****

**REPUBLIC OF KENYA**

**COMPETENCY BASED MODULAR CURRICULUM**

**FOR**

**HORTICULTURE**

**KNQF LEVEL: 3**

**ISCED PROGRAMME CODE:** **0812 254 A**

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# FOREWORD

The provision of quality education and training is fundamental to the Government’s overall strategy for social and economic development. Quality education and training contribute to the achievement of Kenya’s development blueprint and sustainable development goals.

Reforms in the education sector are necessary to achieve Kenya Vision 2030 and meet the provisions of the Constitution of Kenya 2010. The education sector had to be aligned to the Constitution, and this resulted in the formulation of the Policy Framework for Reforming Education and Training in Kenya (Sessional Paper No. 14 of 2012). A key feature of this policy is the radical change in the design and delivery of TVET training. This policy document requires that training in TVET be competency-based, curriculum development be industry-led, certification be based on demonstration of competence, and the mode of delivery allow for multiple entry and exit in TVET programmes.

These reforms demand that Industry takes a leading role in curriculum development to ensure the curriculum addresses its competence needs. It is against this background that this curriculum has been developed. For trainees to build their skills on foundational hands-on activities of the occupation, units of learning are grouped in modules. This has eliminated duplication of content and streamlined exemptions based on skills acquired as a trainee progresses in the up-skilling process, while at the same time allowing trainees to be employable in the shortest time possible through the acquisition of part qualifications.

It is my conviction that this curriculum will play a great role in developing competent human resources for the Horticulture Sector’s growth and development.

**PRINCIPAL SECRETARY**

**STATE DEPARTMENT FOR TVET**

**MINISTRY OF EDUCATION**

# PREFACE

Kenya Vision 2030 aims to transform Kenya into a newly industrializing middle-income country, providing high-quality life to all its citizens by the year 2030. Kenya intends to create globally competitive and adaptive human resource base to meet the requirements of a rapidly industrializing economy through lifelong education and training. TVET has a responsibility to facilitate the process of inculcating knowledge, skills, and worker behaviour necessary for catapulting the nation to a globally competitive country, hence the paradigm shift to embrace Competency-Based Education and Training (CBET).

TVET Act, CAP 210A and Sessional Paper No. 1 of 2019 on Reforming Education and Training in Kenya for Sustainable Development emphasized the need to reform curriculum development, assessment, and certification. This called for a shift to CBET to address the mismatch between skills acquired through training and skills needed by industry, as well as increase the global competitiveness of the Kenyan labour force.

This curriculum has been developed in adherence to the Kenya National Qualifications Framework and CBETA standards and guidelines. The curriculum is designed and organized into Units of Learning with Learning Outcomes, suggested delivery methods, learning resources, and methods of assessing the trainee’s achievement. In addition, the units of learning have been grouped in modules to concretize the skills acquisition process and streamline upskilling.

I am grateful to all expert trainers and everyone who played a role in translating the Occupational Standards into this competency-based modular curriculum.

# ACKNOWLEDGMENT

This curriculum has been designed for competency-based training and has independent units of learning that allow the trainee flexibility in entry and exit. In developing the curriculum, significant involvement and support were received from expert trainers, institutions and organizations.

I recognize with appreciation the role of the Agriculture National Sector Skills Committee (NSSC) in ensuring that competencies required by the industry are addressed in the curriculum. I also thank all stakeholders in the Agriculture sector for their valuable input and everyone who participated in developing this curriculum.

I am convinced that this curriculum will go a long way in ensuring that individuals aspiring to work in the Agriculture Sector acquire competencies to perform their work more efficiently and effectively.

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# ABBREVIATIONS AND ACRONYMS

ATVET Agricultural Technical and Vocational Education and Training

CAADP Comprehensive Africa Agricultural Development Programme

CBET Competency Based Education and Training

CDACC Curriculum Development Assessment and Certification Council

CU Curriculum

DACUM Develop a Curriculum

DANIDA Danish International Development Agency

EMCA Environmental Management and Conservation Act

GAP Good Agricultural Practices

GDP Gross Domestic Product

GMOs Genetically Modified Organisms

HCDA Horticultural Crops Development Authority

HCP Horticultural Crop Production

HNO Horticultural Nursery Operator

IDM Integrated Disease Management

IPM Integrated Pest Management

IWM Integrated Weed Management

KCSE Kenya Certificate of Secondary Education

KNQA Kenya National Qualifications Authority

SMoALF Ministry of Agriculture Livestock and Fisheries

MoEST Ministry of Education Science and Technology

NGO Non-Governmental Organization

NOS National Occupation Standard

OS Occupational Standard

OSHA Occupation Safety and Health Act

PPE Personal Protective Equipment

RPL Recognition of Prior Learning

SSAC Sector Skills Advisory Committee

TC Tissue Culture

TVETA Technical and Vocational Education and Training Authority

**KEY TO ISCED UNIT CODE**



# COURSE OVERVIEW

Horticulture Level 3 qualification consists of competencies that an individual must have to carry out production of horticultural produce. It involves producing selected vegetable crops, producing selected herbs and spices and producing selected fruit crops.

The units of learning comprising Horticulture Level 3 qualification include the following basic and core units:

**Core Units of Learning**

|  |  |  |  |
| --- | --- | --- | --- |
| **Unit Code** | **Unit Title** | **Duration in Hours** | **Credit Factor** |
| 0812 251 01A | Production of Vegetable Crops in open environment | 80 | 8 |
|  | Production of Vegetable Crops in protected environment | 80 | 8 |
| 0812 251 02A | Production of Herbs and Spices in open environment | 60 | 6 |
| 0812 251 03A | Production of Herbs and spices in protected environment | 60 | 6 |
| Industry training | | 240 | 24 |
| **Grand total** | | **520** | **52** |

**Entry Requirements**

An individual entering this course should have any of the following minimum requirements:

1. Attained Kenya Certificate of Primary Education (KCPE) certificate

**Or**

1. KNQF level 1 equivalent qualification as determined by relevant regulatory body

**Trainer qualifications**

Qualifications of a trainer for Horticulture level 3 include:

1. Possession of a higher qualification than Horticulture level 4 or in related trade area; and
2. License by TVETA.

**Credit Accumulation, Transfer, and Exemptions**

………… (QAI) Guidelines on credit accumulation and transfer shall apply.

