to improve growth of the crop and leaf quality
- A nitrogenous fertilizer such as CAN, ammonium sulphate or mono-ammonium sulphate can be used in top dressing the crop
- Avoid excessive application of fertilizers as this alters the herb flavor

2.9.7 Water requirements

- Constant supply of water is required throughout the growing season
- In drier areas, watering can be supplemented by irrigation
- Drip irrigation works best as it saves water and reduces fungal infections

2.9.8 Weed control

- The field should be kept weed free to avoid competition for space, moisture and nutrients between parsley and the weeds
- Hand weeding is recommended
- The weeds also harbor crop pests such as aphids and spider mites which are the key threats to the crop

2.9.9 Major pests of parsley and their control

- The main pests of parsley are white flies, red spider mites and aphids
- An appropriate broad spectrum insecticides can be used to control the pest population
- Yellow traps can be used to trap white flies
- For farmers growing the herb for the export market and there are restricted GLOBALGAP guidelines, biological control agents can be used in an integrative manner with chemical control in order to achieve minimum residue levels as per export requirements by the Kenya Plant Health Inspectorate Service (KEPHIS)

2.9.10 Major diseases of parsley and their control

- The common diseases of parsley are leaf spot and stem rot
- Field hygiene remains the main preventive measure for bacterial diseases

2.9.11 Harvesting

- Parsley is ready for harvest from 70 to 90 days after planting or transplanting, when the plants reach at least 15cm
- Parsley is harvested by cutting at 4 to 5cm above the crown
- One third of the plant is trimmed to encourage new growth
- Parsley is mostly hand harvested in bunches that are then tied with a rubber or twist -tie
- For domestic consumption, one can pluck a few leaves

- For commercial purposes, whole stems are cut
- There are multiple harvests from the same crop
- Harvest the crop during cooler parts of the day to reduce moisture loss and cooling costs
- Store the harvested parsley under shade as soon as possible after harvest to remove field heat

2.9.12 Post-harvest handling

- At the packing house, parsley is washed and sorted to remove faded and yellowing leaves
- Parsley is packed in cartons and kept under cool temperatures to maintain the green color and freshness
- Cracked ice used in or around packages will help maintain quality during transportation
- Parsley should be stored at a relative humidity of 95-100%



Figure 2. 29: A bunch of freshly harvested parsley and parsley packaged in a plastic container
Photo Credit: Maroc

2.10 MODULE 9: SAGE

2.10.1 General aspects

Sage is a perennial shrub that grows up to 60cm in height. It is grown for its aromatic leaves which are used fresh or in dried form. Sage is also referred as common garden Sage, culinary, or garden Sage. The leaves and flowers also produce essential oils. Sage is also used for seasoning meat, in baking and beverages.



Figure 2. 30: Sage production fields
Photo Credit: Wikifarmer (A), Yuelan-iStock (B)

2.10.2 Climatic requirements

- Climate is the most important restrictive factor when growing Sage
- The plant grows well in warm, dry climate with full sunlight at an altitude of up to 1500m
- The optimum soil temperature for Sage is between 15 and 21 °C; while the optimum temperature for germination of seeds is 10 to 24 °C

2.10.3 Soil requirements

- Sage is a very resilient and adaptable plant and can thrive even in nutrient poor soil
- The plant can grow and give an average yield in nearly all well-drained soils
- However, it grows best in well drained sandy, loamy fertile soils with a pH of 5.5 to 8
- The best yields are achieved in soils with a pH close to 7 and with very good drainage
- Soil analysis should be done to determine the appropriate fertilizer regime for Sage

2.10.4 Propagation, thinning and pinching

- Sage can be propagated by direct seeding in the field, seeding in the nursery then transplanting and by cuttings
- As a general rule, herb producers prefer vegetative propagation over sexual reproduction (by seeds), because this will ensure that they will have clones of the mother variety
- For direct seeding in the field, 400-500g of seed per hectare is required
- If starting with seeds, they are first raised in a seedbed, where they take about 3 weeks to germinate and are then transplanted to the field
- Cuttings are most preferred because seeds take longer to grow
- There is need to do thinning to retain the recommended plant population in order to promote crop aeration and general health
- Pinching is practiced to encourage growth of young shoots and enhance flavor

2.10.5 Site selection and land preparation

- The planting site should be warm, dry and protected from wind
- Soil in the selected site should be well drained and not prone to water logging
- To obtain good crop growth, plough to a fine tilth and remove weeds and debris
- Apply manure followed by a basal fertilizer containing nitrogen, phosphorus and potassium and micronutrients
- Application of nitrogen fertilizer improves the dry matter and essential oil yield

2.10.6 Fertilizer requirements and planting

- Seedlings are planted at a spacing of 25 to 30cm within rows and between rows
- Cuttings should also be planted at a spacing of about 25 to 30cm apart or more
- Planting distances depend on the variety selected
- The recommended plant population is 5,000 – 10,000 plants per acre
- The plant density also varies depending the type of soil, soil fertility levels and altitude

2.10.7 Water requirements and mulching

- Sage is drought tolerant and can thrive under minimal water supply
- Sage can be grown in areas without any additional irrigation
- However, irrigation promotes plant growth and rapid regeneration
- Drip and flood irrigation are recommended
- The plants need to be mulched after transplanting, which helps in moisture conservation and weed suppression
- The decomposed mulch also releases nutrients into the soil

2.10.8 Weed control

- Weeds compete with Sage for space, sunlight, water and nutrients
- They also reduce the fresh weight and quality of essential oils
- Manual control on a weekly basis is recommended
- Use of mulch also prevents the growth of weeds
- In case of direct seeding in the field, hand weeding is required nearly every week, as weeds will emerge between the Sage seedlings



Figure 2. 31: Weed-free Sage production fields

Photo Credit: Dikir and Zigene, 2017

2.10.9 Key pests and diseases of Sage and their management

- Aphids are the main pest of Sage
- Root rot is the main disease that affects Sage especially when the soil is not well-drained or when there is over-irrigation
- The key to growing healthy Sage plants is to build an unfavorable environment to pests and diseases including:
 - i. Grow the Sage plants in a site with direct access to the sun
 - ii. Water regularly, but keep the soil well-drained
 - iii. Remove any dead leaves or flowers
 - iv. Remove any unwanted weeds that can attract various insects

2.10.10 Maturity and harvesting

- Sage is ready for harvesting 75-90 days after sowing
- Harvesting is by cutting the top 20cm of tender growth with scissors just under the first set of leaves
- Leaves are harvested fresh but can be dried depending on the target market

- Harvesting at flowering is most preferred as it gives higher yields for dry herb and essential oils
- Leaves should be harvested sparingly during the first year of growth and normally in the following years
- Leaves should only be harvested from the well-established plants
- Commercial fields may be harvested by mowing but the highest quality product is achieved by harvesting only the leaves
- Sage is harvested 2-3 times per annum



Figure 2. 32: Fresh Sage leaves ready for harvesting (A) and freshly harvested Sage

Photo Credit: Gilmor

2.10.11 Post-harvest handling

- Sage should be kept under shade after harvesting as the leaves normally dry out quickly
- Sage is best used fresh but may be stored
- Sage can remain fresh for 2 to 3 weeks while the dried form can last for months
- The leaves can also be frozen for storage
- The leaves should be dried out of direct light in a cool, well-ventilated area
- Dried Sage has a stronger and slightly different flavor than fresh Sage
- When crispy dry, Sage leaves are stored in airtight jars and light tight containers
- The optimum postharvest temperature and humidity are 2°C and 95-100%, respectively

2.11 MODULE 10: TARRAGON

2.11.1 General aspects

Tarragon is a perennial herb that is grown for its medicinal value and culinary purposes. It has long, light green leaves and tiny greenish or yellowish white flowers. The leaves and flowers also produce essential oils. The herb grows to a height of between 30 and 150cm.



Figure 2. 33: Tarragon plants (A), a flowering tarragon plant (B) and a bunch of freshly harvested tarragon

Photo Credit: Almanac (A), Plant Village (B), Nawiri Plant Limited (C)

2.11.2 Climatic requirement

- Tarragon grows optimally in a dry location in full sun and warm temperatures
- Tarragon requires 300-1300 mm rainfall annually

2.11.3 Soil requirements

- Tarragon grows best in warm, dry, well-aerated soils with a pH of 6.5 to 7.5
- The soil should be light in texture and well-draining
- Tarragon performs better in slightly acidic soils
- It does not tolerate wet soil
- Soil test is recommended to determine the soil nutrient level

2.11.4 Propagation

- Tarragon is propagated using stem cuttings and root divisions
- Care should be taken when using the roots as they easily break off
- Cuttings are usually 4-6 inches long with a single node and taken from the shoot tip
- The cuttings are established in a nursery before transplanting
- Rooting hormones can be used to encourage root growth

2.11.5 Land preparation and planting

- Prepare a fine tilth by ploughing, removing weeds and debris
- Incorporate manure in the soil and mix thoroughly
- Tarragon is planted at a spacing of 25-40 cm between rows and 25cm within rows
- Mulching is encouraged to maintain soil moisture and lower soil temperature
- Tarragon does not require extra fertilization as the flavor improves in nutrient poor soils
- Pruning is encouraged to promote branching and to keep the height to around 2 feet (otherwise the plant will fall over)

2.11.6 Water requirements

- Tarragon should be watered regularly but soil should be allowed to dry out between irrigations
- Dry periods during growth result in better growth and quality of the plant
- Over watering can lead to root rot
- Mulching is practiced to retain soil moisture, suppress weeds and lower the soil temperature

2.11.7 Weed control

- Weeds compete with tarragon for water, nutrients and sunlight
- Mulching can help reduce weed pressure
- Shallow cultivation is encouraged to avoid damaging the roots

2.11.8 Key tarragon disease

- The major disease of tarragon is tarragon rust caused by the fungus *Puccinia dracunculina*
- The disease is favored by poor air circulation around plants
- Spores of the fungus are transmitted by wind

Symptoms of tarragon rust:

- Yellow or white spots on underside of leaves
- Bright orange or yellow pustules on underside of leaves
- Leaves may turn yellow
- Growth is stunted and plant may become stunted

Control:

- Remove all crop debris and infected leaves
- Avoid use of over-head irrigation or watering in the morning to allow plant foliage to dry during the day
- Ensure plants are well spaced to promote good air circulation around plants

Table 2. 3: Common pests and diseases of herbs, their symptoms and management practices

A. PESTS				
Pest	Description and key symptoms	Management practices	Commonly affected herbs	Image and photo credit
Aphids	- Aphids are Small soft bodied insects on underside of leaves and/or stems of a plant - Are usually green or yellow in color - High aphid infestation may cause leaves to yellow and/ or distorted, necrotic spots on leaves and/ or stunted shoots - Aphids secrete a sticky, sugary substance called honeydew which encourages the growth of sooty mold on the plants	- Under low infestation affected plant parts can be removed - Grow tolerant varieties - Use beneficial insects like lady bugs that feed on aphids - Apply horticultural soaps and neem oil - Spray insecticides upon heavy infestation	- Basil - Dill - Parsley - Thyme - Sage	 <i>Aphids on basil leaf</i> PC: S. Rae

