

EAST AFRICAN STANDARD

Fresh collard greens or broccoli greens — Specification and grading



EAST AFRICAN COMMUNITY

HS 0704.90.4000

Foreword

Development of the East African Standards has been necessitated by the need for harmonizing requirements governing quality of products and services in East Africa. It is envisaged that through harmonized standardization, trade barriers which are encountered when goods and services are exchanged within the Community will be removed.

In order to meet the above objectives, the EAC Partner States have enacted an East African Standardization, Quality Assurance, Metrology and Test Act, 2006 (EAC SQMT Act, 2006) to make provisions for ensuring standardization, quality assurance, metrology and testing of products produced or originating in a third country and traded in the Community in order to facilitate industrial development and trade as well as helping to protect the health and safety of society and the environment in the Community.

East African Standards are formulated in accordance with the procedures established by the East African Standards Committee. The East African Standards Committee is established under the provisions of Article 4 of the EAC SQMT Act, 2006. The Committee is composed of representatives of the National Standards Bodies in Partner States, together with the representatives from the private sectors and consumer organizations. Draft East African Standards are circulated to stakeholders through the National Standards Bodies in the Partner States. The comments received are discussed and incorporated before finalization of standards, in accordance with the procedures of the Community.

Article 15(1) of the EAC SQMT Act, 2006 provides that "Within six months of the declaration of an East African Standard, the Partner States shall adopt, without deviation from the approved text of the standard, the East African Standard as a national standard and withdraw any existing national standard with similar scope and purpose".

East African Standards are subject to review, to keep pace with technological advances. Users of the East African Standards are therefore expected to ensure that they always have the latest versions of the standards they are implementing.

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Introduction

In the preparation of this East African Standard, the following sources were consulted extensively:

United States Standards for Grades of Collard Greens or Broccoli Greens, Effective April 16, 1953
(Reprinted — January 1997)

CODEX STAN 193:1995 (Rev.5:2009), *General Standard for Contaminants and Toxins in Foods*

CODEX STAN 228:2001 (Rev.1:2004), *General methods of analysis for contaminants*

Codex Alimentarius website: http://www.codexalimentarius.net/mrls/pestdes/jsp/pest_q-e.jsp

USDA Foreign Agricultural Service website: <http://www.mrlatabase.com>

USDA Agricultural Marketing Service website: <http://www.ams.usda.gov/AMSV1.0/Standards>

USDA Plant Inspectorate Service website: http://www.aphis.usda.gov/Import_export/plants

European Union: http://ec.europa.eu/sanco_pesticides/public

Assistance derived from these sources and others inadvertently not mentioned is hereby acknowledged.

This standard has been developed to take into account:

- the needs of the market for the product;
- the need to facilitate fair domestic, regional and international trade and prevent technical barriers to trade by establishing a common trading language for buyers and sellers.
- the structure of the CODEX, UNECE, USA, ISO and other internationally significant standards;
- the needs of the producers in gaining knowledge of market standards, conformity assessment, commercial cultivars and crop production process;
- the need to transport the product in a manner that ensures keeping of quality until it reaches the consumer;
- the need for the plant protection authority to certify, through a simplified form, that the product is fit for crossborder and international trade without carrying plant disease vectors;
- the need to promote good agricultural practices that will enhance wider market access, involvement of small-scale traders and hence making fruit and vegetable production a viable means of wealth creation; and
- the need to keep unsatisfactory produce from the market by allowing the removal of unsatisfactory produce from the markets and to discourage unfair trade practices e.g. trying to sell immature produce at the beginning of the season when high profits can be made. Immature produce leads to dissatisfaction of customers and influences their choices negatively, which disadvantages those traders who have waited until the produce is mature.

Contents

1	Scope	1
2	Normative references.....	1
3	Definitions	1
4	Provisions concerning quality	2
4.1	General	2
4.2	Minimum requirements	2
4.3	Classification	3
5	Provisions concerning sizing	3
6	Provisions concerning tolerances	3
6.1	Quality tolerances	3
6.3	Basis for calculating percentages	3
7	Provisions concerning presentation.....	4
7.1	Uniformity.....	4
7.2	Packaging	4
7.3	Presentation.....	4
8	Marking and labelling.....	4
8.1	Consumer packages.....	4
8.2	Non-retail containers.....	4
9	Contaminants.....	5
9.1	Pesticide residues.....	5
9.2	Other contaminants.....	5
10	Hygiene.....	5
	Annex A (informative) Cabbages and leafy vegetables — Commercial production guide	7
	Annex B (informative) Guide to cold storage and refrigerated transport	25
	Annex C (informative) Model certificate of conformity with standards for fresh fruits and vegetables	28
	Annex E (informative) Collard or broccoli greens — Codex, EU and USA pesticide residue limits	29

Fresh collard greens or broccoli greens — Specification and grading

1 Scope

This East African Standard applies to collard greens or broccoli greens, or mixtures of the two which may consist of leaves, or parts of leaves, plants or mixtures of leaves and plants, grown from *Brassica oleracea* subsp. (var.) *botrytis*; subgroup *cymosa (italica)* (broccoli) and *Brassica oleracea* subsp. (var.) *acephala*; subgroup *laciniata*, intended for human consumption.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

CAC/GL 21, *Principles for the Establishment and Application of Microbiological Criteria for Foods*

CAC/RCP 1, *Recommended International Code of Practice — General Principles of Food Hygiene*

CAC/RCP 44, *Recommended International Code of Practice for the Packaging and Transport of Tropical Fresh Fruit and Vegetables*

CAC/RCP 53, *Code of Hygienic Practice for Fresh Fruits and Vegetables*

EAS 38, *Labelling of prepackaged foods — Specification*

CD/K/378:2010, *Horticultural industry — Code of practice*

3 Definitions

For the purpose of this standard the following definition shall apply:

3.1

similar varietal characteristics

the collard greens or broccoli greens shall be of the same general colour and character of growth. No mixture of varieties or types shall be permitted which materially affects the appearance of the lot.

3.2

fresh

the greens are not more than slightly wilted

3.3

fairly tender

the greens are not tough, or excessively fibrous

3.4

fairly clean

the appearance of the greens is not materially affected by the presence of dirt, dust, or other foreign material

3.5

well trimmed

the main stem shall not extend more than one inch below the point of attachment of the first leaf

3.6

damage

any defect which materially affects the appearance, or the edible or shipping quality of the individual unit, or the lot as a whole. Any one of the following defects, or any combination of defects, the seriousness of which exceeds the maximum allowed for any one defect, shall be considered as damage:

- (a) Coarse stalks or seedstems when they are woody and tough and more than 9 cm in length, or when they are fairly tender or tender and are more than one-third the length of the entire plant. The length of the plant shall be measured from the base of the main stem to the tip of the leaf extending the greatest distance from the base of the main stem;
- (b) Discoloration when the appearance of the unit is materially affected by yellowing or any other type of discoloration; and,
- (c) Mechanical damage when the unit is badly crushed, torn, or broken.

3.7

serious damage

any defect which seriously affects the appearance, or the edible or shipping quality of the individual unit, or the lot as a whole. Any one of the following defects, or any combination of defects, the seriousness of which exceeds the maximum allowed for any one defect, shall be considered as serious damage:

- (a) Insects when the unit is noticeably infested, or when it is seriously damaged by them;
- (b) Discoloration when the unit is badly discoloured; and,
- (c) Decay.

4 Provisions concerning quality

4.1 General

The purpose of the standard is to define the quality requirements of broccoli greens or collard greens at the export control stage, after preparation and packaging.

4.2 Minimum requirements

4.2.1 In all classes, subject to the special provisions for each class and the tolerances allowed, the broccoli or collard greens must be:

- (a) intact
- (b) sound; produce affected by rotting or deterioration such as to make it unfit for consumption is excluded
- (c) clean and trimmed, i.e. practically free from all earth or other growing medium and practically free of any visible foreign matter
- (d) fresh in appearance
- (e) practically free from pests
- (f) practically free from damage caused by pests
- (g) turgescient
- (h) not running to seed

- (i) free of abnormal external moisture
- (j) free of any foreign smell and/or taste.

4.2.2 The produce must be of normal development. The development and condition of the produce must be such as to enable it:

- (a) to withstand transportation and handling
- (b) to arrive in a satisfactory condition at the place of destination.

4.3 Classification

The produce is classified as defined below:

4.3.1 Class I

Class I consists of collard greens or broccoli greens, of similar varietal characteristics which are fresh, fairly tender, fairly clean, well trimmed, and of characteristic colour for the variety or type; which are free from decay and free from damage caused by coarse stalks and seedstems, discoloration, freezing, foreign material, disease, insects or mechanical or other means.

