



AGRICULTURE AND FOOD AUTHORITY

HORTICULTURAL CROPS DIRECTORATE

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BULB ONION (*Allium cepa* L) GROWERS MANUAL

PREFACE

Kenya has been endowed with an enabling environment for production of horticultural crops that attracts high demand both in the domestic and international markets. Production is mainly by smallholder farmers, many of whom require skills and knowledge on good agricultural practices (GAP) to produce and handle the fresh produce. According to the Economic Survey 2022 published by the Kenya National Bureau of Statistics (KNBS), horticulture is among the leading sub sectors in agriculture. Therefore, enhancing the capacity of these producers could be of immense beneficial to the Kenyan economy.

Agriculture and Food Authority – Horticulture Crops Directorate (HCD) is a government agency mandated to Regulate, Promote and Develop the horticulture industry in Kenya. In carrying out its mandate, the Directorate through the Technical and Advisory Services department (TAS) has developed this grower’s manual for its stakeholders. The manual has been designed with a simple language and where necessary photos have been used to highlights all processes from plough to plate. HCD envisages that by using this grower’s manual, its stakeholders especially the smallholder farmers, extension staff and trainers would upgrade their knowledge and skills to enable them increase production of the crops thereby improving on food security, household health, as well as create employment and generate income.

The content has largely been developed from the TAS field staff experiences in the 26 stations spread across the country (*Collins & Dinah – Nairobi [NHC], Antonina – Nakuru, Miriam - Nandi, Grace – Homabay, Barnabas- Eldoret & Iten, Carol - Bungoma, Peter- Busia, Charles -Kisumu, Irene - Narok, Lal – Kisii, Victor – Mombasa, Crispin – Kibwezi, Esther Ngutho– Kitui, Esther Kabatha – Nyandarua, Susan – Taveta, Syphrosa – Machakos, Catherine – Yatta, James – Kitale, Julius – Kajiado, Amedeo & Brenda – Meru, Mary – Kericho, David & Delphina – Mwea, Fridah – Nyeri, Emma – Sagana, Sarah – Limuru*), some content were reviewed from literature and images used properly acknowledged. Technical editing and reviewing of the manuals were done by Mary Chacha, Syphrosa Wanyama, Barnabas Kiptum, Antonina Lutta, Carol Soita, Amedeo Muriungi, Peter Mwanja, Victor Omari, Emma Ndirangu, Esther Kabatha, David Makori, Dinah Karimi, Collins Otieno, Dr Jacqueline Oseko the acting Deputy Director, Technical and Advisory Services department and Director Benjamin Tito all of Horticulture Crops Directorate.

BULB ONION (*Allium cepa* L) GROWERS MANUAL

Common Name: Kitunguu Maji (Swahili)



Introduction

Onion is one of the most important vegetable in Kenya, grown for its edible bulb and as a spice for foods when cooked or served raw. It is also used to make pickles or chutneys. Onion is rich in Calcium, Iron, Potassium, Vitamin B6 & B9, vitamin E and has medicinal properties.

The common varieties grown in Kenya includes Dominator F1, Red Creole, Bombay Red, Texas Grano, Tropicana F1, Jambar F1, Red Passion F1 and Red Pinoy F1, Sivan F1, Russet F1, Red Cornet FI, Red coach FI

In Kenya, the Counties leading in onion production are Kajiado, Meru, Homabay, Mandera Taita Taveta, Nyeri, Nakuru, Laikipia Narok, Baringo, West Pokot and Bungoma.

Ecological requirements

Altitude: 500-1900m above sea level

Rainfall: 500 -700mm, requires a dry spell at maturity before harvesting

Temperature range: 15 °C- 30 °C

Soils: Well drained fertile soils with good water holding capacity and pH of 6.0-7.0

Good Agricultural Practices

Horticulture industry in Kenya is guided by a code of practice (KS1758-2016 part II) which is a standard for vegetable, fruits, herbs and spices for both local and export market. The standard aims at ensuring food safety, environmental sustainability and social accountability by following Good Agricultural Practices from production, processing, transportation and marketing of fresh produce. Hence, onion production process should

comply with all the guidelines in the standard. In addition, ensure documentation and record keeping of all farm operations for traceability.

Propagation materials

Certified onions seedlings are acquired from registered vegetable nurseries in Kenya. Farmers can also propagate seeds at the farm and later transplant. However certified seed/ seedlings are recommended because of high vigor for faster establishment and growth. A Seed rate of 1kg/acre is economical.

Soil testing

Soil testing is recommended before planting to guide on fertilizer and manure application to onion crop.

Land preparation

Ploughing is done earlier followed by harrowing 2-3 weeks later to make a fine tilth on the farm for planting onions seedlings. If possible observe minimum tillage.