Spider mites	• Prefer hot, dry conditions and are often on the underside of the herb leaves • Manifested by presence of fine webs, which cover the leaves and stems • Plants become weak and brittle • Leaves may later turn yellow and drop • Silk webbing may be present when infestation is heavy	• Remove infected plants and weeds to reduce inoculum • Maintain good hygiene in the farm • Apply a strong stream of water or soapy water aimed at the foliage • Regular irrigation • Use recommended miticides	• Basil • Thyme • Rosemary • Sage	 <i>Spider mites on basil</i> PC: Sophieinaus
Slugs and snails	• They cause irregularly shaped holes in leaves and stems • Occurrence of slime trails on plant foliage and walkways • Flowers may also be damaged if present • If infestation is severe, leaves may be shredded	• Practice field hygiene - remove weeds and plant debris • Handpicking slugs at night can reduce population • Spread wood ashes or eggshells around plants • Use a beer trap • Chemical control using metaldehyde or carbaryl	• Basil • Chives • Dill	 <i>Dusky slugs</i> PC: G Bernon  <i>Cartusian snail</i> PC: Lubos Kolouch

Whiteflies	• They appear on the underside of the leaves • Whiteflies suck sap from the leaves of plants and excrete large quantities of honeydew which serves as a growth medium for sooty mold • Leaves may turn yellow and fall off the stem • Overall stunted growth	• Avoid high-nitrogen fertilizers • Install yellow sticky traps in the field • Apply neem oil or soap water aimed at the foliage • Regular pruning where necessary • Spray recommended insecticides upon heavy infestation	• Thyme • Mint • Basil • Rosemary • Sage	 <i>Whiteflies on basil</i> PC: Neil Palmer
Leaf miners	• They attack succulent leaves, leaving tunneling trails between the upper and lower leaf surfaces • Larvae mine in the inner layer of the leaves and eat from inside • They cause meandering mines or trails in the leaves • Infestation can lead to desiccation and premature leaf-fall	• Practice crop rotation • Remove debris from the previous crop before planting • Practice crop rotation • Maintain field sanitation and weed control • Use biocontrol agents like parasitoid wasp where available • Spray recommended insecticides	• Basil • Oregano	 <i>Mining symptoms caused by leaf miners on succulent leaves</i> PC: S. Dekker

Mealybugs	• Mealybugs damage plants by sucking sap from roots, tender leaves and petioles and fruit • They attach themselves to the plant and secrete a powdery, white, waxy layer used for protection while they suck the plant juices • The honeydew attracts ants • Severely infested leaves turn yellow and gradually dry • Severe attack can result in shedding of leaves and inflorescences, • The foliage and fruit may become covered with sticky honeydew, which serves as a medium for the growth of sooty moulds	• Do not over fertilize the plants • Wash off with steady stream of water • Regular pruning and destroying affected parts • Use natural enemies like parasitic wasps, ladybird beetles, hover flies and lacewings • Apply neem oil or soap water aimed at the foliage	• Rosemary	  <i>Mealy bug on stem</i> PC: Kings Plant Barn
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Thrips	• Thrips are very small, slim and elongated insects • They are hard to spot on plants and herbs • They puncture the surface tissue and suck the sap from the plant cells of the leaves • They feed on leaves causing browning and leaf drop • Damage manifested by silvery shining areas and leaf distortion • They can also be vectors of disease causing organisms	• Prune out heavily infested parts • Spray with a stream of water • Do not over-fertilize with Nitrogen • Spray the plant with soap water • In case of heavy infestation, spray the plants with recommended insecticides	• Rosemary • Sage	 <i>Thrips on Rosemary</i> PC: L. Pundt
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B. DISEASES

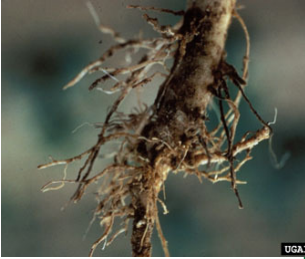
Disease	Description and key symptoms	Management practices	Commonly affected herbs	Image and photo credit
Damping off	- Seeds become soft and mushy, turn brown and finally break down - infected part of the seedling becomes watery, discoloured and thinner than the uninfected - Collapsed young seedlings - Fuzzy whitish mold on the soil surface and girdles succulent stems of newly germinated seedlings - The stem develops black spots, shrink and eventually fall over	- Keep the field free of crop residues and debris - Use clean planting tools - Properly dispose infected plants - Avoid overcrowding of plants - Avoid over-watering the plants - Avoid planting the herbs in fields prone to waterlogging - Practice seed dressing where possible	- Basil - Chives	 <i>White mold associated with damping off on the stem</i> PC: Pakistan Hydroponics

Rust	• Yellow or white spots on underside of leaves • Bright orange or yellow pustules on underside of leaves • Leaves may turn yellow • Growth is stunted • Leaves may drop from the plant prematurely	• Remove infected plants and alternate hosts to reduce source of inoculum • Remove crop debris after harvest to reduce source of inoculum • Avoid overhead irrigation to minimize the spread of rust spores • Proper disposal of infected plants • Plant resistant varieties • For severe infection, apply sulphur or copper fungicides	• Thyme • Sage • Tarragon • Chives	 <i>Pustules on underside of the leaf</i> PC: Kevin Ong  <i>Rust pustules on a leaf</i> PC: UC IPM
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Powdery mildew	• White or grayish spots on the upper surface of leaves and on tender new growth • As the infection advances, the fungus produces whitish to yellow-brown and then black fruiting minute structures • Leaves can become twisted and distorted before wilting and dying • Unopened flower buds may be white with mildew and may never open	• Use clean planting seed • Remove infected leaves and crop debris to reduce the source of inoculum • Use the correct spacing/ pruning to avoid overcrowding of plants • Practice mulching where applicable to minimize disease spores from splashing back up onto the leaves • Avoid overhead irrigation • Apply neem oil or soap water • Plant resistant varieties • In case of severe infection, spray with recommended fungicides	• Basil • Dill • Sage • Thyme • Rosemary	 <i>Powdery mildew symptoms on Sage</i> PC: Amazing gardener  <i>Powdery mildew symptoms on Rosemary</i> PC: Aaron Palmateer
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Bacterial spot	• Key symptoms include small angular shaped leaf spots that enlarge as the disease develops • The spots are soft when tissue is wet, but sunken and brittle when leaves are dry • Symptoms are restricted by leaf veins • The spots are light tan to dark brown in colour and appear on both sides of the leaf	• Use disease free seed or treated seed • Avoid use of overhead irrigation during the evening and night to minimize splashing of water • Remove any crop residues and weeds • Rogue out infected plants • Avoid handling plants when they are wet • Use resistant varieties	• Parsley • Coriander • Lavender • Basil	 <i>Parsley leaves infected by bacterial leaf spot</i> PC: S. Koike
Downy mildew	• White spots appear on the upper surface of leaves and as the spots enlarge, they become angular and turn yellow followed by browning • On the under surface of the leaf a white to greyish fluffy mat develops • Affected leaves curl and wilt	• Keep the field clean • Planting materials used should be disease free • In case of heavy infection, apply appropriate fungicide	• Basil • Parsley • Chives • Mints	 <i>Downy mildew symptoms on the underside of a parsley leaf</i> PC: EPPO

Leaf spots	• Black or brown irregular spots that appear on the leaves and streaking on the stems of the plant • The spots on the leaves are dark with light centers	• Remove infected crop debris after harvest to reduce source of inoculum • Remove and dispose infected leaves • Practice crop rotation • Avoid overhead irrigation to minimize water splashing • Avoid long periods of leaf wetness • Ensure recommended plant spacing to enhance air circulation in the field • Use resistant varieties	• Basil • Chives • Sage	 <i>Leaf spot symptoms on basil leaves</i> PC: S. Nelson
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Fusarium wilt	• Often appear later in the growing season • Wilting symptoms are first noticed on the lower (older) leaves and progresses to the younger foliage • Wilting is followed by a yellowing of the leaves and finally necrosis • In many cases, only one branch or side of the plant show symptoms • Ultimately, the entire plant wilts • Fusarium wilt can survive for years in the soil and is spread by water, insects and garden equipment	• Practice crop rotation with non-host crops • Remove infected crop debris after harvest to reduce source of inoculum • Use disease free planting materials • Avoid application of high levels of nitrogen fertilizers – they may increase susceptibility of the plant to the disease • Plant resistant varieties • Soil solarization in case of production in a greenhouse	• Basil • Parsley • Coriander • Mint	 <i>Wilting basil plants</i> PC: North Carolina State Extension
Root rot	• The key symptom is wilting of leaves followed by dying of the whole plant and rotting of the roots • Roots turn brown or reddish and mushy with numerous feeder roots • The disease can occur due to excessive moisture especially in poorly drained soils	• Avoid growing herbs in a field prone to water logging • Reduce over-watering • Avoid excessive application of fertilizers • Properly discard affected plants and soil • Treat seeds with a seed dresser where applicable • Apply biocontrol agents such as <i>Trichoderma</i> and mycorrhizae	• Thyme • Sage • Tarragon • Rosemary	 <i>Root rot symptoms on a thyme plant</i> PC: R. J. Reynolds

2.11.9 Harvesting

- Tarragon is mostly used as a fresh herb as drying reduces the flavor
- It is normally harvested two months after transplanting
- Tarragon is harvested by pinching 1/3 length of the stem just as the flower buds appear
- Harvesting is normally done 2-3 times in a growing season
- Avoid harvesting during wet weather to minimize rotting and microbial invasion especially for the dried form of the herb
- Harvested stalks in bunches are hang in a warm dry place out of direct sunlight
- Dried tarragon may lose some color and flavor



Figure 2. 34: Harvesting tarragon (A) and a bunch of freshly harvested tarragon (B)

Photo Credit: Agrifresh (A), Utah State University

2.11.10 Post-harvest handling

- Tarragon should be placed under a shade after harvest to prevent excessive moisture loss
- The leaves bruise easily hence require gentle handling
- The fresh herb should be packed in perforated bags to minimize water loss
- Tarragon should be packed in strong clear plastic containers to prevent physical injury during transportation
- The leaves can be frozen or dried
- However, if the leaves are left to dry for too long, the leaves lose their flavor
- As soon as the leaves are dry, store them in airtight containers



Figure 2. 35: Dried tarragon (A), dried tarragon packaged in an airtight glass container (B), and fresh tarragon packed in clear plastic bags (C)

Photo Credit: Amazon (A and B), Agrifresh (C)

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CHAPTER 3: REQUIREMENTS FOR EXPORT OF CHILLIES, HERBS AND SPICES FROM KENYA

- Export of fresh fruits and vegetables in Kenya is regulated by the Agriculture and Food Authority (AFA) under its Horticultural Crops Directorate (HCD)
- HCD as the competent authority of the horticultural sub-sector in Kenya is charged with the responsibility of promoting the development of horticultural crops, licensing exporters and disseminating information on horticultural marketing
- To export chillies, herbs and spices from the country, there are various documents that are required and fall in different categories:

3.1 Required documents, permits, licenses and business premises

3.1.1 Legal documentation and licensing requirements

To export horticultural products, the following legal documents and licenses are mandatory:

