MoFA

Modernizing Agriculture in Ghana

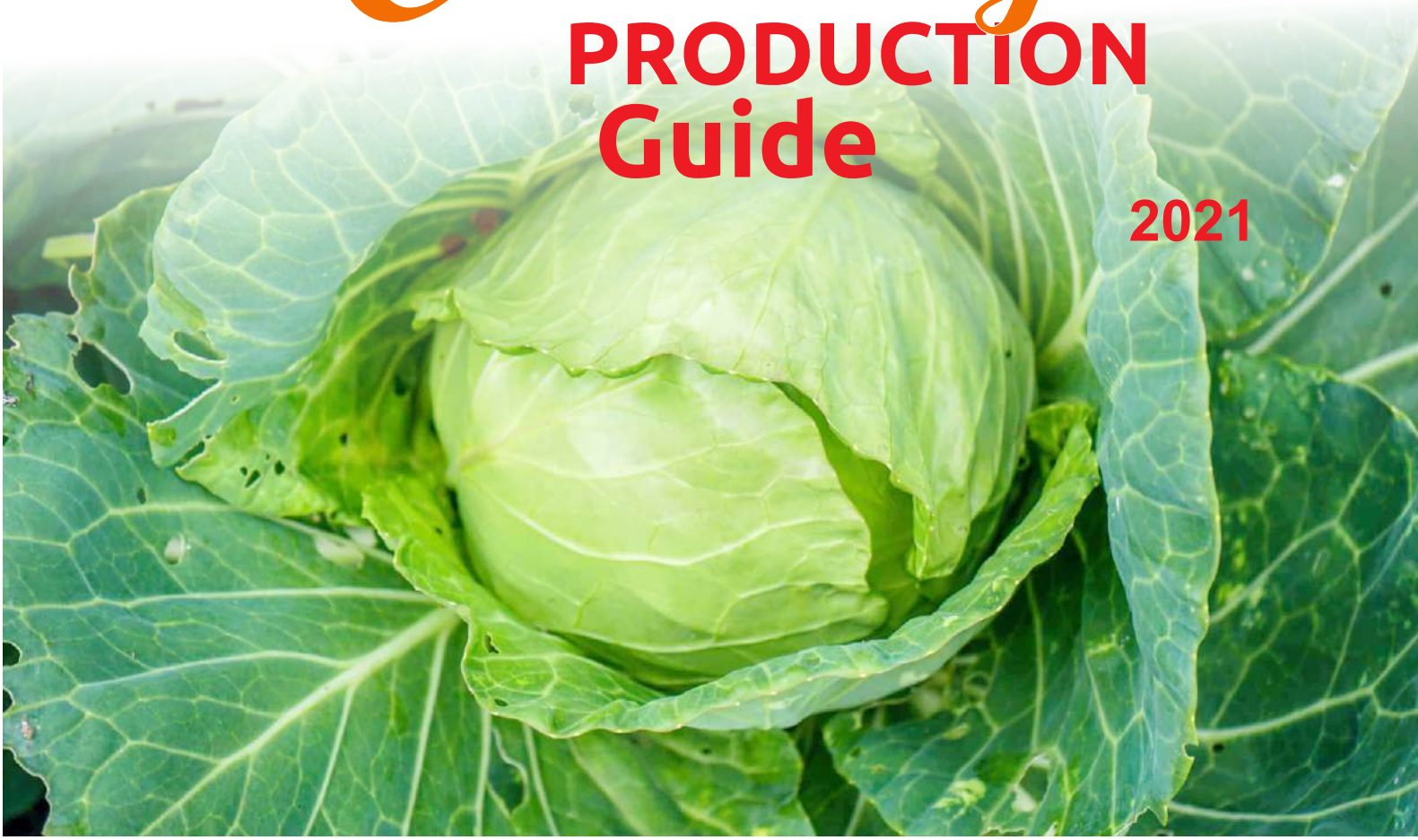
REPUBLIC OF GHANA

DIRECTORATE OF AGRICULTURAL EXTENSION SERVICES (DAES)

Cabbage

PRODUCTION Guide

2021



CABBAGE PRODUCTION GUIDE

This production guide was developed to complement existing Information, Education and Communication (IEC) materials available on the Agronomy of selected commodities under the "Planting for Food and Jobs"campaign. It is designed for use by Agricultural Extension Agents and other farmers who can equally use to train their colleague farmers.