**Industry Training**

An individual enrolled in this course will be required to undergo Industrial attachment for a minimum period of 240 hours in a Horticulture farm. The trainee is expected to apportion time in vegetable farm, and herbs and spices farm both in open and protected environment set ups. for those takin full qualification. The industrial training will distributed equally in each unit for those pursuing partial qualification. In the case of dual training model, industrial training shall be as guided by the dual training policy.

**Assessment**

The course shall be assessed formatively and summatively:

1. During formative assessment all performance criteria shall be assessed based on performance criteria weighting.
2. Number of formative assessments shall minimally be equal to the number of elements in a unit of competency
3. Assessment of basic and common competencies shall be integrated in the core units
4. Theoretical assessment shall be integrated in practical assessment and conducted orally in both formative and summative assessments.
5. Theoretical and practical weight shall be 10:90 respectively for each unit of learning.
6. Formative and summative assessments shall be weighted at 60% and 40% respectively in the overall unit of learning score
7. Assessment performance rating for each unit of competency shall be as follows:

|  |  |
| --- | --- |
| **MARKS** | **COMPETENCE RATING** |
| 80 -100 | Attained Mastery |
| 65 - 79 | Proficient |
| 50 - 64 | Competent |
| 49 and below | Not Yet Competent |
| Y | Assessment Malpractice/irregularities |

1. Assessment for Recognition of Prior Learning (RPL) may lead to award of part and/or full qualification.

**Certification**

A candidate will be issued with a Certificate of Competency upon demonstration of competence in a Unit of Competency. To be issued with the Kenya National TVET Certificate in Horticulture Level 3, the candidate must demonstrate competence in all the Units of Competency as given in the qualification pack. Statement of Attainment certificate may be awarded upon demonstration of competence in certifiable element within a unit.

These certificates will be issued by Qualification Awarding Institution.

# PRODUCTION OF VEGETABLE CROPS IN OPEN ENVIRONMENT

**ISCED UNIT CODE:** 0812 251 01A

**Relationship to Occupational Standards**

This unit addresses the Unit of Competency: Produce Vegetable Crops in open environment

**Duration of Unit:**  80 Hours

**Unit Description**

This unit specifies the competencies required to produce vegetable crops. It involves propagating vegetable crop seedlings, preparing land for vegetable crop, growing vegetable crop, harvesting vegetable crop, undertaking post-harvest activities and undertaking marketing activities.

**NOTE: The trainer to choose at least one vegetable in each category in the range for propagation. The choice should be based on ecological zone, interest of trainees and market demands.**

**Summary of Learning Outcomes**

|  |  |  |
| --- | --- | --- |
| **SNO** | **Learning Outcome** | **Duration (hours)** |
|  | Propagate vegetable crop seedlings | 15 |
|  | Prepare land for growing vegetable crop | 15 |
|  | Grow vegetable crop | 15 |
|  | Harvest vegetable crop | 10 |
|  | Undertake post-harvest activities | 15 |
|  | Undertake marketing activities | 10 |