- i. A Certificate of Business Incorporation/Registration from the Registrar of Companies
 - ii. Obtain an Export Permit from the Horticultural Crops Directorate (HCD), Agriculture Food Authority (AFA) on the fulfilment of the following conditions:
 - Submit copies of Certificate of Incorporation/Registration
 - Photocopy of ID cards of all the Directors (passport or work permit if they are foreigners)
 - Packing facilities inspection report
 - Register the contract (between the producer and exporter) with the HCD indicating produce price, quantity and quality requirements
 - Company stamp and authorized signatory of the applicant
 - Details of a bank account
 - Declaration of source of produce
 - If you are a grower, indicate the location of the land and the total acreage under production
 - If not, provide written contracts with farmers for supply of produce of a certain quality and standard, unless you are producing the export crop yourself
- You will also need to have or demonstrate access to:-
 - Packing facilities (shed, grading hall, cold store, etc)
 - An adequate knowledge of quality standards for horticultural produce on the market (Good Agricultural Practices, GAP; Traceability; Maximum Residue Level, MRLs; Post Harvest Handling procedures, KEBS etc)
 - Documentary evidence from your overseas client, that you are ready to start an export business e.g. an order from the client, or agreement to start business etc
 - Export Licence fees payable to the HCD:
 - Export License fees
 - New/Renewal forms are obtained in the AFA Website, HCD Section (<http://horticulture.agricultureauthority.go.ke/index.php/export-import-guidelines>)

3.1.2 Business infrastructure

- Acquire a trading premise (office, pack house, cold store)
- Establish communication infrastructure – Address, Telephone, Fax, Email address, Skype

3.1.3 Technical requirements for all applications

- i. Farm inspection for all produce source
- ii. Pack house inspection for packing facility - The facility where the produce is handled, must be inspected by HCD to ensure that the facility is clean and the staff observe hygiene. Once the facility has been inspected and is in full compliance to the standards, HCD will issue a packhouse inspection report. Before pack house inspection by the HCD officials, the farmer or exporter must have met all the requirements, including a food hygiene licence, valid medical certificates for the personnel of the premises and protective clothing and equipment
 - The owner must give a list of:
 - Produce handling staff
 - Traceability procedure (copy) — which should contain farm codes, produce collection notes and codes, stock records, protective clothing and equipment for personnel handling the produce and packing facility
- iii. PS I or II form (farm/farmer details) and a soft copy forwarded to: hcdtechnical@gmail.com (Excel format)
- iv. Produce contracts for contracted sources – between the farmer and buyer witnessed by HCD
- v. Inspection of transport facility
- vi. Demonstrate traceability system (farm to packhouse)
- vii. Declaration of clearing and forwarding agents

Please note:

All documents should be put in order as per the Vetting Checklist

Registration fee of Ksh. 5,000 per year

Cess deposit fee of Ksh. 5,000

3.1.3.1 Legal and non-legal technical quality requirements for export of chillies, herbs and spices

Chillies, herbs and spices destined for the export markets have to meet several legal and non-legal technical quality requirements. The legal requirements include:

- i. MRLs for pesticides and contaminants
- ii. Traceability
- iii. Product conformity
- iv. Product integrity
- v. Product specifications
- vi. Labelling
- vii. Packaging

The produce is subjected to official control to ensure food safety and compliance with the legal requirements, including:

- i. Documentary checks
- ii. Identity checks
- iii. Traceability
- iv. Conformity to the required market standards

The required documentation includes

- i. Bill of landing
- ii. Phytosanitary certificate
- iii. Codex Alimentarius food safety standards certification
- iv. Packing list
- v. Customs clearance
- vi. A unique traceability code - In most cases, lot number or Global-GAP Number (GGN) are used as the traceability code
 - The non-legal requirements address social and environmental compliance

3.1.4 Prerequisite licenses and certificates required for export of chillies, herbs and spices

The following are the prerequisite licenses and certificates required for export of fresh fruits and vegetables:

i. Export licence from HCD

Requires a registration fee of Ksh. 5,000 yearly

ii. Phytosanitary and conformity certificates from KEPHIS

- This is a phytosanitary certificate that certifies that the chillies, herbs and spices are free from regulated pests and conforms to other phytosanitary requirements of the importing country.
- Issuance of the phytosanitary certificate is regulated by Kenya Plant Health Inspectorate Service (KEPHIS).
- Traders are required to obtain a phytosanitary certificate for each consignment.
- The phytosanitary certificate must guarantee that a product is:
 - Properly inspected
 - Free from quarantine pests; within the requirements for regulated non-quarantine pests and practically free from other pests
 - For export to the EU, the certificate guarantees that the product is in line with phytosanitary requirements that are laid down in the EU Regulation 2019/2072¹

iii. Euro 1 Certificate (For EU Market)

- Issued for those exporting to EU markets
- The certificate demonstrates that goods are of preferential origin

iv. GlobalGAP Certification

- This certificate shows that the exporting farmer has engaged in Good Agricultural Practices that ensures that crops have been grown in safe, healthy and responsible way

v. MRL limit compliance (EU)

- This certificate is important for exporters to EU markets
- It confirms that farmers are abiding to the right pesticides and herbicides application when they are growing their produce

vi. BRC certification

- For UK supermarkets, exporters require BRC certification which guarantees the standardization of quality, safety and operational criteria and ensure that producers or exporters fulfil their legal obligations and provide protection for the end consumer

1 <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32019R2072>

3.2 Procedure and documents required for export of chillies, herbs and spices from Kenya

The checklist of the documents required to export chillies, herbs and spices from Kenya and the stepwise procedure of applying for the export license can be accessed from the *HCD website*² or *infotradekenya.go.ke*³. The required documents fall under two categories depending on whether it is a new application or a renewal:

3.2.1 Documents required for new applicants

- i. Certified copy of Certificate of Business Registration from the Registrar of companies
- ii. A certified copy of the company KRA pin
- iii. Certified copies of memorandum and articles of association
- iv. Copies of Identity Cards of all the Directors. A photocopy of passport and work permit if a Director or Directors are foreigners
- v. Documentary evidence from overseas clients e. g. a letter, fax or e-mail that you are ready to start an export business
- vi. Knowledge of the requirements from overseas market
- vii. County Government business permit
- viii. Typed application form 1A and 1B
- ix. Certified Tax compliance certificate
- x. KEPHIS phytosanitary statement for one calendar year

3.2.2 Documents required for renewals

- a. Clearance of outstanding cess amount receipt from HCD Finance
- b. Dully filled Export Quarterly returns (EQS forms) for the last two years
- c. Tax Compliance Certificate
- d. County Government business permit
- e. Dully filled Form 1A (Typed)
- f. Dully filled Form 2A (Typed)
- g. Clearance letter/recommendation from a relevant horticulture association
- h. No outstanding farmers claims
- i. No outstanding non conformity issues raised for systems audit on notifications and interceptions

2 <http://horticulture.agricultureauthority.go.ke/index.php/export-import-guidelines>

3 <https://infotradekenya.go.ke/media/HCD%20EXPORTER%20REGISTRATIONS%20CHECKLIST.pdf>

FORM 1A


AGRICULTURE, FISHERIES AND FOOD AUTHORITY
HORTICULTURAL CROPS DIRECTORATE
 Nairobi Horticultural Centre next to JKIA, P.O. Box 42601 – 00100 Nairobi, Telephone: 020-2088469, 020-2131560 Email: md.hcda@gmail.com / Website: www.hcda.or.ke

APPLICATION FOR EXPORT REGISTRATION

1. Full Name of Applicant: _____

2. Postal Address: _____

E-mail: _____

3. Location of premises: _____

4. When was the exporting firm established: _____

5. Is the Applicant engaged in any other business: _____

6. If so give particulars: _____

Name: _____

Address: _____

7. If so give particulars: _____

Name: _____

Address: _____

8. How long has the applicant been exporting fruits, vegetables and flowers? _____

Name and Address of your Bankers: _____

 Serving the Horticulture Industry

FORM 1B


AGRICULTURE, FISHERIES AND FOOD AUTHORITY
HORTICULTURAL CROPS DIRECTORATE
 Nairobi Horticultural Centre next to JKIA, P.O. Box 42601 – 00100 Nairobi, Telephone: 020-2088469, 020-2131560 Email: md.hcda@gmail.com / Website: www.hcda.or.ke

APPLICATION FOR EXPORT LICENCE FOR THE YEARS

Name of applicant: _____

a) List of shareholders / Directors, their Citizenship and percentage shareholding for each

NAME	CITIZENSHIP	% OF SHARES
_____	_____	_____
_____	_____	_____

b) Location of offices including Telephone, Fax and Telex numbers.

Location: _____

Tel. No. _____ Fax _____

Email: _____

c) Overseas markets to be supplied and terms of payment _____

Specify the prices of the customers _____

Name and Address of your bankers _____

 Serving the Horticulture Industry Page 1

Figure 3. 2: Samples of forms 1A and 1B that need to be filled by new applicants who intend to export chillies, herbs and spices from Kenya.

3.3 Enforcement and facilitation of phytosanitary and quality regulations in Kenya

Government institutions that enforce phytosanitary and quality standards in fresh vegetables and fruits in Kenya include:

- i. Horticultural Crops Directorate (HCD)
- ii. Kenya Plant Health Inspectorate Services (KEPHIS)
- iii. Ministry of Agriculture
- iv. Pest Control Products Board (PCPB)
 - The Fresh Produce Exporters Association of Kenya (FPEAK) and Kenya-GAP are private institutions and standards that facilitate the implementation of phytosanitary and quality regulations
 - KEPHIS is the National Plant Protection Organization (NPPO) in Kenya, and it is mandated to enforce compliance with phytosanitary and quality requirements in the export of agricultural produce. Harvested chillies, herbs and spices are subject to checks for pesticide residues at an accredited KEPHIS laboratory and inspection for the presence of pests at the port of exit
 - KEPHIS, in collaboration with stakeholders in the horticultural sub-sector, ensures early detection of pests and pesticide residues and trains smallholder farmers on produce quality management and traceability

- KEPHIS is also responsible for the certification of fresh produce exporters to ensure compliance with phytosanitary and quality standards along the commodity value chain

3.4 Stepwise summary of exporting chillies, herbs and spices from Kenya

- i. The farmer or exporter must meet all necessary requirements including a food hygiene licence, valid medical certificates for the personnel of the pack house premises and protective clothing and equipment
- ii. Pack house inspection by the HCD officials - HCD must ensure that the pack house is safe, free of waste materials, has adequate ventilation, temperature control, lighting and designed to prevent entry of animals, pests, insects and dust
- iii. Farm inspection - the farm is assessed to check if it has good security, hygiene, grading facility, storage area, plastic crates and pallets, ventilation and a waste disposal facility
- iv. Farmer fills and submits an application for export licence at HCD – This step requires nine other documents to be attached; including the already obtained reports, business permit, and tax compliance certificate
 - A notification for approval is given before a farmer pays Ksh. 10,000 - Ksh. 5,000 is export licence fee and a similar amount for advance cess fee, a form of levy imposed on all horticultural crops for export
- v. Register to become an exporter at KEPHIS. The application costs Ksh 15,000, which comprises a deposit for phytosanitary certificates and farm inspection
- vi. KEPHIS will subsequently carry out an audit, then training on electronic certification system, which can be done physically or on phone, and later they give the farmer an export authorisation letter via mail
- vii. Compulsory three-day training done by KenTrade, aimed at acquainting the trader with the industry
 - For training in Nairobi and Mombasa, one pays Sh10,000 while those trained in regional offices have to pay Ksh. 18,000
- viii. A farmer or exporter registers their company with the Kenya National TradeNet System (KESWS), where one can transact online and access trade-related procedures and updates
- ix. Obtaining a European Union (EU) certificate of origin. This is obtained from KRA after submitting an application and then the taxman has to verify the origin of the product at the premises
 - KRA gives a registration letter and payment authorisation slip, which one is required to produce while making payment of Ksh 300 at the bank for issuance of the EU certificate of origin