Transplanting and spacing

Seedlings are transplanted when they reach pencil thickness which is about 6-8 weeks after sowing. The seedlings are planted in 2.5 – 3 cm deep trenches at a spacing of 30cm between rows by 8cm-10 cm between plants. A path of 45 cm should be placed after every 3 rows for easy field operations. Expected plant population is 120,000-150,000 plants per acre.

Manure and fertilizer application; About 10 to 16 tons of well decomposed manure/compost is needed per acre the application is done 1-2 weeks before transplanting. Top dressing is done in two splits before the onion start bulbing where 1st top dressing is done at 30 days after transplanting then 2nd top dressing done 45 days after transplanting. 40kg of CAN is adequate per acre using strip method of application.

Irrigation;

Onion can be grown under irrigation or rain fed. At growing stage, onions require light but frequent watering. Excessive watering must be avoided since it can result into root rot. Water application is increased as plant grows but should be reduced towards crop maturity.

Weeding and Unearthing

Onions have shallow and fibrous root system that cannot allow competition with weeds hence weeding should be frequent. Weeds can be managed by hand weeding and using selective herbicides.



Unearthing is done which involves the removal of excess soil around the bulb to enhance expansion and proper bulb development.

Pest management

Use of Integrated Crop Management (ICM) is a more recommended strategy for pest and disease control in onion crop production. ICM strategy integrates use of (resistant/tolerant varieties, predators, and parasitoids, mass trapping, field sanitation, crop rotation, and solarisation practices.




Crop rotation replenishes soil nutritional status and prevents pest and disease build-up. It is recommended to rotate onion crop with those from different families.



Major onion Pests

Common onion pests	Symptoms	Control measures
<p>Onion Thrips (<i>Thrips tabaci</i>)</p>  <p>Source; https://infonet-biovision.org/PlantHealth/Crops/Onion</p>	<p>-Thrips feed on onion foliage affecting the ability of the plant to manufacture and transport nutrients to the bulb.</p> <p>-White and silvery patches appear on the leaves</p>	<p>-Keep the onion field free from weeds that can act as alternative hosts of the pest</p> <p>-Use blue traps</p> <p>Use insecticides with Abamectin and Acetamiprid</p>
<p>Onion fly (<i>Delia antiqua</i>)</p>  <p>https://en.wikipedia.org/wiki/File:Uienvlieg_maden.jpg</p>	<p>-Maggot stage is the most destructive stage. They feed on the lateral roots forming tunnels into the taproot and hide in developing bulbs causing Bacterial soft rot through their feeding</p>	<p>-Use of well decomposed compost manure.</p> <p>-Crop rotation.</p> <p>-Remove and destroy infested plant debris.</p> <p>-Remove and dispose onion culls and volunteer onions.</p> <p>Chemical control can be used when there is pest resistance e.g neem product Use fly traps</p>

		Use such as cromazine and chlorpyrifos
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Common diseases

Diseases	Symptoms	Control
<p>Downey Mildew (<i>Peronospora Destructor</i>)</p>  <p>Source: Howard F. Schwartz, Colorado State University, Bugwood.org</p>	<p>-White Lesions are formed near the tips of older leaves. Yellowish patches covered in purplish -grey wet fields are seen.</p> <p>-The leaf tips shrink and death of the leaf proceeds towards the younger leaves.</p> <p>It reduces growth and yield. The disease flourishes in cool, humid conditions especially in poor drainage and field hygiene</p>	<p>-Crop rotation</p> <p>-Use tolerant varieties such as Red Pinoy F1</p> <p>-Use fungicides e.g dithiocarbamate, propamocarb+cymoxanil</p>
<p>Purple Blotch caused by <i>Alternaria porri</i></p>  <p>https://www.greenlife.co.ke</p>	<p>-Small white spots on the foliage</p> <p>-Under moist condition, the spots rapidly increase to large purplish blotches often surrounded by a yellow to orange border</p> <p>-White Lesions extend to girdle the leaf which leads to its collapse.</p> <p>-Infection may spread to the bulb, where it may cause a wet, orange rot starting at the neck.</p>	<p>-Use tolerant varieties Red Pinoy F1.</p> <p>-Crop rotation</p> <p>-Field Sanitation</p> <p>-Use of fungicides such as mancozeb, metalaxyl, copper Oxychloride.</p>
<p>Onion rust caused by <i>Puccinia porri</i></p>  <p>Source: https://infonet-biovision.org/PlantHealth/MinorPests/Onion-rust</p>	<p>-Small reddish dusty spots (pustules) on leaves</p> <p>-Heavily infected leaves turn yellow and die prematurely.</p>	<p>-Crop rotation</p> <p>-Application of proper agronomic practices: proper nutrition and spacing</p> <p>-Use of fungicides such as Mancozeb, Difenconazol, Eugenol.</p>