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1.0 INTRODUCTION

Botanical name: *Brassica olerecea var. capitata*

Cabbage (Brassica olerecea var. capitata L.) is a biennial herb and belongs to the family. Cruciferae. It is an important global vegetable crop with the edible part of the cabbage plant which is the "head"is made up of a series of overlapping expanded leaves cover a small terminal bud. The crop is of very ancient cultivation and has been grown in Europe as far back as 2500 B.C. It was introduced into England by the Romans and is now grown throughout the world. In Ghana, it is believed that the British introduced it into the country, and that the crop was grown on a small scale around 1940. The popularity of cabbage among Ghanaians especially those in the urban centres have increased. This is due to the nutritional value of the vegetable and the desire of the average Ghanaian to indulge in some western dishes. Cabbage is currently eaten in many homes. It is also served in many restaurants and fast food outlets. The booming tourism industry and foreign investment drive in the country, which is attracting many foreigners, have also put pressure on the demand for cabbage. It is a delicate vegetable crop, despite its adaptability to varying climatic and soil condition.

A typical cabbage farm

2.0 SITE SELECTION /CLIMATIC REQUIREMENTS

Cabbage grows well in deep, well-drained loamy soil. Like other vegetables there should be a regular source of water through out the year especially in the dry season. Sites with soils with high organic matter is generally recommended. Commercial cabbage production is mainly done in Southern Ghana around the Rain forest zones and Coastal savannah zones particularly Eastern, Greater Accra and Ashanti Regions.

3.0 SEED/VARIETAL SELECTION

Cabbage is propagated by seed. Buy and or use certified high yielding seeds from recognized agro-input dealers, MoFA or CSIR-Crops Research Institute. The suitable varieties commonly grown are Oxylus, Super Cross, Santa, Tropica Cross, KKC,

Copenhagen and Gloria. The seeding rate is 300grammes/ha (0.3kg/ha).

3.1 Germination Test

Conduct a germination test before planting to be sure of the viability of your seedlot.

- Pick 100 seeds from the lot
- Sow in a seed box or bed.
- Count number of seeds germinated after 5-7days
- 85%-95% means seeds are very good, but below 85% increase seed rate to make up for the losses.
- Discard seeds with germination rate below 60%.

4.0 LAND PREPARATION

- ❖ The field must be thoroughly hoed or ploughed (30cm deep) and harrowed.
- ❖ Prepare ridges or planting beds where necessary on which seedlings may be transplanted.
- ❖ Incorporate well-decomposed organic manure.
- ❖ There is a possibility of growing cabbage on a No-Till (Conservation Agriculture) field. This method remarkably gives a better yield, reduces the cost of production and is very sustainable. In no-till, the farmer, completely avoids “slash and burn”, ploughing and harrowing. Rather, the farmer maintains adequate soil cover for good water retention and many other benefits.

5.0 PLANTING

5.1 Raising seedlings

- Seeds can be sown on seed beds, in seed trays or seed boxes.
- Prepare seed beds at 1.2m wide at any convenient length and then level beds.
- Water the bed, cover with a 4cm thick layer of dry grass or sawdust and burn to sterilize the soil.
- Alternatively, solarize soil by covering the soil with transparent plastic sheets for 5-8 weeks to sterilize the soil.
- Sow seeds in drills 10cm apart. Cover the beds with well dried non-seeded grass or palm fronds after sowing. After emergence, remove the dry grass and provide shade over the bed. Thin out weak, malformed seedlings to avoid overcrowding.
- Prick out seedlings 6 to 7 days after emergence.
- Two weeks before planting out in the field, fertilize seedlings with NPK 15-15-15 liquid feed (Prepare the solution by dissolving 5g NPK in every 1 litre of water). Apply directly to the soil.
- Harden seedlings one (1) week before transplanting by gradually decreasing shade until at least 1-day full exposure to sunlight and/or by reducing irrigation.
- Control pests and diseases by applying recommended fungicides and erect insect nets over seedlings.