- Since the original EU certificate of origin must be typed and not handwritten, an entity known as Typesetting Company is mandated to do the typing
- It should then be submitted for signing at KRA Forodha House in Nairobi.
- x. Obtaining export clearance from HCD – HCD tests the export samples and issues the trader with a laboratory analysis and evaluation sheet
 - Only after approval can one get an export clearance, which is sent via mail
- xi. Issuance of phytosanitary certificate by KEPHIS
 - A request for inspection of consignment is placed and once cleared, an application for a phytosanitary certificate is also done
 - Ksh. 500 is paid for the licence that comes out after an hour
- xii. Certificate of conformity – while this certificate is not a mandatory requirement, it may be needed by some markets such as the EU and is therefore issued upon the request of the applicant
- xiii. Export health certificate - one pays Sh1,500 to KenTrade to get this certificate
- xiv. Another consignment inspection is done by PHS
 - This paves the way for the final stage of clearance of the consignment
- xv. Contract a clearing agent at the Kenya International Freight and Warehousing Association (KIFWA)
 - The clearing agent is paid 1% of the total value of the goods
- xvi. Customs entry is lodged at KRA before payment for airline concession fee of Ksh. 250 at the bank
- xvii. A trader submits the documents for verification, still at the customs shed, followed by physical verification of the consignment
- xviii. A pass entry is obtained and documents submitted for perfection

Stringent regulations

- xix. A farmer/exporter obtains a certificate of export number, which is a confirmation that the export procedure is complete
 - The exporter can use it to claim VAT from the government where applicable
 - The certificate is issued to the applicant upon request at a cost of Ksh. 500, otherwise the Department only issues the certificate number

At the end of it all, one ends up with 11 documents namely:

- i. Food hygiene licence
- ii. Pack house inspection report
- iii. Farm inspection report
- iv. HVD export licence

- v. Export authorisation letter
- vi. User credentials
- vii. Authentication EU certificate of origin
- viii. Export clearance
- ix. Phytosanitary certificate
- x. Export health certificate
- xi. Certificate of export number

At the end of it all, you will have paid approximately Ksh. 40,000 minus the costs of transport

3.5 Documentation requirements for export of horticultural products from Kenya

Every consignment of horticultural products requires the following documents that are mandatory:

- i. Phytosanitary Certificate (from Kenya Plant Health Inspectorate Services) – issued at the ports of exit after inspection
- ii. Certificate of Origin (depending on the destination market)
 - COMESA Certificate of Origin for products destined to COMESA countries
 - EAC Certificate of Origin for products destined to EAC Countries
 - EUR – 1 Form for products destined to European Union
 - GSP form for products destined to USA, Japan, Australia, and Canada etc
 - Ordinary Certificate of Origin for products destined to Middle East, India, Central Europe, etc
 - AGOA certificate of origin for products destined to the US
- iii. Commercial Invoice
- iv. Bill of lading (sea freight), Airway bill (for air freight)
- v. Packing List

3.6 Private standards in European Union and other countries

- Private standards in EU, non-EU and other countries (e.g. USA, Japan, and Middle East) keep on changing with time, and therefore, individual markets may have additional private standard requirements
- Check with HCD and/or your contracted export company
- Specifications may vary within the EU countries and other European countries

3.7 Buyer requirements for chillies, herbs and spices in the European market

- Exporting fresh fruits and vegetables to Europe requires you to keep high standards of food safety and quality
- Responsible social and environmental conduct has also become a pre-condition to do business, and buyers often ask for certifications as a guarantee
- However, there are also opportunities to distinguish yourself by applying additional or niche market standards

- Buyer requirements can be divided into:
 - i. Musts/compulsory (e.g. legal requirements), which must be met in order to enter the market
 - ii. Common requirements (which have been implemented by most competitors), with which you should comply in order to stay abreast of the market
 - iii. Niche market requirements for specific segments
- The following requirements and standards are mandatory in order to export to the EU market:

3.7.1 Limited use of pesticides

- This is a mandatory requirement in the EU market
- According to the Rapid Alert System for Food and Feed (RASFF) Annual Report 2020⁴, pesticide residues were the main reason for food safety notifications for fruits and vegetables in Europe
- To avoid health and environmental risks, the EU has set maximum residue levels (MRLs) for pesticides in and on food products
- Products containing more pesticides than allowed will be withdrawn from the European market
- MRLs can become stricter with new insights from Europe's food safety authorities
- Buyers in the UK and several EU member states such as Germany, the Netherlands and Austria use MRLs which are stricter than the MRLs laid down in the European legislation
- Supermarket chains maintain the highest standards and generally demand 33% to 100% of the legal MRL
- The German supermarket chain Lidl is one of the strictest, with a limit of 33% of the EU legal standard for single active substances
- Pesticide management takes a lot of responsibility on the part of a producer or an exporter
- More and more buyers ask for upfront information about your pesticide spray records, and shipments are checked before they are sent to the retailer
- For future business, you must take into account that your responsibility as an exporter will play an important role as retail chains put more pressure on their suppliers

3.7.1.1 Regulations on use of pesticides: Example of Chlorpyrifos

- One of the major pesticide challenges in 2020 was residues of Chlorpyrifos
- Chlorpyrifos and chlorpyrifos-methyl are insecticides used to control insect pests on a range of crops
- The EU made a decision not to renew the approvals of chlorpyrifos and chlorpyrifos-methyl
- Around October 2020, the new lowered MRL became applicable both to food produced in the EU and to imports
- To ensure compliance, it is therefore important to observe the following:
 - i. Use the EU Pesticide Database to find out the MRLs that are relevant for chillies, herbs and spices

4 https://food.ec.europa.eu/safety/rasff-food-and-feed-safety-alerts/reports-and-publications_en

- You can select the specific crop or a pesticide and the database shows the list of associated MRLs
- Always check whether your buyers have additional requirements for MRLs and pesticide use
- ii. Apply integrated pest management (IPM) to reduce the amount of pesticides used
 - IPM is an agricultural pest control strategy which is also part of GLOBALG.A.P. certification
 - IPM uses natural control practices such as the application of pests' natural enemies
 - The fewer chemicals you use, the better your marketing position will be for export to Europe

3.7.2 Regulations on maximum residue level (MRL)

- Maximum residue level (MRL) is the highest level of a pesticide residue or a contaminant that is legally tolerated in or on food or feed
- Contaminants include heavy metals such as cadmium, lead, mercury and tin, which may contaminate the commodity during production, packaging, transportation, or storage
- The *European Commission directive 2009/128/EC*⁵ gives a general default MRL of 0.01 mg/kg where a pesticide is not explicitly mentioned (EC, 2009) for most fresh fruits and vegetables
- The amounts of pesticide residues in or on food must be safe for consumers and must be as low as possible
- The MRLs requirements dictate that the produce should not contain banned or higher amounts of agrochemical pesticide residues
- The EU's MRL harmonization advocates to improve access for countries like Kenya exporting fruits, vegetables, herbs and spices to the trading block
- However, importers in the UK and within EU member states like Germany apply stricter MRLs rules than those of the EU
- For example, the set MRLs by supermarket chains in the UK, Germany, the Netherlands, and Austria usually demand 33–70% of the legal MRL and upfront information on the commodity spray programs and pesticide application records
- The non-uniform and always changing MRLs requirement in international markets is a challenge to exporters of fruits, vegetables herbs and spices
- Data from the rapid alert system for food and feed (RASFF) shows Kenyan fruits and vegetables have been rejected at the ports of entry of the importing EU member countries (PRF, 2016)

5 <https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:309:0071:0086:en:PDF>

3.7.3 Avoiding contaminants

- Contaminants are substances which have not been intentionally added to food but which may be present as a result of the various stages of its production, packaging, transport or holding
- Similar to the MRLs for pesticides, the EU has set limits for several contaminants
- For fresh fruits and vegetables, the main concern will be the contamination with lead, cadmium and nitrate
- To address the challenge of contaminants in chillies, herbs and spices, the following tips are important:

- i. Maintain good contact with your buyers, because they will often keep you up to date with changes in regulation which affect the chillies, herbs and spices business
- ii. Read more about contaminants on the *website of the European Commission*⁶ and find an overview of the maximum contaminant levels in the *Annex of Regulation (EC) 1881/2006*⁷. Try to check this information on an annual basis
- iii. Find out more about the prevention and reduction of Lead contamination in the Code of Practice published by the FAO Codex Alimentarius

3.8 Marketing standards

- European legislation sets general and specific marketing standards for the minimum quality of fresh fruits and vegetables
- A marketing standard determines the characteristics of “Extra Class”, Class I and Class II products, the minimum maturity, the different size codes, and the allowed tolerances in quality and size
- Over the years, the marketing standards have been aligned with the United Nations Economic Commission for Europe (UNECE) standards for fresh fruits and vegetables
- These standards provide guidance to businesses
- The preferred sizes sometimes vary between the different European markets, but the quality is generally “Extra Class” or Class I
- You might find a market for Class II products in some Eastern European countries, the processing industry or less formal segments
- Fresh products that are not covered by a specific marketing standard have to comply with: The general marketing standards (GMS) in Annex I, Part A of EU Regulation No 543/2011; or the applicable UNECE standard (sometimes less strict than the EU standard)

6 https://food.ec.europa.eu/safety/chemical-safety/contaminants_en

7 <https://eur-lex.europa.eu/eli/reg/2006/1881/2022-01-01>

3.9 Labelling and packaging specifications for chillies, herbs and spices destined for the EU markets

- The labelling and packaging specifications for chillies, herbs and spices destined for the EU markets require that the produce meets the specifications as per the legislation on food labelling (VCAD, 29018)
- The packaging materials should be new, clean, transparent, and should keep the pods intact without causing any damage (CBI, 2018; USAID-KHCP, 2011)
- Each package should have a sticker label including:
 - i. The name and address of the packer
 - ii. Name and variety of the produce
 - iii. Country of origin
 - iv. Class and size
 - v. Lot number or the Global-GAP number (GGN) for traceability
 - vi. Official control mark.
- The premium quality requirements include (UNECE, 2017):
 - i. The product being fresh
 - ii. The product being intact
 - iii. Free of any foreign matter
 - iv. Free of pests
 - v. Aesthetically acceptable
 - vi. Free of strange smell and taste
 - vii. Free from abnormal external moisture
 - viii. Free from parchment
- The market standards also set out the minimum quality and maturity of the commodity and spell out the characteristics of the various quality classes such as Extra Class, Class I, and Class II products, the different size codes, and the allowed tolerances in quality and size (CBI, 2018)
- The produce must have a certificate of conformity with the commodity-specific standard
- Fresh produce that is not covered by the particular standard must comply with the *General Marketing Standards (GMS) of EU Regulation No. 543/2011*⁸ or the applicable UNECE standard (CBI, 2018; UNECE, 2017)