4.3.2 Unclassified

Unclassified consists of collard greens or broccoli greens which have not been classified in accordance with the foregoing grade. The term "unclassified" is not a grade within the meaning of these standards but is provided as a designation to show that no definite grade has been applied to the lot.

5 Provisions concerning sizing

Sizing is not used in this produce.

6 Provisions concerning tolerances

6.1 Quality tolerances

In order to allow for variations incident to proper grading and handling, not more than a total of 10 percent, by weight, of the units in any lot, may fail to meet the requirements of the grade provided that not more than one-half of this amount, or 5 percent, shall be allowed for serious damage by any cause, and including therein not more than 2 percent for decay.

6.2 Application of tolerances

The contents of individual containers in the lot, based on sample inspection, are subject to the following limitations provided that the averages for the entire lot are within the tolerances specified:

- (a) When a tolerance is 10 percent or more, individual containers in any lot shall have not more than one and one-half times the tolerance specified.
- (b) When a tolerance is less than 10 percent, individual containers in any lot shall have not more than double the tolerance specified provided that at least one specimen which does not meet the requirements may be permitted in any container.

6.3 Basis for calculating percentages

Percentages shall be calculated on the basis of weight or an equivalent basis. In sorting or grading the sample, the unit shall be the plant, the leaf, or a portion of the leaf or plant exactly as it occurs in

the sample. A plant or portion of plant shall not be broken to remove the defective portion, but shall be considered as a unit.

7 Provisions concerning presentation

7.1 Uniformity

The contents of each package must be uniform and contain only beet greens of the same origin, quality, colour and size (if sized).

The visible part of the contents of the package must be representative of the entire contents.

7.2 Packaging

Collard greens or broccoli greens must be packed in such a way as to protect the produce properly. The materials used inside the package must be new¹, clean, and of a quality such as to avoid causing any external or internal damage to the produce. The use of materials, particularly of paper or stamps bearing trade specifications is allowed, provided the printing or labelling has been done with non-toxic ink or glue.

Collard greens or broccoli greens shall be packed in each container in compliance with CAC/RCP 44.

7.2.1 Description of containers

The containers shall meet the quality, hygiene, ventilation and resistance characteristics to ensure suitable handling, shipping and preserving of the collard greens or broccoli greens. Packages must be free of all foreign matter and smell.

7.3 Presentation

The collard greens or broccoli greens may be presented as bunches.

8 Marking and labelling

8.1 Consumer packages

In addition to the requirements of EAS 38, the following specific provisions apply:

8.1.1 Nature of produce

If the produce is not visible from the outside, each package shall be labelled as to the name of the produce and may be labelled as to name of the variety and/or commercial type.

8.2 Non-retail containers

Each package² must bear the following particulars, in letters grouped on the same side, legibly and indelibly marked, and visible from the outside:

8.2.1 Identification

The exporter, packer and/or dispatcher shall be identified by name and physical address (e.g. street/city/region/postal code and, if different from the country of origin, the country) or a code mark officially recognized by the national authority.³

¹ For the purposes of this Standard, this includes recycled material of food-grade quality.

² Package units of produce prepacked for direct sale to the consumer shall not be subject to these marking provisions but shall conform to the national requirements. However, the markings referred to shall in any event be shown on the transport packaging containing such package units.

8.2.2 Nature of produce

— “Collard greens” or “Broccoli greens”

8.2.3 Origin of produce

Country of origin and, optionally, district where grown, or national, regional or local place name.

8.2.4 Commercial specifications

- Class
- Nature expressed by "Bunched collard greens" or "Bunched broccoli greens"
- Number of bunches.

8.2.5 Official control mark (optional)**9 Contaminants****9.1 Pesticide residues**

Fresh broccoli or collard greens shall comply with those maximum pesticide residue limits established by the Codex Alimentarius Commission for this commodity.

9.2 Other contaminants

Fresh broccoli or collard greens shall comply with those maximum levels for contaminants established by the Codex Alimentarius Commission for this commodity.

10 Hygiene

10.1 It is recommended that the produce covered by the provisions of this Standard be prepared and handled in accordance with the appropriate sections of CAC/RCP 1, CAC/RCP 53, and other relevant Codex texts such as Codes of Hygienic Practice and Codes of Practice.

10.2 The produce should comply with any microbiological criteria established in accordance with CAC/GL 21.



Quality collard greens

Fresh collard greens

The national legislation of a number of countries requires the explicit declaration of the name and address. However, in the case where a code mark is used, the reference "packer and/or dispatcher (or equivalent abbreviations)" has to be indicated in close connection with the code mark, and the code mark should be preceded by the ISO 3166 (alpha) country/area code of the recognizing country, if not the country of origin.



Broccoli greens



Growing broccoli greens

Growing collard greens



Collards seeding

Collards in farm

Annex A (informative)

Cabbages and leafy vegetables — Commercial production guide

A.1 History, utilization and botany

The botanical classifications of several types of cabbage and leafy greens are listed in Table A.1. *Brassica oleracea* includes all cabbage, collard and kale. This group has long been referred to collectively as "cole crops." This term comes from a Middle English or Norse word that originated from the Latin word *caulis*, which refers to the cabbage stem or stalk. Wild types of these crops have been found along the Atlantic Coast of Europe and cabbage, kale and collard are believed to have originated in Western Europe. Early uses of these crops were for medicinal purposes.

Table A.1 — Botanical classification of several types of cabbage and leafy greens

Common Name	Genus	Species	Group	Subgroup
Green Cabbage	<i>Brassica</i>	<i>oleracea</i>	Capitata	Alba
Red Cabbage				Rubra
Savoy Cabbage				Sabauda
Kale		Acephala	none	
Collard			none	
Mustard		<i>juncea</i>	Pervirdis	none
Turnip		<i>rapa</i>	Rapifera	none

Kale is thought to be the first form to be domesticated and may have been cultivated as early as 2000 BC. Hard-headed types of cabbage were not cultivated until around the ninth century. Traders and explorers spread the crops to other parts of the world, where they were quickly adopted as cultivated crops. Although cabbage is not particularly high in protein, vitamins and minerals, kale is one of the most nutritious vegetables grown, based on fresh weight. Mustard originated in central and eastern Asia, the Mediterranean and the Himalayas.

Uses of cabbage and leafy greens vary widely. All are grown for both the fresh market and processing into any number of products. Cabbage is popular as a fresh item used in slaw, cooked or processed into preserved products such as sauerkraut. Kale is used primarily as a garnish because of its attractive curly leaves. However, kale can be cooked and eaten in much the same fashion as other leafy greens. Collard, turnip greens and mustard are used primarily as cooked fresh vegetables. However, the tendency to find them served in a raw form is increasing. All are grown for the fresh market but also are grown widely for processing both as canned and frozen products.

Collard, kale, turnip and cabbage are dicotyledonous herbaceous plants that are biennial in nature, although the wild form of cabbage is an annual. All are grown commercially as annuals, however. Kale, turnip and collard do not form a head; all have a rosette form of vegetative growth on a short stem. Collard produces a large smooth leaf, and turnip produces smaller leaves that are generally pubescent. Newer varieties of turnip may be smooth-leaved and are more similar in appearance to mustard. Mustard is a cool-season annual that also forms a rosette of vegetative growth. Mustard leaves may be curly or smooth depending on the cultivar. Cabbage forms a head as the leaves mature and become densely packed.

Cabbage and leafy greens are all produced for their leaves. Some types of turnip also produce a fleshy root harvested for consumption. These roots can vary in shape from flat-round to elongated to spherical. The outer colour may be totally white or have shades of red or purple, particularly at the shoulder. Cabbage, collard and kale are hard to distinguish from one another at the seedling stage but soon develop recognizable characteristics.

All of these crops may be subject to bolting (premature appearance of a flower/seed stem). Flowering usually occurs after an extended period of exposure to low temperatures (below 10 °C) followed by a

period of warmer temperatures. Exposure to temperatures below 4.4 °C or above 21 °C after low temperature exposure causes rapid emergence of the seed stem. Losses to bolting in these crops occur almost every year, particularly in overwintered crops that are exposed to severe temperatures. The flowers of the crops are whitish or yellow and are pollinated by insects.

A.2 Culture and variety selection

A.2.1 Climatic requirements

Cabbage and leafy greens are adapted to a wide range of environmental conditions. Cabbage, collard and kale can tolerate hard frosts, but severe freezes can be damaging. Turnip and mustard can tolerate fairly cold temperatures, but hard frosts can kill the crops or make them unmarketable. All can be grown on a wide range of soil types and are somewhat drought tolerant, although production without irrigation is not recommended.