5.2 Transplanting

- Transplant the seedlings 4 weeks after emergence on the field at the 5-leaf stage in the early morning or late afternoon. The planting distance for cabbage depends on the variety grown. Varieties with larger heads require wider spacing. For most varieties, a planting distance of 45cm to 60cm between rows and 45cm to 60cm within rows will be adequate.
- Apply the recommended fungicides 24-48 hours before transplanting and irrigate immediately after transplanting.

Transplanted cabbage seedling

5.3 Water Requirement

- The optimal amount of rainfall required for cabbage during the growing period is 500mm.
- Regularly water the cabbage to ensure uniform head formation, prevents head splitting and increases head size.
- Reduce watering as crop matures.
- Do not over water since this will lead to leaching of magnesium and phosphorus
- Use clean water to ensure the safety of consumers.
- To ensure good soil water retention, practice No-Till under Conservation Agriculture.
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6.0 FERTILIZER RECOMMENDATION

Use soil test as a guide to fertilizer application. A general recommendation is to apply 40 to 50 tons/ha of decomposed farmyard manure, poultry manure or cow dung during ridging or bed preparation. At planting, apply 15-15-15 NPK at 250kg/ha (50kg bag or 5g/plant). Two weeks after planting, apply Urea 100kg/ha (50kg bag or 3g/plant) and repeat 6 weeks after planting.

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7.0 WEED MANAGEMENT

Regular shallow hoeing (to prevent root destruction) should be done to control weed growth. Where manual weed control is difficult, a recommended pre-emergence herbicide may be applied prior to transplanting .Take precautions to avoid injuries from chemicals.

8.0 PESTS AND DISEASES MANAGEMENT

8.1 PESTS;

(i) Diamondback moth (Plutella xylostella)

The main insect pest in brassica crops, particularly cabbage, kale broccoli and cauliflower.

Male adult is small grayish moth with diamond pattern on its back when winds are closed.
Eggs are laid on upper surface of leaves. A single female can lay 400 eggs.

Symptoms and damage

- The caterpillars cause the damage.
- The first two larval stages are small and feed by mining the leaf; later, when they are larger, they burrow through the leaf and create wide cavities on the lower leaf surface leaving the waxy layer intact, which gives the appearance of windows in heavily damaged plants.
- Infestation are normally severe in dry months.

Adult cabbage moth

Caterpillars damaging cabbage leaf

Cabbage damage by Diamond back moth

Management

- Rotate with non-brassicas such as onions, legumes and cereals for at least 2 years.
- Remove all crop debris including weeds at least 4 weeks prior to sowing to reduce moth population
- Transplant only healthy seedlings free of eggs, caterpillars and pupae of the moth
- Establish nursery beds away from production fields to prevent cross infestation
- Start monitoring for moths when cabbage is at the 4-leaf stage, scout for small light greenish, sometimes grey-greenish, thin larvae on leaves and stems. Continue inspecting weekly especially on the underside of the leaves
- Use lure traps (water or funnel traps) to monitor adult moth populations.
- Conserve natural enemies such as *Cotesia plutellae* ,*Trichogramma* spp. and *Diadegma insulare,* .
- Spray with Neem based insecticide.Spray every 10 days from seedling to head formation.

- Use microbial insecticides such as *Bacillus thruringiensis (Bt*) to control young larvae.
- Spray foliage with imidacloprid + Emamectin benzoate insecticide

(ii) Cabbage webworm (*Hellula undalis)*
Symptoms and damage

- Young caterpillars mine the leaves while older caterpillars feed on the underside of rolled leaves within spun webs.
- Mature caterpillars feed on leaves as well as stems and growing points. They are often hidden behind a web of silk and masses of frass (insect faeces).
- Caterpillars feeding on young plants frequently cause the death of the plants, especially when the larvae feed on the growing point.
- In older cabbage plants, new shoots are produced and the attacked plants produce several small heads of little commercial value. Caterpillar feeding after heading may cause head stunting.