<p>Pink rot caused by <i>Phoma terrestris</i></p>  <p><i>Source:</i> https://extension.usu.edu/pests/ipm/notes_ag/veg-pink-root-of-onion</p>	<p>Light pink to yellowish-brown discoloration on roots that becomes dark pink then red and eventually purple. Under advanced stages, roots eventually shrivel, become brittle and die.</p>	<p>-Good management practices that reduce plant stress -Crop rotation -Use tolerant cultivars -Use fungicides such as</p> <ul style="list-style-type: none"> • Mancozeb • Difenoconazole • Propineb + Cymoxanil • Eugenol
<p>Neck rot (caused by <i>botrytis allii</i>)</p>  <p><i>Source:</i> https://www.rhs.org.uk/disease/onion-neck-rot</p>	<p>Top part of the bulb will turn browner and the skin will be darker brown. Top of the bulb will be softer than the lower parts. Grey mold and sometimes speckled with small black spots will appear.</p>	<p>-Seed and seedlings treatment using Dicarboximide</p>

Harvesting techniques

Maturity Indices

Harvesting can be done in 90 – 150 days after transplanting depending on the variety.

Bulb onions are ready for harvesting when the leaves collapse or when 75 % of the onions tops have dried and fallen over.

Leaf tops begin to discolor and bend as they dry towards the ground.

Reduced thickness of sheath leaves surrounding the bulbs (papery membranous).

Harvesting and field curing: when the bulb is fully formed, irrigation should be stopped and onion stem is bent. The stem wither after a few days and they are then pulled out and the onion bulbs cured.



Source: SHEP- PLUS

Post-harvest handling

Transport after harvesting

Packing and transportation of onions should be done to maintain quality as per the Crops (Horticultural Crops) regulation 2020

Curing: Curing is a process intended to dry off the necks and outer leaves of bulbs. The main objective is to prolong shelf life by preventing moisture loss and attack by diseases. It can be done in the field or in a protected environment away from adverse weather conditions, such as rain or direct sunlight.

Field curing is done if the maturity and harvesting coincides with dry months, it takes 2-3 weeks. Harvested onions are placed in rows with leaves partially covering the bulbs to prevent sunburn or greening. Onions are then left in the field until the outer leaves and neck are completely dry and papery.

Protected curing is done in a warm, dry and well-ventilated location protected from direct sunlight and rain. The process involves removal of excess soil, trimming of foliage leaving 2.5cm of section of stem at neck and placing onions in single layer in large flat tray.

Sorting and grading: Before storage, bulb onions are sorted to remove the onions with thick necks, bolted, injured, decayed, doubles and small bulbs. Grading should be done before & after storage. For domestic market onions are put into 3 grades: large, medium and small. Bulbs must be intact with a firm flesh which is not exposed. Ensure that onions are clean and free from visible foreign matter, sufficiently dry with the first two outer skin and stem fully dry, free from abnormal external moisture and free from foul smell. Package in well-ventilated containers such as onion nets.

Expected Yield: At optimum onion production the expected yield is 10-20 tons per acre depending with the variety.

GROSS MARGIN FOR 'RED CREOLE' ONIONS VARIETY PRODUCTION IN AN ACRE

1 acre area, spacing of 30cm by 8cm- expected yield 15000kgs Open Pollinated Varieties	Unit	Quantity	Cost per unit	Total cost
Yield in Kilograms (Gross income)	Kgs	15000	50/=	750,000
Variable costs				
Land preparation				
Ploughing	Acre	1	5,000/=	5,000/=
Harrowing	Acre	1	4,000/=	4,000/=
Ridging/ bed making	mds	10	500/=	5,000/=
Soil testing	soil Analysis	1	2500/=	2500/=
Inputs				
seedlings	No.s	120,000	0.5/=	60,000/=
Fertilizers With NPK	Kgs	160	120/=	19,200/=
Fertilizers with CAN		40	120/=	4,800/=
Insecticides	Litres/ kg	3	1500/=	4,500/=
Fungicides	Litres / kg	4	1500/=	6,000/=
Irrigation water	Session	32	1500/=	50,000/=
Labour Requirements				
Weeding	Mds	10	500/=	5,000/=
Planting	Mds	10	500/=	5,000/=
Irrigation	Mds	32	500/=	16,000/=
Spraying	Mds	5	500/=	2,500/=
Harvesting and curing	Mds	10	500/=	5,000/=
Total Variable Costs				194,500/=
Gross income (GI)				750,000- 194,500 = 555,500

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