A.2.2 Crop establishment

Turnip and mustard are direct seeded. Kale, collard and cabbage can be either direct seeded or transplanted. Transplanting has some advantages over direct seeding but also involves an increased cost.

A.2.3 Plant spacing and planting dates

The optimal plant population per acre depends upon the plant's growth habit (compact, medium or spreading), size (small, medium or large) at maturity, vigour of specific cultivars, climate, soil moisture and nutrient availability, soil productivity and intended use.

Plant spacing for cabbage and kale is usually about 90 cm between rows and 23 cm to 30 cm in the row. Turnip may be spaced closely (four to six seeds per 30 cm) if no roots are to be harvested or spread to wider in-row spacings (three to four seeds per foot) if grown for roots and tops. One popular arrangement is to grow four rows, each 35 cm apart, on a 1.8 m bed. Mustard arrangements are similar to turnip grown for greens only.

Collard spacing will depend on the harvest method. If young collards are to be harvested similarly to turnip, they may be grown in rows 30 cm to 45 cm apart with plants 5 cm to 10 cm apart in the row. If they are to be cropped or cut as whole plants, they should be spaced in rows 90 cm apart with plants 30 cm to 45 cm apart. Kale can be grown in 76 cm to 90 cm rows or with three rows on a 1.8 m bed with plants 23 cm to 30 cm apart. Cabbage grown for sauerkraut or slaw may be spaced further apart in the row.

A.2.4 Variety selection

Numerous varieties of cabbage and leafy greens are available on the market. Several factors should be considered in selecting appropriate varieties. Yield, of course, is important to every grower. However, this should not be the sole factor in determining variety. Disease resistance/tolerance is important in many of these crops and should be critically examined. Buyer preference and market acceptability are probably two of the most important factors to consider. Horticultural characteristics such as product colour, growth habit and shape should also be considered. Finally, the variety should be adapted to the area in which it is to be grown.

A.3 Soil and fertilizer management

Although these crops grow best in light, fertile, well-drained soils, when production is properly managed, they can be grown successfully in a wide range of soil types.

A.3.1 Soil management

Plants depend on the soil for physical support, nutrients and water. The degree to which the soil adequately provides these factors depends upon topography, soil type, soil structure and soil fertility.

Under cultivated conditions, soil and fertilizer management are two key factors influencing plant growth and yield.

Tillage is a general term for any operation that disrupts and/or moves the soil, typically within 25 cm to 30 cm of the soil surface. Land preparation involves one or more tillage operations that loosens, pulverizes, smooths or firms the soil and makes it more conducive to plant establishment and root growth.

Growth of cabbage and leafy green roots is influenced (and in many cases is limited) by the soil profile. Hard pans, clay pans and generally compacted soil restrict root growth. This, in turn, reduces nutrient and water uptake, limits plant growth and reduces yields. Although cabbage and leafy greens are shallow rooted, under favourable conditions and in properly prepared soil, roots will grow to a depth of 45 cm to 60 cm.

Cabbage and leafy greens may be planted or transplanted on flat or raised beds. A raised bed will warm up more quickly and enhance earlier growth. Cabbage and leafy greens do poorly in excessively wet soils. Raised beds facilitate drainage and help prevent "wet feet" in low or poorly drained soils. Keep in mind, however, that cabbage or leafy greens planted on raised beds may require more irrigation during drought conditions.

Lime and fertilizer management refers to the application of optimal amounts of lime and fertilizer (or nutrient-containing materials) at the most appropriate time(s) and by the most effective method.

A.3.2 Fertilizer management

Recommendations based on soil tests result is the most effective lime and fertilizer management program possible. However, recommendations can be accurate only if valid soil sampling procedures are used to collect the samples submitted for analysis.

Recommending a specific fertilizer management program that has universal application for all cabbage and leafy greens fields is impossible. In addition to crop nutrient requirements and soil types, fertilizer recommendations should take into consideration soil pH, residual nutrients and inherent soil fertility. Therefore, fertilizer recommendations based on soil analysis have the greatest potential for providing cabbage and leafy greens with adequate, but not excessive, fertility. Apply only the needed amounts of fertilizer for optimum growth and yield. Excessive fertilizer application wastes fertilizer, encourages luxury consumption of plant nutrients and may cause fertilizer burn

A.3.3 Soil pH

Soil pH influences plant growth, the availability of nutrients and the activities of microorganisms in the soil. Keeping soil pH in the proper range is important for production of the best yields of high quality cabbage and leafy greens. Soil test results indicate soil pH levels and are used to recommend the amount of lime required to raise the pH to the desired range.

The optimum pH range for cabbage and leafy greens production is 6.0 to 6.5.

A.4 Cabbage disease management

Cabbage and leafy greens are susceptible to a number of diseases that may seriously injure or even destroy the crop. Some diseases may cause only minor spotting, but because the leaves are consumed, the quality may be reduced below market standards. Prevention is the key to controlling all diseases affecting crucifers. Some of the diseases can be controlled with timely fungicide applications and others must be prevented altogether. This section will aid in the identification of diseases and discuss environmental conditions that favour disease development. Sources of infection are discussed relative to specific diseases on specific crops.

Black-rot (Figure A.1)

Black-rot is caused by the bacterium *Xanthomonas campestris* pv. *campestris*. The bacterium attacks many species of the mustard family. Among these are cabbage, collard, kale, mustard and turnip. Plants may be affected at any stage of growth. This disease is seedborne and is often introduced by contaminated seeds or infected transplants. In some cases, the crop may be destroyed. In the field, the disease is easily recognized by the presence of large yellow to yellow-orange V-shaped lesions extending inward from the margin of the leaf.

**Figure A.1 — Black-rot**

When infected seeds germinate, the resulting young plants usually die quickly; however, these plants serve as an inoculum source for other plants. If infection occurs in young seedlings, the disease is much more severe because the main stem becomes infected and the disease becomes systemic and moves throughout the plant. These plants remain stunted and the veins in the stem are black. Heads developed from these plants deteriorate rapidly after harvest.

The bacterium enters the vascular system of the plant principally through natural openings and injuries on the leaf. In time, the bacterium spreads in the vascular system of the leaf and stem. The disease spreads and causes most damage in wet, warm weather. It does not usually spread in dry weather and is inactivated at temperatures below 10 °C. The bacterium can survive in the soil for 14 to 42 days, depending on the season, and in old cabbage stems for 244 days. The disease is also carried over on weed hosts such as "pepper grass" and with wild species of mustard, radish and turnip. The bacterium is spread by splashing rain, irrigation and running surface water as well as insects and other movement in the field while the plants are wet. Disease management strategies such as crop rotation away from contaminated land for two years and use of certified seed or transplants are effective. There is no remedial control for this disease.

Wirestem, Bottom Rot and Head Rot (Figure A.2)

Wirestem, bottom rot and head rot are caused by *Rhizoctonia solani*. This fungus also is a common cause of damping-off. Wirestem is normally more serious in transplant beds; however, it can be a serious problem after plants are transplanted to the field. Cabbage, collard and kale planted in early fall are more vulnerable to *Rhizoctonia* injury than spring plantings. Wirestem infected plants are first infected near the soil surface. The initial infection site may be as small as a pinpoint or extend an inch up the stems.

**Figure A.2 — Wirestem, bottom rot and head rot**

This area shrivels and becomes reddish brown; outer tissues slough off, leaving the woody inner stem exposed. The infected plant may be bent or twisted without breaking — hence the name. The amount of *Rhizoctonia* present is greatly influenced by the cropping history. Wirestem damage may be suppressed by adding a fungicide to the transplant water. Frequent irrigations during hot dry periods will reduce the incidence of the disease; water evaporation cools the soil surface.

Rotating with grain crops, deep turning and using a fungicide in the transplant water will greatly reduce the incidence of disease.

Black leg

Black leg, caused by the fungus *Phoma lingam*, is another disease that can cause serious loss to cabbage. Plants are usually infected in seedbeds. Usually the first symptom is an oval, depressed, light brown canker near the base of the stem. The canker enlarges until the stem is girdled. Circular light brown spots also appear on the leaves. Soon after cankers or spots begin to form, they are marked with numerous black dots that are the fruiting bodies of the fungus. The fungus lives for at

least three years in the soil and is carried on and in the seeds. Black leg is influenced by environmental conditions, with the severity of the disease in direct proportion to the amount of rainfall received. The fungus grows well at all temperatures suitable to cabbage.

