Production guidelines for Cabbage



agriculture,
forestry & fisheries

Department:
Agriculture, Forestry and Fisheries
REPUBLIC OF SOUTH AFRICA

Production guidelines for Cabbage

DEPARTMENT OF AGRICULTURE, FORESTRY AND FISHERIES

Directorate Plant Production

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Part i: General aspects

1. Classification

Scientific name: *Beta vulgaris var. cicla*

Family: Cabbage, *Khavhishi*

Common names: Cabbage, *Khavhishi*

2. Origin and distribution

Cabbage is believed to have evolved from a wild form native to Europe, growing along the coast of the North Sea, the English Channel and northern Mediterranean. Theoprastus described cabbage in 350 BC and the Greeks cultivated it as early as 600 BC and they believed that cabbage was a gift from the gods. Pliny reported a soft-headed form in ancient Rome and the Saxons and Romans probably cultivated it and introduced it to the British Isles. The hard-headed types were only mentioned in the 9th century. The early Egyptians are said to have worshipped it. The plant was used for medicinal purposes to treat gout, stomach problems, deafness, headache and hangovers in the early days. Cabbage is now grown throughout the world.

3. Major production areas

3.1 South Africa

Cabbage is one of the most popular vegetables in South Africa. Cabbage is grown country-wide, but production is more concentrated in Mpumalanga and the Camperdown and Greytown districts of KwaZulu-Natal.

3.2 Internationally

Cabbage is a popular vegetable throughout the world because of its adaptability to a wide range of climatic conditions and soil, ease of production and storage, and its food value.

4. Description of the plant

4.1 Roots

Cabbage has an adventitious root system.

4.2 Stem

Cabbage has an unbranched stem that remains less than 30 cm long.

4.3 Leaves

A rosette of sessile leaves arises as the growing point continues to form leaf primordial. The outer leaves are green in colour and the inner ones are white.

As the plant grows, the leaves increase in number, forming a ball-shaped "head" in the centre of the plant. The head is basically a large vegetative terminal bud, formed by overlapping of numerous leaves developing over the growing point of its shortened stem.

5. Cultivars

Several types of cabbage are grouped into conical or sugarloaf-headed, ball-headed and drum-headed based on the shape of the head and the savoy. They can also be classified according to their colour and growth cycle. The leaves may be green or red and smooth or wrinkled. The savoy types are tolerant to cold conditions and they have deep-wrinkled dark green-leaves.

6. Climatic requirements

6.1 Temperature

Cabbage grows best in a relatively cool and humid climate. Leaves are more distinctly petioled and the quality of the head is impaired in drier atmospheres. The delicate flavour is also lost under these conditions. Yield and quality are poor in summer and it is also difficult to control insect pests. The optimum temperatures for growth and development are from 18 °C to 20 °C. It is fairly resistant to frost and can survive temperatures as low as - 3 °C without damage. Cabbage is also adapted to a wide variety of climatic conditions and can such be grown throughout the year in most regions.

6.2 Rainfall

Water requirements vary from 380 to 500 mm per crop, depending on climate and length of growing season. Crop water use increases during the growing period with a peak towards the end of the season.

7. Soil requirements

Cabbage can be grown on a wide range of soils but it thrives on well-drained, moisture-retentive loamy soils well supplied with organic matter. It does not grow well on highly acidic soil. The ideal soil pH ranges from 5,5 to 6,5 and it should not be allowed to fall below 4,5. In soils with pH above 6,5 the leaves become dark but leaf margins die back. Plants in saline soils are also highly susceptible to blackleg.

Part ii: Cultivation practices

1. Propagation

Cabbage is propagated from seeds.

2. Soil preparation

The land should be clean cultivated eight weeks before planting and the ground must be ploughed deeply, immediately before planting, with a disk harrow or other suitable implement to a depth of 450 to 600 mm. The soil should be fumigated two weeks before planting time if necessary, to control nematodes.

3. Planting

Cabbage may be planted by direct-seeding or transplanting of seedlings. If direct seeding is to be used, about 2 kg of seed per hectare may be required.

Seedlings should be transplanted as soon as they reach the desired size and only well-hardened, young, stocky plants should be used. Transplanting is done on moist soil. The soil around the roots should be firmed and irrigated as soon as possible after the seedlings rare set. In wet areas, cabbage should be planted on raised beds or ridges to reduce water-logging and stem or root rot diseases.