Moth of cabbage webworm

Larvae of Cabbage webworm

Damage caused by cabbage webworm

Management

- Disposal of crop residues; uproot and burn cabbage stalks after harvest
- Crop rotation or intercropping with non-host (e.g. mustard, onion, carrot to reduce field populations
- Start monitoring after seedling emergence and check crops for larvae twice a week
- Inspect plants for egg masses, these are usually found in plant buds
- Hand pick and destroy caterpillars found on crops during lower infestation levels
- Plowing/ removing weeds at least one month in advance prior to crop planting reduces potential webworm populations
- Spray with Abamect in benzoate product.
- Use *Bacillus thurigiensis* product and apply before larvae are protected by webs or in the centre of the cabbage
- Use Botanical extracts (such as neem seed extract, lemon grass or ginger) at 1:15 L of water

(iii) Aphids (Brevicoryne brassicae)

Symptoms and damage

- Aphids feed by sucking sap from their host plants. They produce a sugary waste product called honeydew, which is fed on by ants.
- Continued feeding by aphids causes yellowing, wilting and stunting of plants
- Severely infested plants become covered with a mass of small sticky aphids (due to honeydew secretions), which can eventually lead to leaf death and decay
- Cabbage aphids feed on the underside of the leaves and on the center of the cabbage head. They prefer feeding on young leaves and flowers and often go deep into the heads of cabbage

The cabbage aphid is of agricultural concern because it is a vector of at least 20 viral pathogens that can cause diseases in crucifers and citrus.

Cabbage aphid damage

Management

- Grow repellent plants like onions, garlic and marigold with the crop in alternating rows to prevent aphids
- Conserve natural enemies (e.g ladybird beetles, hoverflies and *Aphidius* spp.) by avoiding spraying broad-spectrum insecticides
- Keep the fields free of weeds and alternative hosts such as peppers, citrus, cashew and wild mustards
- Start monitoring from the seedling stage, look at lower leaves, stems or growing points for soft-bodied insects found in clusters
- Monitor at least three times in a week for aphids early in the morning or late in the day especially during dry spells
- Scout for attendant ants around the crop, which indicate presence of aphids. Check for wilting or yellowing of plants and presence of sooty mould
- Spray with botanical extracts, e.g. garlic, neem, red chilli pepper or soap (take 50g mix in 2L of water, boil for 15 minutes, allow to cool and spray
- Spray with Imidacloprid based product. PHI of 14 days
- Spray with Deltamethrin product PHI of 14 days

(iv) Whitefly *(Bemisia tabaci, Aleyrodes proletellai)*

Symptoms

- Look for stunted leaf growth and curling of leaves
- Look for yellowing of crop
- Look for sooty mould on leaves
- Look for presence of ants which indicates aphids infestation

Whitefly adults

Whitefly damage

Management

- Clear weeds to reduce overwintering pest stages
- Ensure healthy and vigorous crop growth to reduce whitefly impact with recommended irrigation and fertilization
- Avoid broad spectrum insecticides to conserve natural enemies such as parasitic wasps, ladybirds, lacewings and hoverflies
- Monitor the feeds every week during plant growth and observe entire plants for infestation found primarily on stems, and the underside of leaves
- Plant whitefly repellent crops such as marigold around the boundary of the field
- Use yellow sticky traps, 2 /acre to monitor adults' populations and for identification
- Use botanical extract sprays (such as neem seed extract, lemon grass or ginger) 1: 15 L of water
- Spray Lambda cyhalothrin + Acetamiprid product bi-weekly up to a flowering stage of the crop

8.2 DISEASES

(i) Black rot on cabbage *(Xanthomonas campestris pv. Campestris)*

Symptoms

- The disease is caused by bacteria and can be identified on the leaf as a "V" shaped yellow colour, moving from the edge inwards and downwards into the stem.
- This symptom distinguishes Black rot from Fusarium wilt where symptoms move upwards from the soil level towards the stem.
- As the disease progresses, the yellowing part of the leaf turns brown and the tissues die.
- Leaf veins turn black at the final stage of the disease.
- The disease thrives in wet conditions with high temperatures

Black rot on cabbage. Note the V shaped lesions spreading from the edges of the leaves.