**Learning Outcomes, Content, and Suggested Assessment Methods**

| **Learning Outcome** | **Content** | **Suggested**  **Assessment Methods** |
| --- | --- | --- |
| 1. Propagate vegetable crop seedlings in open environment | 1. Definition of horticulture 2. Types of horticultural crops 3. Vegetables 4. Fruits 5. Herbs and spices 6. Cut Flowers 7. Ornamental plants 8. Mushrooms 9. Nuts 10. Procedures for occupational safety and health. 11. Market survey on suitable crop 12. Consumer preferences 13. Maturity period 14. Ecological requirements 15. Resistant to pests and diseases. 16. Sources of finances 17. Vegetable crop business plan 18. Planting materials 19. Types 20. Sources 21. Preparation 22. Uses of the vegetable crops 23. Basic plant anatomy 24. Classification of vegetable crops 25. Leaf vegetables  * Kales * Cabbage * Black nightshade (Managu)  1. Fruit vegetables  * Tomatoes * Capsicum * Cucumber  1. Root and Tuber  * Onions * Carrots * Garlic  1. Tools, equipment, supplies and materials 2. Identification 3. Sourcing 4. Use 5. Maintenance 6. Storage 7. Types of Nurseries 8. Sunken beds 9. Raised Beds 10. Flat beds 11. Factors to be considered for site selection for nurseries.  * Nursery bed preparation  1. Propagating of the planting materials 2. Nursery Management practices 3. Weeding 4. Mulching 5. Watering/ Irrigation – Types of irrigation 6. Shading 7. Pricking out 8. Pest and diseases control 9. Hardening off 10. Procedures for occupational safety and health. 11. Record Keeping 12. Waste management practices  * 3Rs of waste disposal | * + Observation   + Oral assessment   + Portfolio of evidence   + Third party report   + Written assessment   + Project   + Practical |
| 1. Prepare land for growing vegetable crop | 1. Procedures for occupational safety and health 2. Tools, equipment, supplies and materials 3. Identification 4. Sourcing 5. Use 6. Maintenance 7. Storage 8. Soil management 9. Soil and water conservation measures 10. Land preparation 11. Clearing 12. Primary tillage 13. Secondary tillage 14. Tertiary operations 15. Soil amendments  * Manure application * Liming * Gypsum * Fertilizer application  1. Record keeping 2. Wastes management practices | * Observation * Oral assessment * Portfolio of evidence * Third party report * Written assessment * Practical |
| 1. Grow vegetable crop | 1. Procedures for occupational safety and health 2. Tools, equipment, supplies and materials 3. Identification 4. Sourcing 5. Use 6. Maintenance 7. Storage 8. Planting/transplanting procedure 9. Field agronomic practices 10. Spacing 11. Watering/ Irrigation 12. Gapping 13. Thinning 14. Mulching 15. Pruning 16. Training 17. Crop rotation 18. Intercropping 19. Weeding 20. Importance of weeding 21. Methods of weeding.  * Biological method * Mechanical method * Cultural method * Chemical method  1. Crop protection 2. Types of pests and diseases 3. Methods of controlling pests and diseases 4. Integrated Pest and diseases Management 5. Efficient use of crop protection products 6. Crop nutrition 7. Types of fertilizers 8. Method of fertilizer application 9. Efficient use of fertilizer 10. Food safety measures 11. Record keeping 12. Wastes management practices 13. 3Rs of waste disposal | * Observation * Oral assessment * Portfolio of evidence * Third party report * Written assessment * Practical * Projects |
| 1. Harvest vegetable crop | 1. Procedures for occupational safety and health 2. Tools, equipment, supplies and materials 3. Identification 4. Sourcing 5. Use 6. Maintenance 7. Storage 8. Maturity indices 9. Horticultural maturity 10. Physiological maturity 11. Methods of harvesting 12. Pinching 13. Uprooting 14. Cutting 15. Food safety measures 16. Record keeping 17. Wastes management practice 18. Rs of waste disposal | * Observation * Oral assessment * Portfolio of evidence * Third party report * Written assessment * Practical |
| 1. Undertake post-harvest activities | 1. Procedures for occupational safety and health 2. Tools, equipment, supplies and materials 3. Identification 4. Sourcing 5. Use 6. Maintenance 7. Storage 8. Post-harvest handling practices 9. Weighing 10. Cleaning 11. Sorting 12. Grading 13. Packaging 14. Storage 15. Waxing 16. Food safety measures 17. Record keeping 18. Wastes management practice 19. 3Rs of waste disposal 20. Emerging trends- 21. Automated grading 22. Packaging innovations | * Observation * Oral assessment * Portfolio of evidence * Third party report * Written assessment * Practical |
| 1. Undertake marketing activities | 1. Market survey techniques 2. Channels/medium/mode of marketing produce 3. Pricing techniques 4. Customer value-based pricing 5. Cost – based pricing 6. Competition based pricing 7. New- product pricing 8. The 4Ps in marketing 9. Product 10. Place 11. Price 12. Promotion 13. Basic value addition 14. Record keeping 15. Wastes management practice 16. 3Rs of waste disposal 17. Emerging trends 18. e – marketing | * Observation * Oral assessment * Portfolio of evidence * Third party report * Written assessment |

**Suggested Methods of Instruction**

* + Instructor-led facilitation
  + Demonstration by trainer
  + Practical work by trainees
  + Group discussions
  + Presentations
  + Projects
  + Case studies
  + Problem based learning
  + Experiential learning
  + Question and answer
  + Team training
  + Team learning
  + E-learning
  + Academic trips

**Recommended Resources for 25 Trainees**

| **S/No.** | **Category/Item** | **Description/ Specifications** | **Quantity** | **Recommended Ratio**  (Item: Trainee) |
| --- | --- | --- | --- | --- |
| **A** | **Learning Materials** |  |  |  |
|  | GAP guidelines manuals |  | 5 pcs | 1:5 |
|  | MoALF Vegetable production manual |  | 5 pcs | 1:5 |
| **B** | **Learning Facilities & infrastructure** |  |  |  |
|  | Lecture/theory room | 40 M2 | 1 | 1:25 |
|  | Tools and Equipment storage facility |  | 1 | 1:25 |
|  | Chemical and fertilizer storage facility |  | 1 | 1:25 |
|  | Agricultural Land | One Acre | 1 | 1:25 |
| **C** | **Consumable materials** |  |  |  |
|  | Manure | Wheelbarrows/tins of farm yard manure | 2 | 2:25 |
|  | Fertilizers | Planting  2 top dressing | 3 bags of 50kg | 3:25 |
|  | Planting materials | Seeds, seedling, vegetative material | 1kg of seeds/acre | 1:25 |
|  | Mulching materials | Organic and inorganic of 30microns | 20 bales of organic mulch  4rolls of inorganic mulch | 20:25  4:25 |
|  | Khaki paper bags and stickers | 0.5kg bag | 4 packets of khaki bag and 200 stickers | 4:25 |
|  | Seedling trays | 66 cells tray | 50 trays | 2:25 |
|  | Layout string | Sisal twine | 2 rolls | 2:25 |
|  | Twining string | Nylon | 5 rolls | 5:25 |
|  | Binding wire | Staking binding wire | 50kg | 50:25 |
|  | Stationery | Assorted | 1 rim of printing papers  1 packet of pens  1packet of maker pens | 1:25 |
|  | Staking sticks | Wooden sticks 1.5m long | 250 sticks | 10:1 |
|  | Nails | 3 inches and 4 inches | 2kgs | 1:25 |
|  | Pesticides | Herbicides Insecticides Nematicides Fungicides | 1Litre of each | 1:25 |
|  | Rooting hormones | Powder | 200grams | 1:25 |
|  | Pheromones+traps | 2pheromones  Tuta absoluta and fruit fly | 50 pieces | 2:1 |
|  | Scouting flags | 3 fabric ribbon-Red, yellow, green | 75 | 3:1 |
|  | Pest control traps | Sticky traps | 2 | 2:1 |
|  | Personal protective Equipment (PPEs) | Set-(overall, gloves, respirator, gumboot, goggles)  Spray suit | 25  5 | 1:1  1:5 |
|  | Packaging materials | Assorted-3 different packaging materials | 1 | 3:1 |
| **D** | **Tools and Equipment** |  |  |  |
|  | Hoes/jembe |  | 25 pcs | 1:1 |
|  | Panga |  | 10 pcs | 1:3 |
|  | Slasher |  | 10 pcs | 1:3 |
|  | Secateurs |  | 15 pcs | 1:2 |
|  | Spade |  | 15 pcs | 1:2 |
|  | Soil augur |  | 5 pcs | 1:5 |
|  | Pegs |  | 100 pcs | 4:1 |
|  | Hammer |  | 15 pcs | 1:2 |
|  | Saw |  | 15 pcs | 1:2 |
|  | Bucket |  | 15 pcs | 1:2 |
|  | Dibbler |  | 15 pcs | 1:2 |
|  | Garden trowel |  | 15 pcs | 1:2 |
|  | Measuring tape |  | 10 pcs | 1:3 |
|  | Knapsacks sprayers |  | 5 pcs | 1:5 |
|  | Irrigation equipment | A complete set of irrigation system | 1 set | 1:1 |
|  | Storage tanks | 3, 000 litres capacity | 1 | 1:1 |
|  | Watering can | 5litre can-plastic/metalic | 5 pcs | 1:5 |