8 <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32011R0543>

CHAPTER 4: MANDATORY STANDARDS FOR EXPORTING CHILLIES TO THE EU MARKET

- When exporting fresh fruits and vegetables to Europe, you have to comply with the requirements for food safety and product quality
- For a full list of legal requirements, consult *My Trade Assistant of Access2Markets*⁹

4.1 Pesticide residues and contaminants

- Pesticide residues are one of the crucial issues for fruit and vegetable suppliers.
- To avoid health and environmental damage, the EU has set maximum residue levels (MRLs) for pesticides in and on food products
- Fresh chillies containing higher than the allowable pesticide levels will be withdrawn from the market
- The same goes for contaminants such as heavy metals
- Chilli peppers and many of their origins are considered high risk for pesticide residues
- For several countries (Kenya not in the list), there is an increased frequency for pesticide checks
- Note that retailers in several Member States such as the United Kingdom, Germany, the Netherlands and Austria, use MRLs that are stricter than the MRLs laid down in European legislation

Tips:

- Find out the MRLs that are relevant for chilli peppers by *consulting the EU MRL database*¹⁰, in which all harmonised MRLs can be found. You can search on your product or pesticide used. The database shows the list of the MRLs associated with your product or pesticide. For chilli peppers, the same MRLs apply as for 'Sweet peppers/bell peppers' (code 0231020).
- Reduce the amount of pesticides by applying Integrated Pest Management (IPM) in production. IPM is an agricultural pest control strategy that includes growing practices and chemical management.
- Make sure that contamination of lead in chilli peppers remains below 0.10 mg/kg and cadmium below 0,050 mg/kg, according to the *maximum levels for certain contaminants in foodstuffs*¹¹.

9 <https://trade.ec.europa.eu/access-to-markets/en/home>

10 https://food.ec.europa.eu/plants/pesticides/eu-pesticides-database_en

11 <https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=celex%3A32006R1881>

4.2 Phytosanitary regulations

- As from December 2019, the new European regulation went into force for the trade in plants and plant products from non-EU countries
- This regulation requires chilli peppers to have a phytosanitary certificate before importation into the European Union, guaranteeing that they are:
 - a. Properly inspected
 - b. Free from quarantine pests, within the requirements for regulated non-quarantine pests and practically free from other pests
 - c. In line with the plant health requirements of the EU, laid down in *Implementing Regulation (EU) 2019/2072*¹²
- There are additional requirements for different regions
- The phytosanitary certificate must include an official declaration that the chilli peppers originate in a country or region that is free from the pests mentioned below, or effectively inspected and treated to ensure its absence
- Pest that requires additional declaration from countries in the African continent - *Thaumatococcus leucococcus* (Meyrick)
- To avoid exclusion in the trade with the European Union, several countries have taken measures at different moments in time
- For example, in 2009, over 90 percent of the Kenyan suppliers stopped their export to Europe due to the strict phytosanitary restrictions and the presence of the Codling Moth
- Earlier, in 2019, the Ugandan Ministry of Agriculture imposed a restriction on the export of chilli peppers, allowing only a few traders to export that meet a tight set of requirements

4.3 Quality standards

For marketing fresh chilli peppers in Europe, the *General Marketing Standards of Regulation (EC) No. 543/2011*¹³ apply. A more specific marketing standard for fresh chilli peppers is described in:

- a. Codex Alimentarius standard for chilli peppers ('food code' of WHO and FAO)
- b. UNECE Marketing Standard on Chilli Peppers
- These marketing standards describe the minimum requirements for chilli peppers and provide information on the quality requirements for each class
- Chilli peppers can be divided into three classes according to quality: Extra Class, Class I and Class II
- Europe almost exclusively requires class I chilli peppers as a minimum
- Products in this class must be of good quality and within the permissible tolerances
- In the Annex "Pungency" to the same UNECE Marketing Standard on Chilli Peppers¹⁴, categories of 'mild', 'medium', 'hot' and 'extra hot' chilli pepper varieties are distinguished, depending upon the total amount of capsaicinoids per microgram of dry weight
- The development and condition of the chilli peppers must be such as to enable them to withstand transportation and handling and to arrive in satisfactory condition at the place of destination

12 <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32019R2072>

13 <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32011R0543>

14 https://www.unece.org/fileadmin/DAM/trade/agr/standard/standard/fresh/FFV-Std/English/61_ChilliPeppers.pdf

4.3.1 Minimum general quality requirements and permissible tolerances for all chilli pepper classes

- i. Intact - the stalk and calyx may be missing, provided that the break is clean and the adjacent skin is not damaged
- ii. Sound - produce affected by rotting or deterioration such as to make it unfit for consumption is excluded
- iii. Clean - practically free of any visible foreign matter
- iv. Practically free from pests
- v. Practically free from damage caused by pests
- vi. Fresh in appearance, including stalk and calyx
- vii. Firm
- viii. Free from damage caused by low and/or high temperatures
- ix. Free of abnormal external moisture
- x. Free of any foreign smell and/or taste

4.3.2 Quality requirements and permissible tolerances for Class I chilli peppers

- i. A slight defect in shape
- ii. Slight defects in colouring; colour change due to ripening is not considered a defect
- iii. Slight skin defects (up to 2.0% of the product surface)
- iv. A slightly damaged stalk, if present
- v. A tolerance of 10% is allowed for chilli peppers that meet Class II standards
- vi. A tolerance of 10% is allowed for chilli peppers not meeting the size criteria (if sized)

4.4 Product size uniformity

- The size of chilli peppers is determined by either length or diameter (Table 4.1).
- Chilli peppers in a package must be uniform and packages should contain only chilli peppers of the same origin, variety or commercial type, quality and size (if sized)
- Nevertheless, a mixture of chilli peppers of distinctly different colours and/or commercial types may be packed together in a sales package, provided they are uniform in quality and of the same origin
- For chilli peppers sized by diameter, the difference between the diameters in the same package may not exceed 2 cm

Table 4. 1: Provisions on grading chilli peppers based on size

Size Code	Length in centimetres
1	<4
2	4<8
3	8<12
4	12<16
5	>16

4.5 Protective packaging

- Chilli peppers should be packed in a way that ensures proper protection for the product
- Boxes must be new and of good quality
- The visible part of the contents of the package must be representative of the entire contents
- Packages must be free of all foreign matter
- The materials used inside the package must be clean and of such a quality that it prevents any external or internal damage to the produce
- Common package sizes are 2, 4 or 5kg
- Small chilli peppers are often packed in 2 or 4kg cardboard boxes
- In retail, the chilli peppers are often sold loose, but in some cases retailers require additional packaging in trays or punnets
- Retail packaging is often used for exclusive varieties or chilli pepper mixes

4.6 Maintaining temperature during product handling

- After the harvest, it is important to cool the peppers down as soon as possible so as to reduce water losses
- The ideal temperatures during transport should be around 7-8 °C

CHAPTER 5: MANDATORY STANDARDS FOR EXPORTING HERBS AND SPICES TO THE EU MARKET

- Apart from the customs procedures, almost all mandatory requirements related to the importation of herbs and spices (and food in general) in the EU market are related to food safety
- The General Food Law is the legislative framework regulation for food safety in Europe
- This law is based on the 'Farm to Fork' approach
- This means that all food must be traceable throughout the entire supply chain, including exporters from developing countries
- To achieve this, all food business operators need to implement the Hazard Analysis of Critical Control Points (HACCP) system in their daily operations
- Aspects of the most important food safety requirements include:

5.1 Food safety: Traceability, hygiene and control

- Food safety is a key issue in EU food legislation
- The General Food Law guarantees food safety and allows appropriate action in cases of unsafe food
- Food products must be traceable throughout the entire supply chain and risks of contamination must be limited
- An important aspect to control food safety hazards is defining critical control points (HACCP) by implementing food management principles
- Another important aspect is subjecting food products to official controls
- Products that are not considered safe are denied access to the EU

5.2 Control of food imported to the EU

- Your products will be subjected to official controls
- These controls are carried out to ensure that all foods marketed in the EU market are safe i.e. in compliance with the requirements applicable to them
- In the event of repeated non-compliance of specific products originating from a particular country can only be imported under stricter conditions such as having to be accompanied with a health certificate and analytical test report
- It can also lead to suspension of imports from that country
- Due to food safety concerns some spices and herbs (e.g. capsicums, ginger, nutmeg, curry powder) from certain countries are subject to increased level of official controls
- These are put on a list included in the Annex of Regulation (EC) 669/200915
- Nevertheless, only a small part of the products imported and marketed in Europe is subject to official (physical) controls, since the first responsibility for their safety lays with the commercial operators, such as importers
- Importers will therefore conduct most of the checks required to verify the product's safety, and may also demand certification and other proof of quality and safety

5.3 Tariff barriers

- Tariffs are one of the main trade barriers influencing competitiveness when exporting to Europe
- Tariffs are customs duties, normally paid by the importer
- The level of applied tariffs depends on the trade agreements between the EU and the supplying country
- For most of the processed fruits and vegetables imported from developing countries, the tariff rate is zero
- However, in order to benefit from these low tariffs, most single spices and herbs must be fully obtained in the supplier country
- On the other hand, spices in mixtures are allowed to originate from different countries
- For most herbs and spices, tariffs are calculated as a certain percentage of import value

5.4 Phytosanitary inspection

- The EU inspects food products to protect citizens, animals and plants from diseases and pests
- A common way of protection is the inspection of food and the issuing of a phytosanitary certificate before export of herbs and spices
- Phytosanitary certificates are issued for plants or plant products which can be reproduced within Europe after import, such as bulbs, tubers or food containing seeds
- Phytosanitary certificates are not required for most spices and herbs
- The exceptions are seeds used for sowing and fresh spices such as garlic or ginger

5.5 Control of contaminants

- Food contaminants are unwanted and harmful substances in food that can cause consumer illness
- These substances may be present in herbs and spices as a result of the various stages of their production, packaging, transport or handling or from the external environment
- The EU has implemented strict and extensive measures to minimise contaminants in foodstuffs
- The European Commission Regulation sets maximum levels for certain contaminants in food products
- This regulation is frequently updated, and besides the limits set for general foodstuffs, there are limits set for many specific products
- The most common requirements regarding contaminants in herbs and spices are related to microbiological contaminants, mycotoxins, and pesticide residues

5.5.1 Contaminants by foreign bodies

- Insects represent an important contamination issue for spices and herbs imported to the European market
- Insects (or insect body parts) may be found dead in the packaging, but some types of insects can develop inside spices, such as whole chillies or nutmeg, and continue their growth during transportation or storage
- Other types of contamination with foreign bodies include excreta of animals (such as mice, rats, cattle, birds or insects), sand, mud, stones, glass or metal parts (for example, from agricultural machinery and tools)