Alternaria Leafspot (Figure A.3)

Alternaria leafspot, caused by the fungus *Alternaria brassicae*, may cause severe damage if left uncontrolled. The first symptom is a small dark spot on the leaf surface. As the spot enlarges, concentric rings, which are common to this disease, develop. Blight spots enlarge progressively and can defoliate a plant if left uncontrolled. *Alternaria* leafspot is best controlled by applying a fungicide on a schedule throughout the entire growing season.



Figure A.3 — Alternaria leafspot

Downy mildew of cabbage, collard and kale (Figure A.4)

Downy mildew, caused by the fungus *Peronospora parasitica*, can be transferred from the transplant bed; however, it also can be introduced to new field plantings by windblown spores. Plants can be infected at any time during their growing period. Young plants infected early show a white mildew effect mostly on the underside of the leaf; later, a slight yellowing can be observed on the corresponding upper surface. The young leaf, when yellow, may drop off. Older leaves enlarge as they turn tan in colour and papery in texture. The fungus produces a mass of gray growth, conidia, on the underside of the leaves.



Figure 4 — Downy mildew

The conidia, or seed bodies, are able to float long distances in cool moist air. With favourable weather, they may germinate in three to four hours and produce a new crop of seed bodies on a susceptible host in as few as four days. Moisture and temperature are very important to the reproduction of this disease. Drizzling rains and cool weather are very favourable for disease development. The fungus grows best and disease develops most rapidly when the night temperatures are about 7.8 °C for four or more consecutive nights and the day temperature does not rise much above 24 °C. A preventive spray schedule will help control downy mildew.

Downy mildew can infect turnip and mustard at any stage of growth. A greyish mould forms in spots and on the underside of the leaf. Later, a slight yellowing shows on the upper surface. Infected spots enlarge as they turn tan in colour and papery in texture. When the disease is severe, the entire leaf dies. Heavily infected leaves may have a watery appearance, wilt and die before the mould growth is evident. Occasionally, affected leaves will show hundreds of very small, darkened specks.

Downy mildew overwinters in turnip roots or on old tops left in the field. The fungi form thick-walled resting spores in the turnip stem. These tiny bodies become mixed with seed at harvest and can be shipped to new locations.

Downy mildew can destroy a field of greens within three to four days after it is first noticed. Usually, damage is most severe on cabbage and leafy greens grown in the spring because conditions favouring its development are more likely to occur at this time.

Sclerotinia sclerotiorum (Figure A.5)

Sclerotinia sclerotiorum is becoming more prevalent in cabbage fields as well as transplant beds and greenhouses. Recently this disease has also been identified on turnip, mustard and kale. The disease usually begins on the lower stem, causing a watery soft rot followed by white, cottonlike growth. Black sclerotia, overwintering structures that give rise to the spore-producing apothecia, develop later. The disease is favored by cool, wet weather, which may result in a massive steamlike cloud of spores being spread throughout an area. The disease can infect cabbage from the seedling stage to maturity.



Figure A.5 — *Sclerotinia sclerotiorum*

On mature cabbage, the entire head is often covered with the white mycelium and black sclerotia, sometimes referred to as "raisin head." The entire heads melt down, basically leaving a pile of sclerotia. The remarkable thing about this disease is that it does not cause any odour during the destructive process unless other saprophytic organisms invade, which do cause odour. The best defense against this disease is to transplant disease-free transplants and cultivate to cover any sclerotia. No chemical fungicides are recommended. Good rotation practices are usually all that is needed to manage the disease.

Cabbage Yellows (Figure A.6)

Cabbage yellows is caused by *Fusarium oxysporum* f.sp. *conglutinans*. The cabbage strain severely attacks many varieties of kale, cabbage and collard, and moderately affects turnip. The disease is often confused with black rot because of the similar symptoms. Both diseases cause leaf drop, curving stalks and the formation of buds on leafless stems. Yellows is more likely to produce a curve in the midrib or cause the leaf to grow on only one side. *Fusarium* can live for several years in the soil without being associated with any plant parts. After the pathogen becomes established, it spreads by rain and by equipment moving from one field to another. The fungus enters root hairs, and spores are produced inside and outside of affected stems. Most currently recommended varieties are resistant to yellows.



Figure A.6 — Cabbage yellows

Leafspots of Mustard and Turnip

Leafspot of mustard and turnip is most often caused by downy mildew (*Peronospora parasitica*), white spot (*Cercospora brassicae*), anthracnose (*Colletotrichum higginsianum*) and cercospora leafspot (*Cercospora brassicicola*).

***Cercospora* Leafspot** (Figure A.7, left)

Cercospora leafspot is also a major problem on mustard and turnip. This disease is sometimes called frog-eye leafspot. Both *Cercospora* and *Cercospora* develop under similar environmental conditions. The disease is most prevalent in a temperature range of 13 °C to 18 °C, with plenty of moisture.

***Cercospora* Leafspot** (Figure A.7, center)

This fungus is primarily a problem on turnip and mustard. The spots caused by *Cercospora* are white and much larger than those caused by *Cercospora*, and are referred to as pale-spot. White spot causes pale green to greyish white circular to angular spots on leaves. Each spot has a yellowish to brown halo or border around it. Numerous spots may occur on one leaf and merge, killing the entire leaf.

White spot overwinters on such plants as turnip, mustard, collard, cabbage and kale. The fungus



Figure A.7 — *Cercospora* leafspot (left), *Cercospora* leafspot (center) and anthracnose

produces numerous spores in each infected spot on the leaf. The spores are blown long distances by the wind. White spot reproduces and spreads at a temperature of 21.7 °C to 30 °C. This disease is usually more damaging to the fall greens crop.

Anthracnose (Figure A.7, right)

Anthracnose is often a serious problem on turnip and mustard and can infect kale and collard. The leafspots are small, pale gray desiccated circular spots. The same fungus infects turnip roots when spores fall from the leaves to the roots. The infected areas begin as small sunken dry spots. Under moist conditions, bacterial soft rot develops, destroying the entire root. The fungus overwinters on crop debris and in volunteer plants. The disease is most severe at temperatures of 26 °C to 30 °C, with plenty of moisture. The disease is prevented by rotation, deep turning and fungicide sprays.

White Rust (Figure A.8)

White rust is most often seen on spinach and is caused by *Albugo* sp. White rust affects other crucifers. It has been observed on mustard in a few instances. The disease overwinters by means of oospores. In perennial hosts, such as horseradish, it persists in crowns and roots. Secondary spread is by conidia (spores), which are carried by air currents. Moisture on the host surface is essential for germination. White rust is recognized by a white growth, usually on the underside of the leaves. White rust is controlled by soil and foliar applied fungicides.



Figure A.8 — White rust of spinach

Root-knot Nematode (Figure A.9)

Root-knot nematode is the only nematode of economic importance that affects crucifers. All species of root-knot are considered pests of crucifers. Cabbage, turnip, mustard and spinach are the main crops affected. Stunted growth and chlorosis are the above-ground symptoms. Classic galling of the root system is key for diagnosing root-knot nematode damage. Rotation and chemical treatment are the control practices.



Figure A.9 — Root-knot nematode

Viruses (Figures A.10, A.11)

Turnip mosaic virus disease is caused by any of many strains of turnip mosaic. These strains infect almost every crucifer, including weeds such as shepherd's purse and charlock.

Infected cabbage plants have mottled, distorted leaves. The production of leaf bloom is reduced, and the whole plant is stunted, especially when infected early in the season. Some strains show a darkened ring effect, especially on the older foliage, and irregular dead areas between the veins. This virus may be responsible for a stippling symptom on the outer and inner leaves of cabbage heads. The virus overwinters in perennial weeds. It is carried by many species of aphids.

Cauliflower mosaic virus disease is found more frequently on turnip. Plants infected are rarely stunted, but most express a mosaic pattern. The most distinctive symptom is vein clearing. On cabbage, a black stippling symptom develops on the outer leaves of the mature heads.

Cabbage mosaic causes black specking of cabbage



Figure A.10 — Viruses

heads at harvest or during storage. This mosaic is caused by a single or dual infection of viruses. A strain of turnip or cauliflower mosaic virus may be responsible. Infections late in the season cause minor losses, and early infections cause serious losses. The turnip and cauliflower mosaic viruses are transmitted principally by cabbage aphids and green peach aphids. Neither virus is seedborne.

Tomato spotted wilt virus (TSWV) can infect cabbage at any stage of growth. The virus is transmitted by thrips.