# PRODUCTION OF VEGETABLE CROPS IN PROTECTED ENVIRONMENT

**ISCED UNIT CODE:** 0812 251 02A

**Relationship to Occupational Standards**

This unit addresses the Unit of Competency: Produce Vegetable Crops in protected environment

**Duration of Unit:** 80 Hours

**Unit Description**

This unit specifies the competencies required to produce vegetable crops in protected environment. It involves setting up protected environment, establishing vegetable crop in protected environment, harvesting vegetable crop, undertaking post-harvest activities, undertaking value addition processes and undertaking marketing activities.

***NOTE: The trainer to choose at least one vegetable in each category in the range. The choice should be based on market demand and interest of trainee.***

**Summary of Learning Outcomes**

|  |  |  |
| --- | --- | --- |
| **SNO** | **Learning Outcome** | **Duration (Hours)** |
|  | Set up protected environment | 15 |
|  | Establish Vegetable Crop | 15 |
|  | Harvest Vegetable Crop | 15 |
|  | Undertake Post Harvest Activities | 10 |
|  | Undertake Value Addition Processes | 15 |
|  | Undertake Marketing Activities | 10 |

**Learning Outcomes, Content, and Suggested Assessment Methods**

| **Learning Outcome** | **Content** | **Suggested**  **Assessment Methods** |
| --- | --- | --- |
| 1. Set up protected environment | 1. Production structures    1. Greenhouse    2. Shed nets 2. Procedures for occupational safety and health. 3. Planting materials 4. Types 5. Sources 6. Preparation 7. Tools, equipment, supplies and materials 8. Identification 9. Sourcing 10. Use 11. Maintenance 12. Storage 13. Types of propagation media 14. Soil 15. Soilless media 16. Peatmoss 17. Cocopeat 18. Vermiculite 19. Rock wool 20. Propagating media preparation 21. Potting the media 22. Sowing the seeds 23. Types of seedlings trays 24. Nursery Management practices     1. Weeding     2. Watering/ Irrigation – Types of irrigation     3. Pricking out     4. Pest and diseases control     5. Hardening off 25. Record keeping 26. Waste management practices     * 3Rs of waste disposal 27. Emerging trends     * Automated sowing machine | * + Observation   + Oral assessment   + Portfolio of evidence   + Third party report   + Written assessment   + Practical |
| 1. Establish Vegetable Crop | 1. Procedures for occupational safety and health 2. Tools, equipment, supplies and materials 3. Identification 4. Sourcing 5. Use 6. Maintenance 7. Storage 8. Food safety measures 9. Planting/transplanting procedure 10. Protected environment crop agronomic practices     1. Spacing     2. Gapping     3. Watering/Irrigation     4. Thinning     5. Weeding     6. Pruning     7. Trellising     8. Intercropping     9. Crop rotation 11. Structure management practices 12. Crop protection     1. Types of pests and diseases     2. Methods of controlling pests and diseases     3. Integrated Pest and Diseases Management     4. Efficient use of crop protection products 13. Crop nutrition     1. Types of fertilizers     2. Method of fertilizer application     3. Fertigation 14. Record keeping 15. Wastes management practices 16. 3Rs of waste disposal 17. Emerging trends     1. Technologies for pests and diseases control     2. Automated Climate control and fertigation systems | 1. Observation 2. Oral assessment 3. Portfolio of evidence 4. Third party report 5. Written assessment 6. Project |
| 1. Harvest Vegetable Crop | 1. Procedures for occupational safety and health 2. Tools, equipment, supplies and materials 3. Identification 4. Sourcing 5. Use 6. Maintenance 7. Storage 8. Maturity indices 9. Horticultural maturity 10. Physiological maturity 11. Methods of harvesting 12. Pinching 13. Uprooting 14. Cutting 15. Food safety measures 16. Record keeping 17. Wastes management practice 18. 3Rs of waste disposal 19. Emerging trends: 20. Use of A.I 21. Technologies for harvesting | * + Observation   + Oral assessment   + Portfolio of evidence   + Third party report   + Written assessment   + Practical |
| 1. Post Harvest Activities | 1. Procedures for occupational safety and health 2. Measures for food safety 3. Tools, equipment, supplies and materials 4. Identification 5. Sourcing 6. Use 7. Maintenance 8. Storage 9. Post harvest handling practices 10. Weighing 11. Cleaning 12. Sorting 13. Grading 14. Packaging 15. Storage 16. Record keeping 17. Wastes management practice  * 3Rs of waste disposal  1. Emerging trends- 2. Technologies for packaging 3. Technologies for grading 4. Technologies for cleaning | * + Observation   + Oral assessment   + Portfolio of evidence   + Third party report   + Written assessment  1. Practical |
| 1. Undertake Value Addition Processes | 1. Procedures for occupational safety and health 2. Tools, equipment, supplies and materials 3. Identification 4. Sourcing 5. Use 6. Maintenance 7. Storage 8. Meaning of value addition 9. Importance of value addition 10. Value addition techniques and methods 11. Drying 12. Blanching 13. Canning 14. Freezing 15. Waxing 16. Basic Products processing-blending 17. Record keeping 18. Wastes management practice  * 3Rs of waste disposal  1. Emerging trends  * Solar dehydrators | * + Observation   + Oral assessment   + Portfolio of evidence   + Third party report   + Written assessment   + Practical |
| 1. Undertake Marketing Activities | 1. Market survey techniques 2. Pricing techniques 3. Customer value-based pricing 4. Cost – based pricing 5. Competition based pricing 6. New- product pricing 7. The 4Ps in marketing 8. Product 9. Place 10. Price 11. Promotion 12. Wastes management practice  * 3Rs of waste disposal  1. Record keeping 2. Emerging trends  * e – marketing | * + Observation   + Oral assessment   + Portfolio of evidence   + Third party report   + Written assessment |