- There is no official limit for foreign bodies in herbs and spices shipments to the European market
- Most European buyers define their own specification requirements or follow the cleanliness specification of the American Spice Trade Association¹⁶ (ASTA)
- The cleanliness specification of ASTA defines the maximum presence of dead insects, excreta, moulds and other foreign matter
- The Quality Minima Document¹⁷ of the European Spices Association does not allow presence of any foreign objects greater than 2mm in diameter
- In order to prevent contamination with insects, suppliers from developing countries should implement preventive measures, such as heat treatment or fumigation
- If using fumigation, you must apply only officially approved fumigants
- For example, methyl bromide and ethylene oxide as fumigants are banned in the EU
- Using optical, metal and similar detectors is also recommended to prevent contamination with foreign bodies
- However, physical sorting and eye-hand control is always recommended, even if detectors are installed

5.5.2 Reducing the risk of microbiological contaminants

- The most common type of microbiological contaminant in herbs and spices is *Salmonella*
- *Salmonella* is usually transmitted to herbs and spices by irrigation with unsafe water, by use of untreated manure as fertilizer and/or by harvesting with dirty hands
- Infestation with *Salmonella* by animals or birds can happen in areas where the drying process is performed in the open air (often directly on the ground)
- The European regulation on microbiological criteria for foodstuffs sets limits for pathogenic microorganisms, their toxins, and metabolites for certain products, but does not specify limits for herbs and spices
- Table 5.1 lists the limits for the most common pathogens

Table 5. 1: Limits for the most important pathogens for herbs and herbs after heat treatment

Pathogen or toxin	Limit
<i>Salmonella</i>	Absent
<i>Escherichia coli</i>	Absent
Enterobacteriaceae	100 CFU/g
<i>Bacillus cereus</i>	100 CFU/g
Yeast and mould	100 CFU/g

¹⁶ <http://www.astaspice.org/about-asta/>

¹⁷ <https://www.esa-spices.org/download/esa-qmd-rev-5-update-as-per-esa-tc-26-03-18.pdf>

5.5.3 Mycotoxins control

- The main reasons for border rejections for imported herbs and spices are related to microbiological contamination
- Mycotoxins are toxic substances produced by moulds/fungi
- These toxins are stable and can survive severe processes such as heat treatment.
- The most common mycotoxins found in herbs and spices are aflatoxins and Ochratoxin A
- Aflatoxin contamination is most frequently found in imported dried chillies, but also in many other ground types of spices
- European food contaminants legislation sets aflatoxins and ochratoxin A limits for certain herbs and spices as indicated in Table 5.2

Table 5. 2: European Commission limits for aflatoxins and ochratoxin A in certain herbs and spices (as of September 2020)

Mycotoxin	Product	Limit [$\mu\text{g/kg}$]	
		Total aflatoxins	Aflatoxin B1
Aflatoxin	Dried chillies and paprika, pepper, nutmeg, ginger, turmeric, mixtures of spices containing one or more of the listed	10	5
Ochratoxin A	Pepper, nutmeg, ginger, turmeric, mixtures of spices containing one of the listed spices (including mixtures containing capsicum)	15	-
Ochratoxin A	Dried chillies and paprika	20	-

- Control of mycotoxins is best achieved by good agricultural and post-harvest practices, such as a timely harvest or proper drying after harvest
- It is recommended to dry herbs and spices only in thin layers and to frequently turn layers over
- Appropriate moisture and temperature conditions during storage and transport are equally important
- Timely detection and removal of contaminated material from the food supply chain is also an important control measure

5.5.4 Plant toxins

- Some toxins may be naturally present in weeds, which can contaminate herbs and spices in the field
- Limits for some plant toxins are set in the European contaminant legislation, but not yet for spices and herbs

- The most important plant toxins for herbs and spices are tropane alkaloids (TA) and pyrrolizidine alkaloids (PA)
- The potential maximum levels are currently under discussion
- Proposed limits (still not approved) for PA are 400 µg/kg, specifically for dried herbs and cumin seeds
- Contaminants such as tropane and pyrrolizidine alkaloids can be transmitted from certain weeds to herbs and spices
- Common examples of toxic weeds are ragwort (*Jacobaea vulgaris*), *Datura stramonium*, black nightshade (*Solanum nigrum*) and potato berries
- Integrated pest management is recommended to prevent contamination, such as safe planting distance from potential risk areas and physical removal of weeds while they are in the early development stage

5.5.5 Polycyclic aromatic hydrocarbons

- Several polycyclic aromatic hydrocarbons (PAH) contained in smoke, such as benzo(a)pyrene, can increase the risk of cancer
- Excessive level of PAHs can contaminate herbs and spices, especially in cases where they are processed by heating and smoking
- The level of PAHs can increase if the heat is too high, if fossil fuels are used and/or when smoking lasts too long
- Crushing spices may also increase the level of PAHs, as crushed spices absorb more smoke compared to whole spices
- If spices are processed by smoking, it is particularly important to use only wood to produce smoke and not fossil fuels or gas
- Also, it is important not to use coniferous types of wood and any type of wood that is chemically treated, because of its higher PAH level
- Current European legislation on contaminants sets the maximum level of PAH for almost all herbs and spices with the exception of cardamon and smoked *Capsicum* spp
- The maximum level for benzo(a)pyrene is set to 10µg/kg and for sum of all PAHs to 50µg/kg
- In 2020, food control authorities in Germany made a recommendation on “benchmark levels” for contents of mineral oil hydrocarbons (MOH)
- These benchmark levels (non-legislative) are set to 4 mg/kg for MOH, and they cover only the German market

5.5.6 Heavy metals and metalloids

- Heavy metals can occur as residues in food because of their presence in the environment as a result of human activities, such as farming, industry or car exhausts, or from contamination during food processing and storage
- Specific limits for the presence of heavy metals in herbs and spices are not yet set in the European legislation on contaminants, but this may soon change
- The European Commission launched a review process for the maximum allowed levels of lead in 2020
- The limit values for lead (in mg/kg) are:
 - i. 0.60 for fruit spices
 - ii. 1.5 for root and rhizome spices
 - iii. for bark spices

- iv. 1 for bud spices and flower pistil spices
- v. 0.9 for seed spices

5.5.7 Limited use of pesticides

- The EU has set maximum residue levels (MRLs) for pesticides in and on food products
- If your product contains residues of illegal pesticides or higher amounts of pesticide residues than allowed, it can be withdrawn from the European market
- The general public is very concerned about pesticide residues
- Both government organisations and non-governmental organisations frequently conduct sampling and testing, which often leads to public naming and shaming of the industry if residues are found
- The EU regularly publishes a *list of approved pesticides*¹⁸ that are authorised for use in the EU
- This list is frequently updated, and there is a general tendency to lower pesticide limits
- The EU Directive on *Maximum Residue Levels on Pesticides*¹⁹ defines these MRLs and should therefore be checked frequently
- In 2020, the EU implemented a set of policies and actions called the European Green Deal, with the aim of making the European economy more sustainable and climate neutral by 2050
- The action plan also includes a 50% reduction in the use of pesticides and an increase of the share of agricultural land used for organic farming to 25% by 2030
- This means that many pesticides will be banned, and residue levels will decrease gradually over the next years
- In 2020 and 2021, several pesticides were and will be withdrawn from the European market, namely:
 - i. Beta-cyfluthrin
 - ii. Benalaxyl
 - iii. Bromoxynil
 - iv. Mancozeb
 - v. Benfluralin
 - vi. Chlorpyrifos
 - vii. Chlorpyrifos-methyl
 - viii. Thiacloprid
- When assessing the MRL, pesticide residues found in dried herbs and spices have to be measured in relation to fresh products
- In the case of dried products, such as dried herbs, article 20 of the *European MRL regulation*²⁰ permits concentrations caused by the drying process to be taken into account when determining the MRL
- The European Spice Association recommends different dehydration factors for several herbs and spices, ranging from 3 for dried garlic up to 13 for coriander leaves

18 <https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=celex:32011R0540>

19 <https://www.cbi.eu/market-information/spices-herbs/what-requirements-should-your-product-comply>

20 https://food.ec.europa.eu/plants/pesticides/maximum-residue-levels/eu-legislation-mrls_en

- For seed spices, the dehydration factor does not apply
- Note that in organic products, the use of synthetic pesticides is not allowed
- In practice, a very low level of residues is permitted in the product, if it can be proven that this is the result of cross contamination and not illegal use
- However, the applicable limit is often a factor of 10 to 100 lower than that of conventional products, generally standing at 0.01 ppm
- Industry sources have been informing about bad practices of mixing spices containing excessive levels of residues with free-from pesticides spices to meet the required MRL
- Although the final product may be in the required MRL limit, this practice should be avoided, as it is dangerous and not sustainable

5.5.8 Control of chlorate and perchlorate

- One of the most recent changes regards the level of chlorate adopted in June 2020, set to 0.07 mg/kg for all spices
- Chlorate is no longer approved as a pesticide, but it can come in contact with food by using chlorinated water during processing
- Another source may be the use of chlorinated detergents used for cleaning facilities and processing equipment
- Therefore, suppliers of herbs and spices must control the use of water and detergents in their production facilities
- This includes water used for washing products before drying, water used to clean facilities and machines, but also water used in steam sterilisation processes

5.6 Irradiation

- To control contamination caused by micro-organisms, viruses, bacteria or insects it is allowed to use irradiation on dried herbs and spices
- The maximum overall average absorbed radiation dose is 10 kGy
- However, irradiation of herbs and spices is not often used in the EU
- In case you irradiate your spices and herbs tell your buyer
- Irradiated foods must be labelled as such
- However, it is important to note that European consumers dislike irradiated food
- Buyers in Europe commonly ask for radioactivity contamination tests for imported spices and herbs
- Food irradiation legislation, maximum permitted levels of radioactive contamination and the European Union radiation protection legislation are the basic regulations for laboratory tests for the detection of the increased level of radioactivity in food

5.7 Food additives

- Some herbs and spices or mixtures thereof may contain colourings, flavourings or sweeteners
- Buyers and European authorities can reject products if they have undeclared, unauthorised or excessive levels of food improvement ingredients
- There is specific legislation for additives (like preservatives, colours, thickeners and anti-caking agents) and flavourings (like smoke or oleoresins), which lists substances that are allowed to be used

- Authorised additives are listed in Annex II of the *Food Additives Regulation*²¹
- Authorised uses of additives are listed according to the category of food to which they may be added
- Herbs and spices are often used as natural flavourings and colour enhancers
- However, in some cases flavourings are also used to intensify the colour or flavour of spices
- This practice, although sometimes used, is not appreciated
- If those additives are not declared, this practice is considered fraud
- Equally bad practice is false declaration of the spice, for example labelling dried sweet peppers as naturally smoked when smoke flavour is added
- Placing undeclared substances in spices can ruin the reputation of the company doing so
- Examples of the most frequent problems with herbs and spices are related to excessive or undeclared content of food colours
- According to the European Food Additive legislation, spices and spice blends may not contain added colours, although adding colours is allowed for seasonings
- Typical examples include: Sudan 1 and Orange II colours, which are sometimes used to intensify the colour of spices such as curcuma or dried chillies
- Apart from being fraud, adding undeclared colours in spices can sometimes be dangerous
- Recent examples of food fraud include:
 - a. Adding chromate pigment to curcuma containing an excessive level of lead
 - b. False presentation of vanilla bean extract
 - i. Some vanilla extract is found to be adulterated with cheaper tonka bean extract
 - ii. Tonka bean extract smells and tastes like vanilla bean extract, due to the presence of a compound called coumarin
 - c. Mixing oregano with other leaves (for example strawberry or olive)
 - d. Placing powdered materials in ground spices (such as brick powder or rice flour)
 - e. Placing used seeds (from the oleoresins production) in coriander
 - f. Replacing saffron with artificially dyed fibres