Figure A.11 — Viruses

A.5 Insect management

On-farm components of insect management

For example, diamondback moth caterpillar (DBM) resistance to insecticides has been documented for all major insecticide classes: carbamates, organophosphates and pyrethroids. Various formulations of *Bacillus thuringiensis* (BT), occasionally tank-mixed with certain organophosphate insecticides, have had continued success. On-farm tests have consistently yielded 85 percent or more marketable cabbage where these compounds have been used with the following basic practices:

- use of specially designed high pressure/high volume application equipment;
- application of insecticides at delivery speeds of no more than 6.5 km/h;
- early, close-interval applications (every five days or less) of BT;
- the addition of adequate spreading/sticking agents;
- use of an organophosphate insecticide tank-mixed with BTs only as needed when DBM populations begin to increase;
- avoidance of insecticides that have proven to antagonize efforts to control DBM; and
- pest population monitoring so that other insecticides can be used only when necessary.

Although these measures will not eliminate insecticide resistance, they will help to reverse it. After several years of this method of management, DBM can develop strains that will again be susceptible to currently ineffective insecticides.

Foliage-feeding caterpillars

Foliage feeders are the most important pests of cabbage and always pose a serious threat to quality and yield. Even though resistance to insecticides is a major concern, the single most significant problem in control of these pests is the difficulty in maintaining adequate coverage of the plants with insecticidal spray. Most of the eggs of the caterpillar pests are laid either in masses or singly on the underside of the foliage. The larvae, until mature, generally feed on the underside of the foliage or in the bud, making control very difficult.

Another significant problem is that different species of caterpillars are susceptible to different insecticides. When several species are infesting cabbage and greens at the same time, several insecticides may be necessary for adequate control. This increases the cost of production and also creates antagonistic effects in the control of certain pests. Identifying the species complex of a given infestation, maintaining control of the primary species and making judicious insecticide applications for the less significant pest as its population begins to increase are extremely important.

Diamondback moth caterpillar (Figures A.12, A.13, A.14, A.15)

The diamondback moth caterpillar (DBM), *Plutella xylostella*, is the single most destructive pest to cabbage and leafy greens worldwide. Insecticide resistance has been documented in every corner of the globe; DBM is the key pest in most crucifer cultures. By definition, a key pest is the species whose presence triggers the initial, often early, insecticide applications. These early applications often destroy the natural enemies of both the key pest and secondary pests. Secondary pests may then become economically important. Biorational compounds that are "soft" on natural enemies and provide adequate control of DBM have found a solid niche in our current management strategies.

Except for the adult stage, DBM completes its whole life cycle on the plant. DBM moths lay eggs singly on the underside of leaves. The larvae hatch in a day or so and feed on the underside. The larvae grow as large as 1.6 cm. The larvae are green and hang by silken threads when disturbed. They are very active when disturbed. Initial damage is small incomplete holes caused by young larvae and larger complete holes caused by mature larvae. The holes become larger as the leaf develops. The entire plant may become riddled with holes under moderate to heavy populations. Larvae also feed in the developing heads of cabbage, causing deformed heads and encouraging soft rots. The pupae of DBM are green and encased in a netlike cocoon attached to the foliage. Pupae reduce quality as a contaminant.

DBM attacks all types of leafy greens and cole crops during all parts of the growing season. DBM is a cold-hardy species, so it can survive cold temperatures in the caterpillar stage. During temperatures below approximately 10 °C, larvae cease to feed. As the temperature rises above this mark, feeding resumes. The life cycle is retarded during cooler temperatures. In contrast to this, DBM populations may increase dramatically at temperatures above approximately 26.7 °C. The life cycle may be as long as 50 days at low temperatures and as short as 15 to 20 days during high temperatures. There may be 10 or more generations during warm years.

Suppression of DBM populations with preventive treatments is the most efficient control method. Preventive treatments with biological compounds should be made on a five-day interval. A seven-day interval may be used if no worms are found, especially during cool winter weather. Cleanup sprays may be necessary periodically. Heavy rain showers may reduce populations dramatically. Monitor crops two to three times per week and make decisions on changes in control strategies. Note: Transplant beds should be kept free of infestation.



Figure A.12 — Diamondback moth caterpillar (adult)



Figure A.13 — Diamondback moth caterpillar (young larva)



Figure A.14 — Diamondback moth caterpillar (mature larva)



Figure A.15 — Diamondback moth caterpillar damage

Cabbage Looper (Figures A.16, A.17, A.18)

The cabbage looper, *Trichoplusia ni*, is the second most destructive pest to cabbage and leafy greens. Biological insecticides are moderately effective, and other insecticides often are needed for adequate control.

The cabbage looper is most destructive in early summer and fall. The larvae are large worms (up to 3.8 cm) that feed on leaves, creating large holes. Larvae are sluggish and hold on to the plants tenaciously when attempts are made to remove them. This is the only caterpillar pest that has only three pairs of fleshy prolegs near the rear. Except for the adult, the cabbage looper is like the DBM, spending its entire life cycle on the plant. The eggs are laid on the underside of the leaves, and larvae hatch and feed on the underside, with the pupae attached to the underside in a protective cocoon. The pupae are green and two to three times as large as DBM pupae.

Controls should be initiated at the first signs of moth activity, whether this is eggs or young larvae. Monitoring the crop two or three times per week helps in making control decisions.



Figure A.16 — Cabbage looper (adult)



Figure A.17 — Cabbage looper (larva)



Figure A.18 — Cabbage looper (pupa)

Cabbage Webworm (Figure A.19)

The cabbage webworm, *Hellula rogatalis*, is occasionally a serious pest of cabbage, collard and kale. When it occurs, growers are usually caught off guard. Because it has a habit of feeding in the bud area, producing moderate to heavy webbing, growers have difficulty controlling it.

Mature larvae are about 19 mm long and have five dark stripes on a dirty gray body. The head capsule is black with a distinct, white V-shaped mark.

Control for the webworm should be initiated at the first signs of an infestation. Some of the same insecticides used against the cabbage looper give good control if coverage in the bud area is excellent.



Figure A.19 — Cabbage webworm

Imported Cabbageworm (Figures A.20, A.21)

The imported cabbageworm, *Pieris rapae*, is rarely an economic pest on cabbage and leafy greens if controls for other worms are being applied. The adult is a common butterfly that lays eggs singly on the leaf surface. The larvae are green and have a velvety appearance. Larvae have a narrow, light yellow stripe down the back. Initiate controls when a buildup of larvae occurs.



Figure A.21 — Imported cabbage worm (larva)



Figure A.20 — Imported cabbage worm (adult)

Cross-Striped Cabbageworm (Figure A.22)

The cross-striped cabbageworm, *Evergestis rimosalis*, is occasionally a pest in the cooler regions. It is usually not too difficult to control if the crop is being monitored and timely controls are initiated.

The larvae may be slightly longer than 19 mm and have black and white transverse stripes down the back. Below the transverse stripes on each side is a black and yellow stripe along the length of the body. Initiate controls when larvae are observed.



Figure A.22 — Cross-striped cabbageworm

Beet Armyworm (Figure A.23)

The beet armyworm, *Spodoptera exigua*, may be a pest to fall plantings of cabbage, collard, kale, mustard and turnip. Heavy populations that have increased on other crops move to greens crops when food sources become scarce. Diseases during this period often suppress populations below an economic level, but occasionally the beet armyworm can devastate a crop. The beet armyworm is one of the most difficult caterpillars to control. It is naturally resistant to most commonly used insecticides. If it develops into very large populations, control might not be regained. The moth lays masses of eggs on the undersides of leaves. The mass may have up to 150 eggs and is covered with scales off the moth's body, giving the mass a cottony appearance.



Figure A.23 — Beet armyworm

The larvae are light green to dark olive green and sometimes have stripes of these colors down the back. Above the second pair of legs near the head end is a black spot. Larvae may be 3.2 cm long. Initiate controls if egg masses or larvae are found on 2 percent to 3 percent of the plants. To suppress small populations, apply pesticide every five days. A three- to four-day spray interval may be necessary to bring moderate to heavy populations under control.

Corn Earworm (Figure A.24)

The corn earworm, *Helicoverpa zea*, formerly *Heliothis zea*, can be a pest of almost any crop but creates the most serious threat to cabbage. The larvae tunnel into the buds of young plants and the heads of older plants. The larvae are common on many plants and are easily recognized when extracted from the tips of ears of field corn.

Make treatments when small larvae are observed on 4 percent to 5 percent of the plants or if large larvae are found on 2 percent or more on the plants.



Figure A.24 — Corn earworm

Cutworm (Figure A.25)

The granulate cutworm, *Feltia subterranea*, is the most common species in cabbage and leafy greens production areas. Cutworms may survive long times in the larval stage, so large larvae may be present at the time of planting, especially when planting is made into previous crop residue. Cutworms are recognizable by their greasy dingy grey colour and C-shaped posture when at rest. Cutworms feed at night, causing damage to stems and foliage, and retreat into the soil during the day. Treatments for cutworms should be anticipated by inspecting the soil during land preparation so insecticides can be incorporated at planting.