**Suggested Methods of Instruction**

* + Instructor-led facilitation
  + Demonstration by trainer
  + Practical work by trainees
  + Group discussions
  + Presentations
  + Projects
  + Case studies
  + Problem based learning
  + Experiential learning
  + Question and answer
  + Team training
  + Team learning
  + E-learning
  + Academic trips

**Recommended Resources for 25 Trainees**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **S/No.** | **Category/Item** | **Description/ Specifications** | **Quantity** | **Recommended Ratio**  (Item: Trainee) |
| **A** | **Learning Materials** |  |  |  |
|  | GAP guidelines manuals |  | 5 pcs | 1:5 |
|  | MoALF Vegetable production manual |  | 5 pcs | 1:5 |
|  | Fruit Production handbook Manual |  | 5 pcs | 1:5 |
|  | KALRO training manuals |  | 5 pcs | 1:5 |
| **B** | **Learning Facilities & infrastructure** |  |  |  |
|  | Lecture/theory room | 40 M2 | 1 | 1:25 |
|  | Tools and Equipment storage facility |  | 1 | 1:25 |
|  | Chemical and fertilizer storage facility |  | 1 | 1:25 |
|  | Greenhouse |  | 2 | 2:25 |
|  | Shade nets |  | 5 | 1:5 |
| **C** | **Consumable materials** |  |  |  |
|  | Manure | Tonnes of farm yard manure | 2 tonnes | 1:13 |
|  | Soilless medium | Assorted |  |  |
|  | Fertilizers | Planting  2 top dressing | 3 bags of 50kg | 3:25 |
|  | Planting materials | Seeds, seedling, vegetative material | 1kg of seeds/acre | 1:25 |
|  | Mulching materials | Organic and inorganic of 30microns | 20 bales of organic mulch  4rolls of inorganic mulch | 4:5  4:25 |
|  | Khaki paper bags and stickers | 0.5kg bag | 4 packets of khaki bag and 200 stickers | 4:25 |
|  | Seedling trays | 66 cells tray | 50 trays | 2:25 |
|  | Layout string | Sisal twine | 2 rolls | 2:25 |
|  | Twining string | Nylon | 5 rolls | 1:5 |
|  | Binding wire | Staking binding wire | 50kg | 2:1 |
|  | Stationery | Assorted | 1 rim of printing papers  1 packet of pens  1packet of maker pens | 1:25 |
|  | Staking sticks | Wooden sticks 1.5m long | 250 sticks | 10:1 |
|  | Nails | 3’’ and 4’’ nails | 1 each | 1:25 |
|  | Pesticides | Herbicides Insecticides Nematicides Fungicides | 1Litre of each | 1:25 |
|  | Rooting hormones | Powder | 200grams | 1:25 |
|  | Pheromones + traps | 2pheromones  Tuta absoluta and fruit fly | 50 pieces | 2:1 |
|  | Scouting flags | 3 fabric ribbon-Red, yellow, green | 75 | 3:1 |
|  | Pest control traps | Sticky traps | 2 | 2:1 |
|  | Personal protective Equipment (PPEs) | Set-(overall, gloves, respirator, gumboot, goggles)  Spray suit | 25  5 | 1:1  1:5 |
|  | Packaging materials | Assorted-3 different packaging materials | 1 | 3:1 |
| **D** | **Tools and Equipment** |  |  |  |
|  | Hoes/jembe |  | 25 pcs | 1:1 |
|  | Panga |  | 10 pcs | 1:3 |
|  | Slasher |  | 10 pcs | 1:3 |
|  | Secateurs |  | 15 pcs | 1:2 |
|  | Spade |  | 15 pcs | 1:2 |
|  | Soil augur |  | 5 pcs | 1:5 |
|  | Pegs |  | 100 pcs | 4:1 |
|  | Hammer |  | 15 pcs | 1:2 |
|  | Saw |  | 15 pcs | 1:2 |
|  | Bucket |  | 15 pcs | 1:2 |
|  | Dibbler |  | 15 pcs | 1:2 |
|  | Garden trowel |  | 15 pcs | 1:2 |
|  | Measuring tape |  | 10 pcs | 1:3 |
|  | Knapsacks sprayers |  | 5 pcs | 1:5 |
|  | Irrigation equipment | A complete set of irrigation system | 1 set | 1:1 |
|  | Storage tanks | 3, 000 litres capacity | 1 | 1:1 |
|  | Watering can | 5litre can-plastic/metalic | 5 pcs | 1:5 |

# HERBS AND SPICES PRODUCTION IN OPEN ENVIRONMENT

**ISCED UNIT CODE:** 0812 251 03A

**Relationship to Occupational Standards**

This unit addresses the Unit of Competency: Produce Herbs and spices

**Duration of Unit:**  60 Hours

**Unit Description**

This unit specifies the competencies required to produce Herbs and Spices in an open environment. It involves propagating herbs and spices seedlings, preparing land for herbs and spices, growing herbs and spices, harvesting herbs and spices, undertaking post-harvest activities and undertaking marketing activities.