Plant population and spacing influence head size, head shape and yield. Cabbage plant populations vary according to the target market for a particular crop. It has been reported that cabbage forms smaller and slightly more pointed heads when they are spaced closely. Plant populations of 40 000 to 45 000 per hectare are suggested for large-headed types while for cultivars with medium-sized heads, populations of 55 000 to 65 000 plants per hectare are said to be ideal. For baby cabbage, populations of 80 000 to 100 000 plants per

hectare are recommended. It is recommended that large-headed cultivars should be planted 600 to 700 mm apart between rows and 450 mm apart within rows. Smaller-headed varieties are planted 600 X 300 mm apart.

4. Fertilisation

Cabbage is a heavy feeder and requires supplemental fertilisation in the form of manure or compost, nitrogen, phosphorus and potassium. Fertiliser programmes should be based on soil analyses and should be developed for each field. Cabbage requires 200 to 250 kg nitrogen per hectare. Nitrogen is supplied in split applications, where 50% to 66% is broadcast and ploughed in just before planting. The first application is made together with phosphorus and potassium. The remainder is side-dressed two to three weeks after transplanting and again three weeks later or applied once-off at about six weeks.

If a fertiliser mixture is preferred, 1 500 kg of 2:3:2 (22) and 100 kg potassium per hectare may be broadcasted before planting. A top dressing of 300 kg LAN should be applied approximately four weeks after transplanting and again 4 weeks later if required.

Cabbage also needs micronutrients for proper growth and development. The crop has a high requirement of calcium and deficiencies of this nutrient may occur on acid soils, on soils with very high potassium or on very dry soils. Foliar sprays of calcium nitrate can be used to supply calcium. Magnesium may also be deficient on acid soils, on very light soils or on soils that are very high in potassium. Spraying the plants with 5 kg magnesium per hectare can rectify the problem.

Cabbage is very susceptible to molybdenum deficiency. Plants should be sprayed with 125 g of sodium- or ammonium molybdate in 500ℓ of water per hectare as soon as signs of deficiency are noticed. The availability of molybdenum may be increased by providing enough lime prior to planting. Iron may be applied with a foliar spray with 1% iron sulphate or chelate. The deficiency of iron is common on calcareous, alkaline soils. Manganese deficiencies are prevalent on soils with a pH of more than 5,5. A foliar spray of 5 kg per hectare of manganese sulphate or 2 to 3 kg/ha of manganese oxide is suggested as soon as symptoms of deficiency are observed. Cabbage may have boron deficiencies in areas with high rainfall. Three kilograms of Solubor are effective in controlling boron deficiency.

5. Irrigation

Cabbage should be irrigated immediately after sowing or transplanting. Thereafter, irrigation should be applied at intervals of 10 to 12 days in heavy soils or eight days in light soils and the schedule should be followed until the heads are fully developed and firm. Young plants should receive enough water for vegetative growth before forming heads. Excess moisture when the heads have formed may cause them to crack.

6. Weed control

Weeds are controlled mechanically or by hand as well as chemically through the application of registered herbicides. Mechanical cultivation should be done during land preparation until the plants are about half-grown. The first-cultivation should be done two to three weeks after transplanting.

7. Pest control

Aphids *(several kinds)*

Cabbage is attacked by several aphids but the grey cabbage aphid (Brevicoryne brassicae) and the green peach aphid *(Myzus persicae)* are the most common. Damage is caused when they suck sap from the plant and contaminate the edible product. Feeding of the cabbage aphid causes a chlorosis and malformation of the leaf.

Diamond-black moth *(Plutella xylostella)*

They suck sap from tender growth, resulting in a whitish, scarred appearance. Growth and yields can be seriously reduced by heavy infestation.

Bagrada bug *(Bagrada hilarus)*

They suck sap from tender growth, resulting in a whitish, scarred appearance. Growth and yields can be seriously reduced by heavy infestation.

American bollworm *(Helicoverpa armigera)*

The larvae feed on the leave. They cause severe damage in the early stages of growth by destroying the growing points of the plants.

Cabbage webworm *(Helula spp.)*

The larvae spin a thin web over their feeding places. Damage is severe during early attacks when they destroy the growing point of the plants.

Greater cabbage moth *(Crocidolomia binotalis)*

The larvae spin a thin web over their feeding places. Damage is severe during early attacks when they destroy the growing point of the plants.