Figure A.25 — Cutworm

Other Pests

Seedcorn Maggot (Figure A.26)

The seedcorn maggot, *Delia platura*, is a secondary pest that attacks many types of plants. The maggot is a general feeder that is attracted to decaying organic matter. When seedlings are placed under stress, they are most subject to attack by the seedcorn maggot. This occurs most often during the cooler months of planting when transplants are developing slowly. The immature stage is the maggot, which eventually becomes a small housefly-like adult. The maggot damages the plant by entering the roots and stem. Usually, the plant is weakened beyond recovery. Many plants can be killed. The most effective control is to anticipate the conditions that create a favourable environment for maggot attacks and apply the preventive, soil-applied insecticides. Cabbage and collard are the most susceptible to attack.



Figure A.26 — Seedcorn maggots

Aphids

Several species of aphids attack cabbage and leafy greens. Aphids may be present in fields all year, but they do not always cause significant damage. Aphids are subject to control by several diseases and insect parasites. If broad-spectrum pesticides are used sparingly during the early stages of plant development, aphids usually pose very little threat. However, under conditions that favour rapid development, aphid populations can explode to damaging levels. Cool, dry weather during the spring or fall is ideal for the development of high populations.

Cabbage Aphid (Figure A.27)

The cabbage aphid, *Brevicoryne brassicae*, is common. Its appearance differs from other species, with a powdery, waxy covering over its body. Its body is greyish-green. This aphid feeds primarily on cabbage, collard and kale, and seldom feeds on mustard or turnip. The cabbage aphid is difficult to



Figure A.27 — Cabbage aphids

control and should be monitored closely when it is discovered colonizing. Treatments should be made if populations spread beyond the small initial colonies.

Turnip Aphid

The turnip aphid, *Lipaphis erysimi*, resembles the cabbage aphid, but lacks a waxy covering and is pale green. The turnip aphid feeds mostly on turnip and mustard. It is difficult to control when conditions favour rapid development.

Green Peach Aphid (Figure A.28)

The green peach aphid, *Myzus persicae*, feeds on many vegetable crops and row crops. The wingless types are yellowish-green, green or pink. The winged forms are usually darker. The green peach aphid is most destructive to turnip, mustard, kale and collard but can cause problems in cabbage. Control may be difficult, but can be accomplished with thorough coverage of insecticide sprays. Insecticide controls on seedling stage greens should be avoided until parasites and diseases are given a chance to suppress the population.



Figure A.28 — Green peach aphids

Turnip Root Aphid (Figure A.29)

The turnip root aphid, *Pemphigus populitransversus*, feeds on cabbage, collard, kale, mustard and turnip. Infested plants may be yellow and stunted, but under good growing conditions late infestations often result in very little yield loss. However, turnip roots will be disfigured or discoloured and even unmarketable. Preplant incorporation of soil insecticides is the best means of control. Usually this aphid develops higher populations on late fall or early spring plantings. It is difficult to predict, so apply preventive controls only if a history of problems exists.

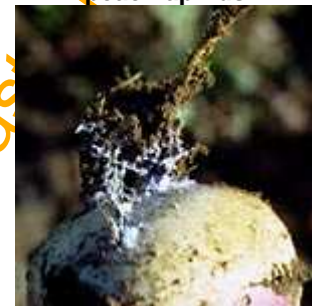


Figure A.27 — Turnip root aphids

Thrips (Figure A.30)

Several thrips species feed on cabbage and collard sparingly. Occasionally, damage may be noted. Thrips may be found aggregated in areas damaged by small worms. This behaviour is suspected to favour the acquisition of moisture and other nutrients in the exudates of the worm-damaged tissue.

Because cabbage is susceptible to tomato spotted wilt virus (TSWV), thrips may become a more important pest in the future. Occasionally, thrips cause a mechanical, "buckskin-type" injury. Controls are not recommended unless heavy populations are observed.



Figure A.30 — Thrips

Harlequin Bug (Figures A.31, A.32)

The harlequin bug, *Murgantia histrionica*, is rarely a pest of commercial plantings of kale, mustard or turnip. It is more likely to be a problem in cabbage and collard. The harlequin bug is a brightly marked shield-shaped bug that has piercing, sucking mouthparts. It feeds on the veins of leaves, causing the leaf to wilt. Their eggs are barrel-shaped and laid in clusters on the leaves. Eggs are white with two black bands around them. Initiate controls if one bug per 10 plants is found.



Figure A.31 — Harlequin bug (eggs)



Figure A.32 — Harlequin bug (adult)

Stink Bugs (Figures A.33, A.34)

Several species of stink bugs attack leafy greens. One of the most common species is the Southern green stink bug, *Nezara viridula*. Stink bugs commonly infest turnip and mustard more than cabbage and other leafy greens. Stink bugs pierce the plant cell and suck out plant sap. The most common problem with stink bug infestations is that they are a contaminant in processed greens. Control stink bugs when wilting is observed from feeding or when they are found above the accepted threshold for processing.



Figure A.33 — Stink bug (eggs)



Figure A.34 — Stink bugs (nymphs and adults)

Chinch Bug (Figure A.35)

The chinch bug, *Blissus leucopterus*, may infest turnip and mustard crops, especially when they are planted near corn or small grains. Chinch bugs are small sucking bugs that prefer to feed on grass crops but may migrate to vegetables when these hosts become unsuitable. Even though the adults have wings, they do not fly. Chinch bugs are difficult to control, so early scouting for chinch bugs migrating from nearby sources is important. Initiate controls if a large migrating population is detected.



Figure A.35 — Chinch bug

False Chinch Bug (Figure A.36)

The false chinch bug, *Nysius raphanus*, is a fragile sucking bug that is primarily a pest on turnip and mustard. False chinch bugs may infest fields in large numbers. They damage plants by feeding on the veins on the undersides of the leaves. They inject enzymes during the feeding process, causing a green wilting of the leaf margins. This condition is variable; no information is available on how many bugs cause wilting. Therefore, decisions on control are arbitrary, but heavy infestations should not be left uncontrolled.



Figure A.36 — False chinch bug

Silverleaf Whitefly (Figure A.37)

The silverleaf whitefly, *Bemisia argentifolii*, is a sporadic pest of cabbage and leafy greens. The adult is smaller than a gnat and is bright white with a yellow head and thoracic region. It is mothlike in appearance and feeds on the undersides of leaves, where it also lays eggs. The larvae hatch and become sessile on the underside of the leaf. The adults fly rapidly from the plant when disturbed. Heavy feeding can result in small yellow spots on the foliage of the tender leafy greens. When on cabbage or collard, the whitefly is more a contaminant than an injurious pest. Control for whiteflies is not recommended unless populations in the area are becoming excessively large or honeydew and/or sooty mould is developing on the foliage. Whitefly control is strictly a judgment decision without threshold guidelines.



Figure A.37 — Silverleaf whitefly

Vegetable Weevil (Figure A.38)

The vegetable weevil, *Listroderes costirostris*, may be a pest of seedling cabbage and leafy greens, especially under cool growing conditions. Adults are about 6.35 mm to 10 mm long with a stout snout. They are brownish-gray with two nondescript whitish marks on the wing covers. The larvae are white legless grubs. The adult weevil and grub feed directly on the foliage and stems of greens. They can cause significant stand reductions on young plantings. If weevils or grubs are found feeding, apply treatments if more than 5 percent of the stand is being damaged.



Figure A.38 — Vegetable weevil (larvae)

Yellow-margined Leaf Beetle (Figures A.39, A.40)

The yellow-margined leaf beetle, *Microtheca ochroloma*, is a small beetle that infests turnip and mustard, especially at field margins. The beetle is black with dirty, yellow-margined wing covers. The larvae are black and alligator-shaped with three pairs of stocky legs. The larvae and adults feed all over the leaves, leaving them with a laced appearance. The pupae may be found in white, round and loosely woven cocoons near the crown of the plants. Initiate controls when larvae and adults are causing noticeable damage and are still present in the field.



Figure A.39 — Yellow-margined leaf beetle (adult)



Figure A.40 — Yellow-margined leaf beetle (pupa)

A.6 Weed management

Managing weeds in leafy greens and cabbage is an important component of overall crop production. With the increased emphasis on integrated pest management and reduced pesticide inputs, weed management efforts will continue to intensify.