***NOTE: The trainer to choose coriander and any other two in the range. Consider ecological requirements, choice of trainees, market demands. Visit to herbs and spices farm is recommended.***

**Summary of Learning Outcomes**

|  |  |  |
| --- | --- | --- |
| **SNO** | **Learning Outcome** | **Duration** |
|  | Propagate herbs and spices seedlings | 15 |
|  | Prepare land for growing herbs and spices | 10 |
|  | Grow herbs and spices | 10 |
|  | Harvest herbs and spices | 5 |
|  | Undertake post- harvest activities | 10 |
|  | Undertake marketing activities | 10 |

**Learning Outcomes, Content, and Suggested Assessment Methods**

| **Learning Outcome** | **Content** | **Suggested**  **Assessment Methods** |
| --- | --- | --- |
| 1. Propagate herbs and spices seedlings | 1. Procedures for occupational safety and health. 2. Market survey on suitable herbs and spices    * Consumer preferences    * Maturity period    * Ecological requirements    * Resistant to pests and diseases. 3. Planting materials    * Types    * Sources    * Preparation 4. Uses of the herbs and spices 5. Basic plant anatomy 6. Classification of herbs and spices    * Annual    * Perennial    * Biennial 7. Tools, equipment, supplies and materials    * Identification    * Sourcing    * Use    * Maintenance    * Storage 8. Soil and water conservation measures 9. Soil sterilization 10. Soil erosion control measures 11. Types of Nurseries     * Sunken beds     * Raised Beds     * Flat beds 12. Factors to be considered for site selection for nurseries. 13. Nursery bed preparation 14. Propagation materials     * Seeds     * Cuttings     * Rhizomes     * Root Tubers.     * Splits 15. Nursery Management practices     * Weeding     * Mulching     * Watering/ Irrigation – Types of irrigation     * Shading     * Pricking out     * Pest and diseases control     * Hardening off 16. Record keeping 17. Waste management practices     * 3Rs of waste disposal 18. Emerging trends- Automated sowing machines | * + Observation   + Oral assessment   + Portfolio of evidence   + Third party report   + Written assessment   + Project   + Practical |
| 1. Prepare land for growing herbs and spices | 1. Procedures for occupational safety and health 2. Tools, equipment, supplies and materials  * Identification * Sourcing * Use * Maintenance * Storage  1. Soil testing 2. Soil conservation measures  * Mulching * Contour farming * Planting cover crops * Gabion construction * Terraces  1. Land preparation  * Land Clearing * Primary tillage * Secondary tillage * Tertiary operations  1. Soil amendments  * Manure application * Liming * Gypsum * Fertilizer application  1. Seedbed preparation 2. Wastes management practices  * 3Rs of waste disposal | * Observation * Oral assessment * Portfolio of evidence * Third party report * Written assessment * Practical |
| 1. Grow herbs and spices | 1. Procedures for occupational safety and health 2. Tools, equipment, supplies and materials  * Identification * Sourcing * Use * Maintenance * Storage  1. Planting/transplanting procedure 2. Food safety measures 3. Field Agronomic practices  * Spacing * Watering/ Irrigation * Gapping * Thinning * Mulching * Pruning * Training * Crop rotation * Intercropping  1. Weeding  * Importance of weeding * Methods of weeding. * Biological method * Mechanical method * Cultural method * Chemical method  1. Crop protection  * Types of pests and diseases * Methods of controlling pests and diseases * Integrated Pest and diseases Management * Efficient use of the crop protection products  1. Crop nutrition  * Types of fertilizers * Method of fertilizer application * Efficient use of fertilizer  1. Record keeping 2. Waste management practices  * 3Rs of waste disposal  1. Emerging trends  * Technologies for pests and diseases control | * Observation * Oral assessment * Portfolio of evidence * Third party report * Written assessment * Practical * Projects |
| 1. Harvest herbs and spices | 1. Procedures for occupational safety and health 2. Tools, equipment, supplies and materials  * Identification * Sourcing * Use * Maintenance * Storage  1. Maturity indices  * Horticultural maturity * Physiological maturity  1. Methods of harvesting  * Pinching * Uprooting * Cutting  1. Food safety measures 2. Record keeping 3. Waste management practices  * 3Rs of waste disposal  1. Emerging trends  * Precision harvesting * Blockchain and traceability | * Observation * Oral assessment * Portfolio of evidence * Third party report * Written assessment * Practical |
| 1. Undertake post-harvest activities | 1. Procedures for occupational safety and health 2. Tools, equipment, supplies and materials  * Identification * Sourcing * Use * Maintenance * Storage  1. Post-harvest handling practices  * Weighing * Cleaning * Sorting * Grading * Packaging * Storage * Waxing  1. Food safety measures 2. Record keeping 3. Waste management practices  * 3Rs of waste disposal  1. Emerging trends-  * Automated grading * Packaging innovations | * Observation * Oral assessment * Portfolio of evidence * Third party report * Written assessment * Practical |
| 1. Undertake marketing activities | 1. Market survey techniques 2. Channels/medium/mode of marketing produce 3. Pricing techniques  * Customer value-based pricing * Cost – based pricing * Competition based pricing * New- product pricing  1. The 4Ps in marketing  * Product * Place * Price * Promotion  1. Record keeping (manual and electronic records) 2. Wastes management practice 3. 3Rs of waste disposal 4. Emerging trends 5. e – marketing 6. Functional and health boosting products 7. Product certification | * Observation * Oral assessment * Portfolio of evidence * Third party report * Written assessment |

**Suggested Methods of Instruction**

* + Instructor-led facilitation
  + Demonstration by trainer
  + Practical work by trainees
  + Group discussions
  + Presentations
  + Projects
  + Case studies
  + Problem based learning
  + Experiential learning
  + Question and answer
  + Team training
  + Team learning
  + E-learning
  + Academic trips