Red spider mite

Red spider mites are found on the underside of leaves, where they weave a fine web. Damage is caused by sucking, resulting in a bronzing and yellowing of leaves.

Cutworm *(Agrotis spp.)*

Cutworms cause damage when they cut off the stems of young seedlings close to ground level.

Plusia looper *(Plusia spp.)*

Plusia looper feeds on the leaves and causes damage by cutting the foliage.

Thrips

Thrips tabaci is the most common species on cabbage. High populations of the insect contaminate the edible product, thus affecting its appearance or quality.

Nematodes

Several nematodes affect cabbage. Plants infested with nematodes are unthrifty and may become stunted. Plants may also have signs of moisture or nutrient stress.

General control measures

Control measures such as crop rotation, using resistant cultivars, using registered chemicals (information from Department of Agriculture, Forestry and Fisheries resource centre)

8. Disease control

Damping off *(Altenaria spp., Rhizoctonia solani, Pythium spp.)*

Infected seedlings wilt, turn purple and die, and often have no lateral roots.

CONTROL

- Using treated seed

- Sterilising the seedbed before planting
- Removing infected plants when symptoms appear

Sclerotonia rot or white mould (sclerotinia sclerotiorum)

The disease is favoured by cool, wet conditions and it can survive for two to three years in the soil. Above-ground parts of infected plants may be covered with a white cottony growth. The tissue beneath the mould turns soft and watery.

CONTROL

- By crop rotation
- Planting on ridges or raised beds
- Removal and destruction of infected crop residues
- Good water management aimed at keeping the soil dry

Clubroot *(Plasmodiophora brassicae)*

The disease is soil-borne and the spores can survive for up to 20 years in the soil. It is most severe on acid soils or moderate pH soils that are poorly drained or have a high clay content. Infected plants are characterised by stunting, wilting and purpling of leaves. The roots change into a mass of large, elongated or rounded swellings or clubs. The clubs rot and form bad smelling wet masses.

CONTROL

- By practising sanitation
- Practising crop rotation
- Grow transplants in fumigated beds
- Lime the soil

Fusarium wilt or cabbage yellows *(Fusarium oxysporum f. conglutinans)*

Fusarium wilt is more prevalent in summer and the fungus persists indefinitely in the soil. Initially the symptoms appear as yellow foliage, often mainly on one side of the plant. The leaves become distorted and gradually turn brown and drop prematurely. The vascular area also discolours.

CONTROL

- By planting resistant cultivars
- Growing cabbage in winter
- Planting on soils free of disease
- Soil fumigation before planting
- Practising crop rotation
- Practising sanitation

Black rot *(Xanthomonas campestris)*

The disease is introduced to fields in seed and its spread is very rapid under hot, rainy, windy conditions. The disease survives for three to five years in fields and in the stems of host plants.

The symptoms first appear as yellow to light brown patches at the margins of leaves and later a network of black veins develops within these areas. Affected areas turn brown and dry out and often leave a characteristic triangular-shaped lesion on the leaf margin, with one point of the triangle directed towards the midrib. Older infected leaves also drop and the vascular tissue turns brown as the bacteria move into the main veins and vascular system. Plants infected at the seedling stage may die or remain stunted.

CONTROL

- Planting tolerant or resistant cultivars
- Using disease-free seed or seed treated with hot water
- Practising crop rotation
- Control cruciferous weeds
- Avoiding the use of sprinkler irrigation
- Increase the interval between irrigation
- Deep-ploughing of all infected plant material

Downy mildew *(Peronospera parasitica)*

Downy mildew is common in cool, humid weather. The fungus survives in debris and is spread by air-borne spores in large numbers. Infected leaves appear as if they have been lightly sprinkled with pepper. The leaves become yellow around the pepper spots. Lesions merge to cover large areas of leaves. Fine, fluffy white mould appears on the lesions on the underside of the leaf during humid conditions.

CONTROL

- Plants should not be irrigated after 15:00 pm and before 10:00 am.
- Treat seedlings with fungicides.
- Fumigation of the seedbed.
- Ensure good seedbed preparation and practices to ensure aeration and drying.