5.8 Safe packaging and informative labelling

- Export packaging must be in line with the European legislation on weighting, it must be safe for consumer health and for the environment
- Packaging made of wood or vegetable materials may be subjected to phytosanitary controls
- The labelling of packed products must contain various items of information relevant to the consumer

5.8.1 Safe, well measured and eco-friendly packaging

- The first requirement is that the packaging is food safe (food grade) and that content in the packaging corresponds with the indicated quantity (in weight or volume) on the label

21 <https://www.efsa.europa.eu/en/topics/topic/food-additives>

- Importers will check packaging size and weight to ensure that pre-packed products are within the limits of tolerable errors²²
- In some EU countries, labour health and safety legislation allows workers to lift a maximum of 20 kg
- Therefore, the maximum size of export packaging must be in line with those rules
- Consumer packaging materials that come in contact with food (like cans, jars), have specific health control provisions
- Food contact materials must be manufactured so that they do not transfer their constituents to food in quantities that could endanger human health, change the composition of the food in an unacceptable way or deteriorate the taste and odour of foodstuffs
- An interesting substance to be aware of is Bisphenol A (BPA), which is known for its use in plastic bottles but is also sometimes used in the inner coatings of jar lids
- Use of BPA is currently still allowed, but its use is under review
- However, BPA is more of a concern for the European spice companies, because they often sell herbs and spices in jars or plastic packaging
- Most imported spices are packed in other types of bulk packaging
- The EU has announced the introduction of new legislation concerning plastic packaging, mandating Member States to collect 90% of their plastic throw-away bottles from 2029
- Since 2021, some single-use plastics were banned, and the use of other types is restricted
- Items on the banned list include oxo-degradable plastic and expanded polystyrene take-away food and drink containers
- By 2030, all bottles in the EU must be made from at least 30% recycled materials
- You must be aware of those requirements and adapt to new export packaging materials in a timely manner
- From January 2021, the EU started to apply a tax on non-recycled plastic packaging waste, at a rate of €0.80 per kilogramme
- This tax goes into the EU budget, and it was used to support Member states during the coronavirus pandemic

5.8.2 Labelling requirements for retail food products

- In the EU, the *labelling rules*²³ enable the citizens to get comprehensive information about the content and composition of food products
- Labelling helps consumers make an informed choice while purchasing their foodstuffs
- Regulation on the *provision of food information to consumers*²⁴ defines obligations such as:
- Nutritional information: energy value and the quantities of fat, saturates, carbohydrates, protein, sugars and salt per 100 g. It is possible to place additional nutritional information on retail products on a voluntary basis, such as the content of fibre, vitamins or minerals

22 <https://www.cbi.eu/market-information/spices-herbs/what-requirements-should-your-product-comply>

23 https://food.ec.europa.eu/safety/labelling-and-nutrition_en

24 https://food.ec.europa.eu/safety/labelling-and-nutrition/food-information-consumers-legislation_en

- Presentation of allergens (like soy, nuts or gluten) in the list of ingredients
- Indication of origin (since April 2020). For example, if Kenyan cinnamon is packed in Germany, the packaging must indicate the origin. The way to do this is to indicate “Kenya” as the origin, but the packer can also write “non-EU” or declare “cinnamon does not originate from Germany.” It is in your interest to negotiate with the buyer about clearly stating your country as the origin, although you usually do not have control over this
- Regarding herbs and spices, celery and mustard must be declared as allergens
- Some spice mixtures can also contain allergens such as gluten, wheat or nuts
- Sulphur dioxide (which is sometimes used as a preservative in spices) must also be declared as an allergen
- Some of the obligations (such as the minimum font size) relate to consumer-packed products only
- However, as a supplier of bulk products, you will be asked to provide relevant information, such as on allergens and composition
- In order to better inform consumers about healthier food choices, several voluntary nutritional labelling schemes have been developed in Europe
- The most famous and widely accepted by consumers is *Nutri-Score*²⁵, but there are other schemes, such as *Nutriform battery*²⁶ (Italy), *Front of Pack Nutritional Labelling*²⁷ (also known as ‘traffic light’, the United Kingdom) and *Keyhole*²⁸ (Sweden)
- In May 2020, the European commission published a report on additional forms of *expressing nutrition declaration*²⁹; which aims to introduce a harmonised mandatory front of pack nutrition labelling at EU level to help consumers make better choices for healthier food
- European nutrition and health claims are important for exporters from developing countries aiming to sell labelled retail products directly to final consumers
- It does not apply to business-to-business communication
- European labelling legislation forbids misleading the consumer
- Claims that any food can prevent, treat or cure a human disease cannot be made on labelling in the EU
- However, some herbs and spices are used in traditional western medicine and in eastern medicine such as Ayurveda
- They are therefore often promoted as health beneficial
- However, if you want to promote the nutritional and health benefits of herbs and spices, you must base any claim on solid scientific evidence

25 <https://www.eufic.org/front-of-pack/nutri-score>

26 <https://www.nutrinformbattery.it/en/home>

27 <https://www.eufic.org/nutrition-label/front-of-pack>

28 <https://www.livsmedelsverket.se/en/food-and-content/labelling/nyckelhalet>

29 <https://eur-lex.europa.eu/legal-content/GA/TXT/?uri=CELEX:52020DC0207>

5.9 Novel foods must be authorized before entering the European market

- Novel food refers to all foods that were not consumed in the EU to a significant degree before May 1997
- 'Novel Food' can be newly developed, innovative food, food produced using new technologies and production processes, as well as food that is or has traditionally been eaten outside of the EU
- Novel food must be approved and safe for consumption and properly labelled
- [*The European legislation on novel foods*](#)³⁰ regulates the import of new and innovative foods to the European market, while maintaining a high level of food safety for European consumers
- For the notification of traditional foods from third countries, the new regulation simplifies the authorisation process by requiring evidence of safe use in at least one country outside of the EU for a period of 25 years
- A notification is sent to the European Commission and then forwarded to all Member States and the EFSA
- Within four months of receiving the valid notification, a member State or the EFSA may submit safety objections to the notified traditional food entering the market

CHAPTER 6: CERTIFICATION REQUIRED FOR EXPORT OF CHILLIES, HERBS AND SPICES TO THE EU MARKET

- Food safety is a top priority in all European food sectors
- Besides the EU legislation requirements, most buyers request extra guarantees from the exporter in form of certification
- There are four categories of certification:

6.1 Voluntary certification requirements

- Food safety, environment, social and sustainability are high on the agenda of retailers
- In most cases voluntary industry standards are a minimum requirement
- However, several EU retailers require exporters to adhere to their internal standards which can exceed industry standards

6.2 Business-to-business (B2B) certification

All buyers in the supply chain, such as traders, food processors and retailers require implementation of a food safety management system based on hazard analysis and critical control points. Examples of such certification include:

6.2.1 GlobalGap certification

- It is the most commonly requested certification scheme, essential for exporting fresh produce to Europe
- It is considered a minimum requirement by importers, retailers and most European supermarkets
- Therefore, any producer and exporter should have GlobalGap certification
- GlobalGap is business-to-business pre-farmgate standard that covers the whole agricultural production process from before planting to the unprocessed product, including a chain of custody to enable full traceability
- GlobalGap focuses on food safety as well as the environment, labour conditions and product quality
- All products should be accompanied by a GGN number - This is a 13-digit number that uniquely identifies each producer and individual member of a producer group in the GLOBALGAP database (https://www.globalgap.org/uk_en/index.html)

6.2.2 Hazard analysis and critical control points (HACCP)

Buyers may ask for the implementation of a food safety management system based on hazard analysis and critical control points (HACCP). The objective of this preventive strategy is to guarantee the safety of food for consumers by preventing, eliminating and reducing food safety risk to an acceptable level of hazard of any kind. Although HACCP is not a certified standard, it serves as a reference for the definition of standards such as ISO 9000 on food safety management.

The objectives of the HACCP method are:

- i. To guarantee quality of the food marketed or served
- ii. To ensure safety of the consumer
- iii. To have a knowledge of the risks documented permanently and to control them based on certain procedures and preventive measures
- iv. Respect the regulations in force
- v. Avoiding food poisoning linked to the consumption of food contaminated by pathogenic micro-organisms

6.2.3 Food safety management systems

- In addition to GlobalGap, other food safety management systems may be required as well; for example, for the handling or processing of fresh fruits and vegetables
- Almost all buyers in the north-western European market (including the UK) require you to comply with the BRC Global Standards, which are widely applied as a standard for hygiene and food safety
- In Germany, the IFS food standard is common
- Alternative food safety management certification includes the Safe Quality Food (SQF) programme and FSSC 22000, an industry-standard developed by the International Organization for Standardization (ISO)
- All the mentioned management systems are recognised by the Global Food Safety Initiative (GFSI), implying that they are generally accepted by the major retailers
- Compliance with certification schemes varies between countries, trade channels and market situations
- Compliance with these standards will only become stricter and more widespread in the future

6.3 Social and environmental certification

- There is growing attention to the social and environmental conditions in the producing areas
- European buyers often have specific requirements, depending on their sales channels and product segments
- Most European buyers have a code of conduct, with which they expect producers and exporters to comply with
- Although product quality is the top priority, social and environmental compliance are becoming more and more important
- Initiatives in and attention to corporate social responsibility (CSR) vary across various parts of Europe
- In Eastern Europe, fewer buyers require strict social compliance, while in Western Europe, there are multinational buyers which have their own compliance programme
- Examples include Unilever's Sustainable Agriculture Code and Tesco's Nurture accreditation
- In some cases, the increasing attention to social and environmental conditions requires specific actions; for example, in water management in arid areas and in achieving 'living wages' in low income supply countries

- As an exporter you need to implement standards, especially when dealing with buyers that are linked to retail chains

6.3.1 Social business standards

The most common social or sustainable business standards for fresh fruits and vegetables include:

1. SMETA (Sedex Members Ethical Trade Audit), a social audit
2. GLOBALG.A.P., including add-ons such as GRASP for social compliance and SPRING for sustainable irrigation and groundwater use
3. Rainforest Alliance, a certification that supports climate-smart agriculture and help reduce climate impacts
4. ISO 26000, a standard for social responsibility and ISO 14001 for environmental management
5. Corporate Carbon Footprint of TÜV Rheinland
6. Fairtrade and environmental labels - These certification labels are consumer-focused and are the most applicable to products from smallholder farms and main fruit and vegetable categories. Well-known fairtrade and environmental labels include:
 - a. The BRC Global Standard – Provides technical standards for food safety, consumer protection and environmental protection.
 - b. International Featured Standards (IFS) - A safety standard for food processors and packers that corresponds to ISO 9001, but focuses on food safety, HACCP, hygiene, the manufacturing process and the company's environment.