**Recommended Resources for 25 Trainees**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **S/No.** | **Category/Item** | **Description/ Specifications** | **Quantity** | **Recommended Ratio**  (Item: Trainee) |
| **A** | **Learning Materials** |  |  |  |
|  | GAP guidelines manuals |  | 5 pcs | 1:5 |
|  | MoALF herbs and spices production manual |  | 5 pcs | 1:5 |
|  | KALRO training manuals |  | 5 pcs | 1:5 |
| **B** | **Learning Facilities & infrastructure** |  |  |  |
|  | Lecture/theory room | 40 M2 | 1 | 1:25 |
|  | Tools and Equipment storage facility |  | 1 | 1:25 |
|  | Chemical and fertilizer storage facility |  | 1 | 1:25 |
|  | Agricultural Land | One Acre | 1 | 1:25 |
| **C** | **Consumable materials** |  |  |  |
|  | Manure | Tonnes of farm yard manure | 2 | 2:25 |
|  | Fertilizers | Planting  2 top dressing | 3 bags of 50kg | 3:25 |
|  | Planting materials | Seeds, seedling, vegetative material | 1kg of seeds/acre | 1:25 |
|  | Mulching materials | Organic and inorganic of 30microns | 20 bales of organic mulch  4rolls of inorganic mulch | 20:25  4:25 |
|  | Khaki paper bags and stickers | 0.5kg bag | 4 packets of khaki bag and 200 stickers | 4:25 |
|  | Seedling trays | 66 cells tray | 50 trays | 2:25 |
|  | Layout string | Sisal twine | 2 rolls | 2:25 |
|  | Stationery | Assorted | 1 rim of printing papers  1 packet of pens  1packet of maker pens | 1:25 |
|  | Nails | 3 inches and 4 inches | 2kgs | 1:25 |
|  | Pesticides | Herbicides Insecticides Nematicides Fungicides | 1Litre of each | 1:25 |
|  | Rooting hormones | Powder | 200grams | 1:25 |
|  | Scouting flags | 3 fabric ribbon-Red, yellow, green | 75 | 3:1 |
|  | Pest control traps | Sticky traps | 2 | 2:1 |
|  | Personal protective Equipment (PPEs) | Set-(overall, gloves, respirator, gumboot, goggles)  Spray suit | 25  5 | 1:1  1:5 |
|  | Packaging materials | Assorted-3 different packaging materials | 1 | 3:1 |
| **D** | **Tools and Equipment** |  |  |  |
|  | Hoes/jembe |  | 25 pcs | 1:1 |
|  | Panga |  | 10 pcs | 1:3 |
|  | Slasher |  | 10 pcs | 1:3 |
|  | Secateurs |  | 15 pcs | 1:2 |
|  | Spade |  | 15 pcs | 1:2 |
|  | Soil auger |  | 5 pcs | 1:5 |
|  | Pegs |  | 100 pcs | 4:1 |
|  | Hammer |  | 15 pcs | 1:2 |
|  | Saw |  | 15 pcs | 1:2 |
|  | Bucket |  | 15 pcs | 1:2 |
|  | Dibbler |  | 15 pcs | 1:2 |
|  | Garden trowel |  | 15 pcs | 1:2 |
|  | Measuring tape |  | 10 pcs | 1:3 |
|  | Knapsacks sprayers |  | 5 pcs | 1:5 |
|  | Irrigation equipment | A complete set of irrigation system | 1 set | 1:1 |
|  | Storage tanks | 3, 000 litres capacity | 1 | 1:1 |
|  | Watering can | 5litre can-plastic/metalic | 5 pcs | 1:5 |

# HERBS AND SPICES PRODUCTION IN PROTECTED ENVIRONMENT

**ISCED UNIT CODE:** 0812 251 04A

**Relationship to Occupational Standards**

This unit addresses the Unit of Competency: Produce Herbs and Spices in protected environment

**Duration of Unit:** 60 Hours

**Unit Description**

This unit specifies the competencies required to produce herbs and spices in a protected environment. It involves setting up protected environment, growing herbs and spices, harvesting herbs and spices, undertaking post-harvest activities, undertaking value addition processes and undertaking marketing activities.

***The trainer to choose any three high value herbs and spices in the range. Consider choice of trainees and market demands. Visit to herbs and spices farm in protected environment is recommended.***

**Summary of Learning Outcomes**

|  |  |  |
| --- | --- | --- |
| **SNO** | **Learning Outcome** | **Duration (hours)** |
|  | Set up protected environment | 15 |
|  | Grow Herbs and Spices | 15 |
|  | Harvest Herbs and Spices | 10 |
|  | Undertake Post Harvest Activities | 5 |
|  | Undertake Value Addition Processes | 10 |
|  | Undertake Marketing Activities | 5 |