Advanced stage of the disease

Management

- Use certified seed and seedlings free from disease as this disease can be seed-borne
- Do not plant crucifers in areas that have a history of the disease where crucifers have been grown within the previous 2 year
- Deep plough fields to bury contaminated crop residues
- Use correct plant spacing; 50cm between plants and 60 cm between rows. If plants are closer together this can encourage spread of disease between plants
- Avoid moving through fields when the plant is wet to prevent disease spread. Clean tools and boots
- Rotate crucifers for a minimum of 3 years with crops that are not susceptible such as maize,

legumes, tomato.

- Spray with Mancozeb 800g/kg at 30- 50g / 15L and Carbendazim 500g/kg at 100-150g/ 100L of water

(ii) Cabbage Rings pot (*Mycosphaerella brassicicola*)

Symptoms

- Ringspot is an airborne fungus disease that also survives on crop debris
- Look for dark ring spots up to 2 cm on outer part of leaves, with dark grey centres surrounded by a yellowish zone. Inside spots maybe whitish.
- Heavy infestation makes cabbage heads spotty and shriveled. Infected cabbage cannot be cured

Cabbage ring spot virus

Management

- Establish nurseries far away from diseased brassicas (at least 200m)
- Plant resistant varieties like Oxylus and KKC
- Prepare non-dense seed bed to ensure aeration and drying
- Plough diseases residues deeply soon after harvest. In contrast, slightly tillaging residues under, supports the diseases survival
- Do not irrigate diseased fields after 3pm and before 10 am, as wind and water splash spread the disease
- Do not plant cabbages on the same land until residues have rotten away. Alternatively, rotate cabbage with maize or soybeans for 2-3 years
- Monitor twice during first 2 weeks of germination
- Inspect seedlings twice a week for ring spots. If seen consider, a management plan
- Remove the seedlings with ring spots in nursery, to prevent disease in the field
- Remove plants if affected in field to limit further spread

(iii) Bacterial soft rot of cabbage (*Erwinia* spp. and *Pseudomonas* spp.)

Symptom

- Affected leaf tissues turn brown, become soft and mushy and has a foul smell
- Leaves, stems and roots decay
- Bacterial soft rots cause the formation of water-soaked spots. These spots enlarge over time and become sunken and soft.
- Interior tissues beneath the spots become mushy and discolored, with the discoloration ranging anywhere from cream to black.

Damage on cabbage

Damage on cabbage

Management

- Site nurseries away from production fields and transplant to well - drained soils.
- Avoid planting on land with continuous history of cabbage for 3 years.
- Practice crop rotations with maize and sorghum every two weeks.
- Destroy plant residues and volunteer crops by burying (1m deep) to decompose.
- Avoid injuries to plants when working to reduce mechanical transmission of bacteria

Management

- Site nurseries away from production fields and transplant to well - drained soils.
- Avoid planting on land with continuous history of cabbage for 3 years.
- Practice crop rotations with maize and sorghum every two weeks.
- Destroy plant residues and volunteer crops by burying (1m deep) to decompose.
- Avoid injuries to plants when working to reduce mechanical transmission of bacteria
- Control insect pests especially caterpillars as insect damage often provides an entry point for bacteria
- Avoid damage during harvest, use clean implements and transport or store in clean containers as this is an important post-harvest disease
- Monitor fields looking for small to large water-soaked lesions on the leaves
- Inspect harvested cabbages for any symptoms and discard before transport or storage
- Take action as soon as symptoms are seen
- Rogue and destroy infected plants in nurseries and fields by deep burying

9.0 HARVESTING

Heads can be harvested in **60–70 days** after transplanting depending on the variety. Cabbage should be harvested when the heads are full and hard. When harvesting, bend the plant over to one side and cut above the outer leaves using a sharp knife. Moreover, you should leave a few wrapper (outer) leaves around the head. Take care not to split the head. Avoid bruising the head as it encourages rotting. Varieties with firm solid heads have good storability.

9.1 Yield

Cabbage yields a head of 25 – 30mt/ha depending on the variety grown.

9.2 Post-harvest handling

Trim off the outer leaves, sort out and grade by sizes. Pack in crates or boxes and keep under well-ventilated shade. Avoid throwing the heads into a truck as poor post-harvest handling may lead to losses**.**

Sorting: damage and diseased heads are discarded.

Grading: Grade cabbage depending on the head size. Small (1 to 2kg), medium (3 to 4kg), large(over 5kg).