6.3.2 Buyer initiatives for social compliance

Buyer initiatives which affect you as a supplier in terms of social compliance include:

- i. The IDH Sustainable Trade Initiative – This is a Sustainability Initiative for Fruits and Vegetables (SIFAV), a pan-European covenant with over 30 partners, including retailers, brands, traders and civil-society organisations. The 2025 strategy focuses on reducing the environmental footprint across the supply chain, improving working conditions, wages and incomes, and strengthening due diligence reporting and transparency.
- ii. Amfori BSCI (Business Social Compliance Initiative) in north-western Europe, which includes a Code of Conduct for all its participants, and amfori BEPI (Business Environmental Performance Initiative) for environmental performance.
- iii. Sedex, a non-profit membership organisation to evaluate and manage your performance on labour rights, health and safety, the environment and business ethics.
- iv. The Ethical Trading Initiative (ETI) in the UK.

Table 6.1 summarizes the requirements by common EU buyers for compliance with social and environmental standards; while Table 10 provides details of the major horticultural products certification bodies in Kenya.

Table 6. 1: Examples of certification requirements by common buyers in the European Union market for compliance with social and environmental standards

Name of certification	Type	Markets where certification is mostly required
GLOBALG.A.P.	Agricultural practices	- Europe in general in particular northern Europe - Supermarket segments
International Featured Standards (IFS)	Food Safety	- Germany - France - Also recognised in many other European markets
British Retail Consortium Global Standards (BRCGS)	Food Safety	- UK retail market - Also very common in mainland Europe
Sedex Members Ethical Trade Audit (SMETA)	Social audit focused on working conditions	- UK - Germany - Most of the European buyers recognise the SMETA audit as a valid assessment
Business Social Compliance Initiative (amfori BSCI)	Social audit focused on working conditions	- Germany - The Netherlands
Rainforest Alliance	Environmental	Large retail chains in northwest Europe
Fairtrade	Sustainability and ethics	- The United Kingdom - Germany - Benelux
Organic	Sustainability and environmental	- European Union - All European countries have their own national organic labels

Table 6. 2: Major horticultural products certification bodies in Kenya

	Company name	Email/Telephone	Web address
1	SGS Kenya Ltd	0709633000	https://www.sgs.co.ke/
2	AfriCert Limited	info@africert.co.ke	www.africert.co.ke
3	Bureau Veritas Kenya Ltd	cer.nairobi@ke.bureauveritas.co	https://www.bureauveritas.ke/
4	Naturland-Verband	naturland@naturland.de	https://www.naturland.de/en/
5	Soil Association Certification Ltd	goorganic@soilassociation.org	https://www.soilassociation.org/certification/
6	EnCert Ltd	info@encert.co.ke	http://www.encert.co.ke/

The listed certification bodies may be accredited for GlobalGAP and/or organic production.

6.4 Organic certification

- More and more consumers in Europe prefer organic fruits and vegetables because of their natural and sustainable production methods and their connection to a healthy diet
- In countries such as Italy, Ireland, France, Germany and Sweden, organic fruits and vegetables represent around a fifth of the total organic demand
- To market organic products in Europe, you have to use organic production methods according to European legislation
- In order to sell organic certified chillies, herbs and spices (and other fruits and vegetables), it is important to be aware that a commitment must be made to cultivate the crop organically
- Smallholders must demonstrate to inspectors of certification bodies that they used organic farming methods such as crop rotation and natural pesticides for at least two years
- All organic products imported into the EU must have the appropriate electronic certificate of inspection (e-COI)
- These certificates are managed through the Trade Control and Expert System (TRACES)
- Starting 2021, the new organic regulation (EU) 2018/848 entered into force together with the new Official Control Regulation
- Under this regulation, inspection of organic products will become stricter to prevent fraud
- Kenyan small holders are required to comply with the same set of rules as large scale farmers as well as those producing in the European Union
- To get certified as an organic farmer or exporter, you must be registered and certified through a recognised control body or accredited certifier
- This control body is responsible for verifying that you comply with the organic rules through an annual inspection and a set of checks

- After being audited by an accredited certifier, you can use the EU organic logo on your chillies, herbs and spices along with the logo of the standard holder
- European countries may prefer a national organic standard, which is in line with the EU certification but often exceeding its requirements
- National standards can be an addition when supplying specific markets, for example Naturland in Germany, KRAV in Sweden, BioSuisse in Switzerland



Figure 6. 1: The official organic label for organic products in Europe

Source: European Commission

6.5 The green deal

- In the coming years, the European Green Deal will influence how resources are used and greenhouse gas emissions are reduced
- The new EU policies on sustainability will prepare Europe in becoming the first climate-neutral continent by 2050
- The Farm to Fork Strategy is at the heart of the European Green Deal, aiming to make food systems fair, healthy and environmentally friendly
- It will ensure sustainable food production and address, for example, packaging and food waste
- EU trade agreements with several countries already include rules on trade and sustainable development
- For suppliers of fresh fruit and vegetables, it is important to look ahead of the increasing standards and try to be ahead of the developments

6.6 Soft skills and company performance

- Complying with the food safety requirements, quality standards and certifications is a pre-condition to market fresh products in Europe, but it is still not a guarantee for success
- Buyers look for trust and reliability and large retailers want to be unburdened
- This means that your soft skills and performance are just as important as your product and certifications
- Some of the most important aspects in the fresh trade are a timely delivery, proactive communication and commitment to agreements
- It is also crucial that you can deal professionally with claims, whether they are justified or not

6.7 Major causes of shipment interceptions in the European Union

The major causes of shipment interceptions in the EU include:

- i. Non-compliance with regulations
- ii. Presence of quarantine pests in consignment - Major threats to horticultural produce for exports include bollworms, leaf miner, white flies, fruit flies, thrips and spider mites
- iii. Pesticide residues above the acceptable limits in and/or on produce
- iv. Other quality considerations
- v. Inappropriate documentation

CHAPTER 7: GUIDELINES AND LOGISTICS FOR PACKAGING, LABELLING AND TRANSPORTATION OF CHILLIES, HERBS AND SPICES

7.1 Suppliers of food packaging material in Kenya

For export of chillies, herbs and spices to the European market, the type of packaging material must be in conformity with the *European Union quality standard (Standard EC 912/2001³¹)*. The produce is packaged in different containers based on the target market. The most common packaging is fibreboard boxes, perforated plastic bags or plastic prepacks. Packaging materials for export should be labelled with information such as the origin of the produce, name of producer(s) and category size. There are various suppliers of food grade packaging containers in Kenya as outlined in Table 7.1.

Table 7. 1: Examples of key suppliers of food grade packaging containers in Kenya (as at August 2022)

S/No	Company name	Web address
1	General Plastics Limited	https://www.genplastkenya.com/
2	Propak Kenya Limited	http://www.propack-kenya.com/
3	Nampak Kenya Limited	http://www.nampak.com/products/metals/kenya
4	Flexipac Limited	http://www.flexipac.co.ke/flexipac-kenya-limited/
5	Techpak Industries Limited	https://www.techpakindustries.com/
6	Statpack Industries	https://www.statpack.co.ke/
7	Platinum Packaging	https://www.ppl.co.ke/
8	Dune Packaging Limited	https://www.dunepackaging.com/
9	Packaging Industries Limited	https://www.pil.co.ke/
10	Thermopak Kenya	https://thermopakkenya.com/
11	Blowplast Limited	https://blowplastkenya.com/
12	East Africa Packaging Industries	https://eapi.co.ke/

7.2 Labelling for the export market

Each packaging for the export market must show the product characteristics by displaying the following information:

- Name of producer/exporter and address

31 <https://op.europa.eu/en/publication-detail/-/publication/6f424c13-aa8b-4e8d-8e16-ee2a16164a72/language-en>

- Name and variety of the produce (if the produce is not visible from the outside of the packaging)
- Product quantity
- Class and size (referring to the marketing standards)
- Country of origin
- Lot number for traceability or GGN if certified GLOBALG.A.P. (recommended)
- Official control mark to replace name and address of the packer (optional)
- Organic certification, including name of inspection body and certification number (if applicable)
- Recyclable symbols and the green dot where they apply

7.2.1 Labelling for the EU market

- Food placed on the EU market must meet the legislation on food labelling
- Trade packages and cartons of fresh fruits or vegetables must mention the following particulars:
 - i. Name and address of the packer or dispatcher
 - ii. Name and variety of the produce (if the produce is not visible from the outside of the packaging)
 - iii. Country of origin
 - iv. Class and size (referring to the marketing standards)
 - v. Lot number for traceability or GGN if certified GLOBALG.A.P. (recommended)
 - vi. Official control mark to replace name and address of the packer (optional)
 - vii. Organic certification, including name of inspection body and certification number (if applicable)

When chillies, herbs and spices are processed or directly packed for consumption, you must include appropriate labelling for consumers:

- i. Common name of the product
- ii. Full name of the country of origin
- iii. Name and address of the producer, packer, importer, brand owner or seller (retailer) in the EU who places the product on the market, and the wording “Packed for:”, if applicable
- iv. Net content in weight
- v. Minimum durability – a best-before date (on all processed fruits and vegetables)
- vi. Producer identification or lot number
- vii. List of ingredients (if applicable), including additives and post-harvest treatment
- viii. Allergenic declaration (if applicable)
- ix. Declaration of nutritional value (when mixed with other foodstuffs)
- x. Packed in protective atmosphere, if applicable

- The EU requires that the text on the label must be written in one of the official languages of an EU Member State and be understandable for the consumer
- Packaging marketed within Europe must comply with the general requirements and specific provisions
- These aim at protecting the environment and preventing any risk to the health of consumers
- The packaging must protect the product against contamination, leakage and dehydration
- Also pay attention to your buyer's preference for presentation, such as individual wrapping or sortation (for example, one side up)
- Products and packaging should be uniform

7.3 Transport logistics providers

There are several logistics companies in Kenya that would support transportation of chillies, herbs and spices to the desired destination. The leading global logistics companies in Kenya are outlined in Table 7.2; while other logistics companies can be assessed on <https://azfreight.com/country-facility/freight-forwarders-in-kenya/>.

The top 50 Global Third-Party Logistics Providers (as of September 2021) are listed in the website: <https://www.3plogistics.com/3pl-market-info-resources/3pl-market-information/aas-top-50-global-third-party-logistics-providers-3pls-list/> (Armstrong and Associates Inc).

Table 7. 2: Examples of global logistics companies in Kenya

S/No	Company name	Web address
1	Maersk Logistics	https://www.maersk.com/local-information/africa/kenya
2	Kuehne + Nagel	www.home.kuehne-nagel.com
3	Hapag-Lloyd Container Shipping	https://www.hapag-lloyd.com/en/
4	Jansen & Heuning Bulk Handling Systems	https://www.jh.nl/en/contact/
5	DB Schenker	https://www.dbschenker.com/ke-en



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EU-EAC MARKET ACCESS UPGRADE PROGRAMME



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