**Learning Outcomes, Content, and Suggested Assessment Methods**

| **Learning Outcome** | **Content** | **Suggested**  **Assessment Methods** |
| --- | --- | --- |
| 1. Set up protected environment | 1. Procedures for occupational safety and health. 2. Tools, equipment, supplies and materials  * Identification * Sourcing * Use * Maintenance * Storage  1. Different production structure    * Greenhouse    * Shed nets 2. Types of propagation media 3. Media sampling and results interpretation 4. Soil and water conservation measures 5. Types of seedlings trays 6. Propagating media preparation 7. Potting the media 8. Sowing of the planting material 9. Food safety measures 10. Nursery Management practices     * + Weeding       + Watering/ Irrigation – Types of irrigation       + Pricking out 11. Pest and diseases control 12. Hardening off 13. Record keeping 14. Waste management practices  * 3Rs of waste disposal  1. Emerging trends  * Automated irrigation systems | * + Observation   + Oral assessment   + Portfolio of evidence   + Third party report   + Written assessment   + Practical |
| 1. Grow Herbs and Spices | 1. Procedures for occupational safety and health 2. Tools, equipment, supplies and materials  * Identification * Sourcing * Use * Maintenance * Storage  1. Planting/transplanting procedure 2. Protected environment crop agronomic practices    * Spacing    * Gapping    * Irrigation    * Thinning    * Weeding    * Pruning    * Intercropping    * Crop rotation    * Pinching 3. Structure management practices 4. Crop protection    * Types of pests and diseases    * Methods of controlling pests and diseases    * Integrated Pest and Diseases Management    * Efficient use of crop protection products 5. Crop nutrition    * Types of fertilizers    * Method of fertilizer application    * Fertigation 6. Record keeping 7. Wastes management practices  * 3Rs of waste disposal  1. Emerging trends    * Precision Technologies for pests and diseases control    * Automated Climate control and fertigation    * Use of applications and tracking tools | 1. Observation 2. Oral assessment 3. Portfolio of evidence 4. Third party report 5. Written assessment |
| 1. Harvest Herbs and Spices | 1. Procedures for occupational safety and health 2. Tools, equipment, supplies and materials  * Identification * Sourcing * Use * Maintenance * Storage  1. Maturity indices  * Horticultural maturity * Physiological maturity  1. Methods of harvesting  * Pinching * Uprooting * Cutting  1. Food safety measures 2. Record keeping 3. Wastes management practice  * 3Rs of waste disposal  1. Emerging trends  * Precision harvesting * Blockchain and traceability | * + Observation   + Oral assessment   + Portfolio of evidence   + Third party report   + Written assessment   + Practical |
| 1. Undertake Post Harvest Activities | 1. Procedures for occupational safety and health 2. Tools, equipment, supplies and materials  * Identification * Sourcing * Use * Maintenance * Storage  1. Post harvest handling practices  * Weighing * Cleaning * Sorting * Grading * Packaging * Storage  1. Food safety measures 2. Record keeping 3. Wastes management practice  * 3Rs of waste disposal  1. Emerging trends-  * Automated grading * Packaging innovations | * + Observation   + Oral assessment   + Portfolio of evidence   + Third party report   + Written assessment  1. Practical |
| 1. Undertake Value Addition Processes | 1. Procedures for occupational safety and health 2. Tools, equipment, supplies and materials  * Identification * Sourcing * Use * Maintenance * Storage  1. Meaning of value addition 2. Importance of Value addition 3. Food safety during value addition 4. Value addition techniques and methods  * Drying * Blanching * Canning * Freezing * Powder form * Basic Products processing - blending  1. Record keeping 2. Wastes management practice  * 3Rs of waste disposal  1. Emerging trends  * Solar dehydrators * Blockchain and traceability | * + Observation   + Oral assessment   + Portfolio of evidence   + Third party report   + Written assessment   + Practical |
| 1. Undertake Marketing Activities | 1. Procedures for occupational safety and health 2. Market survey techniques 3. Pricing techniques  * Customer value-based pricing * Cost – based pricing * Competition based pricing * New- product pricing  1. The 4Ps in marketing  * Product * Place * Price * Promotion  1. Wastes management practice  * 3Rs of waste disposal  1. Record keeping 2. Emerging trends  * e – marketing * Functional and health boosting products * Product certification | * + Observation   + Oral assessment   + Portfolio of evidence   + Third party report   + Written assessment |

**Suggested Methods of Instruction**

* + Instructor-led facilitation
  + Demonstration by trainer
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  + Team learning
  + E-learning
  + Academic trips

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|  | Chemical and fertilizer storage facility |  | 1 | 1:25 |
|  | Greenhouse |  | 2 | 2:25 |
|  | Shade nets |  | 5 | 1:5 |
| **C** | **Consumable materials** |  |  |  |
|  | Manure | Tonnes of farmyard manure | 2 | 2:25 |
|  | Soilless media | Assorted |  |  |
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|  | Layout string | Sisal twine | 2 rolls | 2:25 |
|  | Stationery | Assorted | 1 rim of printing papers  1 packet of pens  1packet of maker pens | 1:25 |
|  | Nails | 3’’ and 4’’ nails | 1 each | 1:25 |
|  | Pesticides | Herbicides Insecticides Nematicides Fungicides | 1Litre of each | 1:25 |
|  | Rooting hormones | Powder | 200grams | 1:25 |
|  | Pheromones+traps | 2pheromones  Tuta absoluta and fruit fly | 50 pieces | 2:1 |
|  | Scouting flags | 3 fabric ribbon-Red, yellow, green | 75 | 3:1 |
|  | Pest control traps | Sticky traps | 2 | 2:1 |
|  | Personal protective Equipment (PPEs) | Set-(overall, gloves, respirator, gumboot, goggles)  Spray suit | 25  5 | 1:1  1:5 |
|  | Packaging materials | Assorted-3 different packaging materials | 1 | 3:1 |
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|  | Secateurs |  | 15 pcs | 1:2 |
|  | Spade |  | 15 pcs | 1:2 |
|  | Soil augur |  | 5 pcs | 1:5 |
|  | Pegs |  | 100 pcs | 4:1 |
|  | Hammer |  | 15 pcs | 1:2 |
|  | Saw |  | 15 pcs | 1:2 |
|  | Bucket |  | 15 pcs | 1:2 |
|  | Dibbler |  | 15 pcs | 1:2 |
|  | Garden trowel |  | 15 pcs | 1:2 |
|  | Measuring tape |  | 10 pcs | 1:3 |
|  | Knapsacks sprayers |  | 5 pcs | 1:5 |
|  | Irrigation equipment | A complete set of irrigation system | 1 set | 1:25 |
|  | Storage tanks | 3, 000 litres capacity | 1 | 1:25 |
|  | Watering can | 5litre can-plastic/metalic | 5 pcs | 1:5 |