Weeds compete with the crop for light, water, nutrients and physical space. In addition, weeds can harbor harmful insects and diseases that can severely damage the present or proceeding crop. This is especially important with crucifer crops such as greens and cole crops, because many common weeds can harbor black-rot (*Xanthomonas campestris*). This disease is a serious problem for many

cole crops. Wild radish can also harbor and increase problems with diamondback moth caterpillars (*Plutella xylostella*). Weeds also interfere with the harvesting process, either through decreased efficiency with the hand-harvested crops or contamination of machine-harvested commodities. In the case of leafy greens for processing, weed contamination may make the product unmarketable.

Cultural weed management practices are the most effective methods of weed control because of the lack of chemical weed control alternatives. Such practices include rotation and the stale seedbed technique. The first step in cultural weed management is growing a good crop. Proper fertilization as well as good disease, insect and nematode management are critical. Most leafy greens and cabbage are not highly competitive and early season weed control is necessary for these crops to gain a competitive advantage.

Rotation will continue to be one of the vital components to a successful weed management program in cabbage and leafy greens. Rotation also benefits crop production by lowering the levels of insects and soilborne pathogens and maintains better soil tilth. From a rotational standpoint, controlling weeds in one crop is easier than in another because of: 1) the ability to cultivate, 2) the ability to use different herbicides and 3) the economics of hand weeding. One problem with leafy greens production is the inability to cultivate; thereby, rotational crops that can employ cultivation will help to reduce weed levels.

The stale seedbed technique employs the use of a nonselective herbicide such as paraquat or glyphosate to kill emerged weeds before planting the crop. In the stale seedbed method, the seedbed is prepared as usual but the crop is not planted. The weeds are allowed to emerge and are then killed by the nonselective herbicide. The crop is planted with minimal soil disturbance to prevent stimulation of weed germination. This method can also be used to kill weeds that emerge before the crop. However, great care must be taken to properly identify seedling weeds vs. the crop. This generally works well with weeds such as nutsedge, which commonly emerges three to four days before most crops. Another, nonchemical, method involves reworking the desired area several times before planting, destroying weed seedlings as they emerge. This method seeks to reduce the levels of infestation. Coupled with chemical control just prior to planting, it is an effective means of reducing weed problems.

Mechanical weed control has been, and will continue to be, one of the primary methods of weed control for cole crops such as cabbage, cauliflower, broccoli or collard. Cultivation works extremely well for transplanted crops where small weeds can be eliminated without damaging the crop. Care must be taken to avoid root pruning and excessive leaf damage. If the crop is direct seeded, care must be taken to avoid covering the crop with soil.

Carryover from herbicides is a critical issue with many vegetable crops, especially leafy greens. Leafy greens such as turnip and mustard are very sensitive to many soil active herbicides and great care must be taken to avoid such possibilities. Be sure to know the cropping history of the area, including herbicide use. Rotational restrictions are listed on all herbicide labels and must be followed to avoid severe injury or crop death.

A.7 Irrigation

Even though cabbage and leafy greens are primarily cool-season crops, irrigation will significantly increase their yield and quality in most years. These crops are shallow rooted, and even though their water requirements are less than those for most crops, they can use up the available moisture in the shallow root zone very quickly. The most serious yield reductions result when moisture deficits occur during late development and, in the case of cabbage, during head formation.

Sprinkler irrigation is the only method that has proven practical for irrigation of these crops. Any sprinkler system used on cabbage or greens should be capable of delivering at least 3.2 cm of water each week. In addition, the system should apply the water slowly enough to prevent run-off. With most soils, a rate less than 5 cm per hour safely prevents runoff. Drip irrigation is often used when cabbage, collard or kale are double cropped with another vegetable on mulched beds.

Scheduling irrigation

The water used by a crop and the water evaporated from the soil is commonly referred to as evapotranspiration (ET). ET rates for cabbage and greens rarely exceed 3.8 mm per day. Factors that

affect ET are the stage of crop growth, temperature, relative humidity, solar radiation, wind velocity and plant spacing.

Plant seeded crops into moist soil and irrigate frequently with light applications until germination occurs. If possible, apply 6.35 mm every other day to ensure complete germination. The soil should not become waterlogged.

Plant transplants into moist soil and irrigate with 7.6 mm to 12.7 mm immediately. This helps to ensure good contact between the soil and roots.

Once a root system is established, maintain soil moisture to a depth of 30 cm. No more than 50 percent of the available water should be depleted before irrigating. This means that net irrigation amounts should be between 12.7 mm and 25 mm per irrigation. The actual amount applied should be 10 percent to 20 percent higher to account for evaporation losses and wind drift. The irrigation frequency will depend on the daily ET rate. In general, during peak water-use periods, sandy soils need 0.6 inch twice a week, and clay soils need 30 mm once a week.

Irrigation can best be managed by monitoring the amount of moisture in the soil. Tensiometers or resistance blocks can be used to measure soil moisture. For best results on cabbage and greens, maintain soil tension below 30 centibars. For cabbage, maintaining uniform moisture during head formation is especially important to prevent bursting. Maintain soil moisture until harvest.

A.8 Harvest and handling

Harvesting

Many leafy greens (including cabbage, collard, kale, mustard and turnip) are cut by hand and packed directly in the field for the fresh market. Necessary trimming to remove any yellowed, brownish or damaged leaves should be done as the plants are picked and before they are tied into bunches and placed into containers. In addition, cabbage may be cut by hand, loaded into a bulk container such as a field wagon and hauled to a packing shed for trimming, grading and packaging. During cabbage harvest, cut stems so that they do not extend more than 12.7 mm beyond the point of attachment of the outmost leaves. Heads may be damaged by excessively long, protruding stems. Bunch collards according to uniform size. Coarse, tough stems of plants should not be packed. Harvest leaves of turnip, mustard and kale when tender by feel, and avoid those showing tough stems.



Figure A.45 — Damaged or diseased leaves should be removed before field packing.

Ensuring a quality pack can be a problem for hand harvesters. Field labour must be adequately trained and supervised to harvest only optimum maturity and/or sized leaves or rooted plants to meet potential buyer's quality standards.

Field sanitation is very important to reduce the spread of disease among plants. Cutting tools are a primary source of disease carryover. Knives should be routinely sanitized to keep disease inoculum from building on their surfaces and infecting sound cabbage heads or leafy greens. Worker's knives should be collected at the end of a harvest day and placed in a bucket of sanitizer (use 28 g of household bleach per gallon of water). For better protection, place buckets of sanitizer at the end of selected rows in the field so workers can sanitize their knives at regular intervals to reduce disease build-up over the course of the production day.

Postharvest handling/cooling

When harvesting cabbage or other leafy greens, field crews should exercise care to minimize bruise damage and leaf punctures. Cabbage is sometimes considered a "hardware" item, because it is thrown into bulk containers in the field or at the packing shed. Outer leaves are broken and heads

burst when subjected to impact damage. Leaves of leafy greens are crushed if they are overpacked into field boxes. If not used properly, cutting tools will puncture leaves. Any cuts or breaks in the leaves or heads will cause excessive wilting and provide avenues for decay pathogens.



Figure A.46 — Pitching cabbage into field wagons or packing line bins causes splitting of heads.



Figure A.47 — Harvested greens should be shaded from direct sunlight to preserve quality.

Cabbage and other greens wilt quickly when there is a delay in removing them from the sun. Leafy greens should be harvested during the coolest part of the day to minimize shrivelling and field heat accumulation. If delays occur during packing, shade greens from direct sunlight.

Leafy greens should be cleaned before marketing. Bunches of collards and leaves of mustard, turnip and kale tied in half-dozen bundles are laid on a flatbed trailer and hauled from the field station. A straight-line packing belt conveys bunches beneath spray washers where greens are cleaned to remove sand and dirt and refreshed to improve their appearance. Workers place bundles coming off the end of the belt onto racks and into a storage cooler. Direct field packing of boxed leaves is also done without washing at the request of the buyer.

Quality maintenance is best achieved for leafy greens if they are precooled before shipping. Field workers should trim loose leaves from cabbage during harvest because these leaves interfere with cooling. Buyers prefer three to six wrapper leaves to remain. Packing line graders will typically remove any yellowed, insect damaged or disease damaged heads before boxing. Boxes should have structural integrity (use only new boxes) to prevent product crushing during stacking, loading and distribution. Cabbage is best cooled by vacuum or forced air because rapid air movement is needed to remove heat from solid heads. Other leafy greens (collard, kale, mustard and turnip) should be rapidly cooled using one of the methods above. In addition, most buyers require icing for these greens to provide needed moisture for freshness and crispness. After the field boxing of leaves, they may be taken to the shipping location where a shovel of ice is added to greens in each box. Washed bunches of greens are removed from cooling racks and bulk loaded into trucks by being laid in rows, with top icing for each row. Icing takes 1 kg of ice for every 1.8 kg of greens to maintain the temperature below 4.4 °C. All leafy greens, including cabbage, should be cooled to 0 °C before marketing.