Black leg *(Phoma lingam)*

Black leg is seed-borne and it can infect the whole seedbed when an infected seed germinates. The whole plant wilts when infected. White to light brown lesions with a purple to black margin develop on the stem and on leaves. The lesions have small black dots in the centre. The centre of the lesion gets woody and cracks.

CONTROL

- Use containerised seedlings.
- Do fungicide treatment of seedbed.
- Seedbeds should be situated far from old production fields.
- Seedbed should be destroyed if leaf lesions are found.
- All cabbage material remaining in seedbeds should be removed.
- Remove of cruciferous weeds from production fields.
- All debris should be removed after harvesting.

Bacterial leafspot *(Pseudomonas syringae pv. maculicola)*

Bacterial leafspot is more severe in cool, moist weather. The symptoms initially appear as small, faint, water-soaked areas on the underside of leaves. The affected areas develop into brownish to purplish grey necrotic spots, fairly irregular after a few days. They may coalesce to form large irregularly-shaped spots. The leaf becomes wrinkled and the tissue may tear when the lesions are many.

CONTROL

- Do chemical control.
- Plant tolerant or resistant cultivars.
- Use disease-free seed or seed treated with hot water.
- Practise crop rotation.
- Avoid using sprinkler irrigation.

- Increase the interval between irrigation.
- Control cruciferous weeds.
- All infected plant material should be deep-ploughed.

Alternaria leaf spot *(Alternaria spp.)*

The disease is common during cool, rainy weather. Initially, symptoms appear as small, dark areas and they rapidly enlarge to form large circular lesions that develop a bull's-eye pattern or target spot. The lesions are dark brown during wet periods. A brown, velvety, spore-bearing growth can be noticed on the older lesions.

CONTROL

- Use disease-free or treated seed
- Removal or ploughing in plant refuse
- Chemical control

10. Other cultivation practices

10.1 Harvesting maturity

The crop is harvested when the heads attain their full size and become firm and hard but tender. The colour of the head is sometimes used as a maturity index. A fully developed head has a lighter shade of green. The crop for pickling should be harvested when the cover leaves curl back, and the white leaves beneath are exposed. If harvesting is delayed, the heads may split and rots may occur while the heads harvested early may be soft.

10.2 Harvesting methods

The crop for the fresh market is harvested by hand with a knife or sickle. Cabbage for storage and/or processing is harvested at once mechanically. The heads should be cut off in such a way that a few of the large, open wrapper leaves are left for protection around the heads. Harvesting should be such that bruising of the heads is avoided as this makes them unattractive. Most of the stem should be left on the head if the crop is to be stored.

Part iii: Post-harvest handling

Harvested produce should always be removed from direct sunlight and transported to the packing shed as soon as possible. Cabbage and leafy greens are particularly susceptible to wilting and other damage from high temperatures. When there is a delay of more than an hour or two between harvest and packing, a water drench or spray arrangement can help prevent dehydration and overheating.

1. Sorting and grading

The injured leaves should be removed.

2. Packing

Cabbage is packed in mesh pockets or sold loose.

3. Storage

The optimum storage temperature for cabbage is 0 °C and relative humidity of 90 % to 95 %. Cabbage to be store should be mature and disease-free and should not have been exposed to prolonged frost or cold. Further trimming may be necessary, mainly to remove the discoloured butt upon removal from storage.

4. Transport

Care must be taken that trucks are not overloaded on the bottom layers of produce are crushed. Generally, the produce should be covered with a sheet to prevent frosting or desiccation, but on warmer days, when sweating and heating might occur, the sheet should be left off.

5. Marketing

Cabbage is sold in South African fresh produce markets and also exported, mostly by commercial farmers.

Part iv: Production schedules

ACTIVITIES	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER
Soil sampling	X	X						X	X	X	X	
Soil preparation	X		X	X	X	X	X	X	X	X		
Planting	X		X		X	X	X	X		X	X	X
Fertilisation												
Irrigation	X		X	X	X	X	X	X	X	X		
Pest control	X	X	X	X		X	X	X	X	X		
Disease control	X	XX	X	X	X	X	X	X	X	X	X	X
Weed control	X	X	X	X	X	X		X	X	X	X	X
Leaf sampling	X	X	X			X		X	X			
Harvesting	X	X	X	X	X	X	X	X	X	X	X	X
Marketing	X	X	XX	X	X			X	X	XX	XX	XX

Part v: Utilisation

The whole plant can be consumed cooked or raw as a salad.

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