Quality grade standards

Collard and broccoli greens shall meet the requirements set out in Clause 4 of this standard.

Storage/shipping

Other leafy greens (collard, kale, mustard and turnip) require the same storage conditions (temperature 0 °C; humidity, 95 percent) but have a shelf life of only two weeks. This is due to their higher respiration rate and leafy nature, which causes them to lose moisture rapidly. In addition to cold storage, greens should be top iced to retain crispness. These greens are also ethylene sensitive and should not be stored or shipped with ripening tomatoes, cantaloupes or fruits such as peaches.

Annex B gives guidance for cold storage and refrigerated transport for cabbages. Certain relevant modifications are required to customise it to suit the requirements for leafy greens.

Annex B (informative)

Guide to cold storage and refrigerated transport

B.1 Scope

B.1.1 This annex gives guidance on the operations to be carried out before and the conditions to be met during the cold storage and refrigerated transport of round-headed cabbages (*Brassica oleracea* L. var. *capitata* L., and *Brassica oleracea* L. var. *sabauda* L.), for maintaining quality and avoiding deterioration.

This annex is applicable to roundheaded cabbages intended for human consumption.

B.1.2 This annex gives general recommendations for the cold storage and refrigerated transport of round-headed cabbages.

These recommendations may need to be modified to suit particular cultivars of round-headed cabbage, local climatic conditions, cultivation practices and market requirements, distances of transportation, etc. Experts will be able to establish those recommendations most appropriate for particular market requirements, and ecological and agrotechnical factors. In addition, the quality of the harvest and the storage conditions attainable in particular transport vehicles and cold stores may necessitate modifications to these recommendations.

Subject to local conditions and the fact that cabbages are living matter, the application of the recommendations made in this annex should enable much wastage during refrigerated transport and cold storage to be avoided.

B.2 Conditions of harvesting and storage

B.2.1 Harvesting

Cabbages should be harvested when ripe (firm "head"), i.e. when the size and form of the head of the cabbage is characteristic of the cultivar in question, and during a period of dry weather.

NOTE 1 Premature harvesting may lead to an excessive tendency of the cabbages to wither and, conversely, delayed harvesting may induce bursting of the cabbages.

The best period for harvesting is early in the morning, in dry weather, in the absence of dew and, in the case of irrigated cultivation, 10 days to 15 days after the last irrigation (in order to avoid excessive turgidity of the tissues, cracks in the heads and rotting leaves).

Cabbages harvested in wet weather should be allowed to dry before being stored and transported.

Cabbages damaged or frozen, even partially, should be rejected.

The butt should be cut off slightly below the point from which the outer leaves originate, the latter remaining firmly attached. The cut should be made cleanly and the butt should have a maximum length of 3 cm, in order to avoid cabbages being damaged by mechanical action during handling.

B.2.2 Characteristics for storage

Cabbages intended for storage should be sound, of good quality, not run to seed and, depending on the cultivar, of mass 1.6 kg to 3 kg for white cabbage, and 1 kg to 2 kg for red cabbage.

Cabbages should be free from disease and physiological defects.

The heads should be well covered and free from parasites, bruises and damage or injuries due to frost. They should be clean and free from earth fragments or other foreign materials. Their content of agrochemical product residues should not exceed the limits established by the relevant producing or importing country.

The heads should be free from abnormal surface moisture. They should be covered by at least one layer of outer leaves.

B.2.3 Place of storage

Cabbages should be stored in refrigerated cells of maximum capacity 500 t; the cells should be previously disinfected, free from insects and vermin, aerated and cooled.

The storage of cabbages in the vicinity of products which emit ethylene should be avoided since this may affect the quality of the cabbage by inducing cracks in the head of the cabbage and yellowing and abscission of the leaves.

The time taken to fill a cell should be no longer than 7 days.

B.2.4 Method of storage

Cabbages may be stored in bulk or in standardized containers.

Cabbages stored in bulk should be ventilated in the vertical direction, and the depth of cabbages in any stack should not exceed 3 m.

Cabbages stored in standardized containers should be ventilated in the vertical or in the horizontal direction or in top-ventilated cells. The height of stacks should not exceed 6 m, and a minimum free space of 80 cm should be left between the top row of containers and the ceiling of the cell. The cabbages should be arranged in rows with their butts facing upwards.

The storage system should ensure good air circulation; it is therefore necessary to leave a space of 5 cm to 10 cm between stacks, and a space of about 65 cm between stacks and the wall.

B.3 Optimum storage conditions

See CD/K/378:2010.

B.3.1 Air temperature

The average air temperature in the cold store should be maintained between 0 °C and 1 °C.

The temperature at the centre of a stack should also be between 0 °C and 1 °C, although white cabbage is able to tolerate a temperature of -0.8 °C.

NOTE 2 Reducing the temperature to below -0.8 °C may cause decomposition of leaf tissue.

Owing to the respiration of cabbages, the temperature at the centre of a stack will increase rapidly if the stacking pattern is incorrect and the ventilation inadequate, and therefore the product temperature should be monitored within representative stacks.

B.3.2 Relative humidity

The relative humidity should be maintained between 90 % and 98 %.

B.3.3 Air circulation

The air circulation during storage and transportation should be such (0.25 m/s to 0.40 m/s) that the temperature and relative humidity specified in B.3.1 and B.3.2 are maintained constant and uniform.

B.3.4 Storage life and quality control

The storage life of cabbages depends on the cultivar, the quality and the storage conditions (see B.6). The storage life of most cultivars falls into one of three categories: short term (3 months to 5 months), mid term (4 months to 6 months) and long term (5 months to 7 months).

During the storage period, regular quality control of the product should be carried out.

B.4 Operations at the end of storage

Before marketing, it is necessary to examine cabbages and to discard yellowed or diseased outer leaves, to retrim the butt if necessary, and to discard split or rotten heads.

B.5 Refrigerated transport

To maintain their quality during transportation, cabbages should be packed in containers standardized in the country concerned.

The duration of transport may be 2 days to 3 days at a temperature of 0 °C to 15 °C, or 8 days to 10 days at a temperature of 0 °C to 1 °C.

B.6 Influence of horticultural factors on storage life 1 and defects arising during storage**B.6.1 Influence of horticultural factors on storage life**

Certain ecological or agrotechnical factors have an adverse effect on the storage life of cabbages. These factors may be summarized as follows:

- a) cabbages which are harvested too early or too late (e.g. cabbages which have burst or run to seed);
- b) cabbages (particularly spring, summer and autumn varieties) having leaves which are excessively curled and which do not adhere tightly to the head;
- c) cabbages from land which has been over-treated with nitrogenous fertilizer;
- d) cabbages harvested in wet weather;
- e) cabbage heads damaged by lesions caused by frost (see note 3) or which have lost most of their leaves or which have had too much of their tops knocked off.

NOTE 3 Certain cultivars of green cabbage which are resistant to cold are able to withstand temperatures slightly below 0 °C but not freezing.

B.6.2 Defects arising during storage

In general, a distinction is made between damage of physiological origin and damage of biological origin.

B.6.2.1 Physiological damage

Physiological damage may be characterized by


- a) desiccation of the outer leaves, owing to insufficient relative humidity during storage;
- b) a glassy appearance of the leaves when the storage temperature has been too low (freezing); the leaves will turn brown on warming;
- c) the appearance of small brown specks, owing to lack of oxygen during storage (lack of oxygen occurs when the cabbage or its container is covered with plastic film);
- d) loss of the outer leaves or bursting, due to physiological disorders.

B.6.2.2 Biological damage

Biological damage may be due to bacterial decomposition such as blackening of the veins, caused by *Pseudomonas campestris*, or fungal deterioration.

Annex C
(informative)

Model certificate of conformity with standards for fresh fruits and vegetables

1. Trader:	Certificate of conformity with the Community marketing standards applicable to fresh fruits and vegetables No. (This certificate is exclusively for the use of inspection bodies)		
2. Packer identified on packaging (if other than trader)	3. Inspection body		
	4. Place of inspection/country of origin ⁽¹⁾	5. Region or country of destination	
6. Identifier of means of transport	7. <input type="checkbox"/> Internal <input type="checkbox"/> Import <input type="checkbox"/> Export		
8. Packages (number and type)	9. Type of product (variety if the standards specifies)	10. Quality Class	11. Total net weight in kg
12. The consignment referred to above conforms, at the time of issue, with the Community standards in force, vide: <u>CD/K/073:2010, Fresh collard or broccoli greens — Specification and grading</u> _____ Customs office foreseen Place and date of issue Valid until (date): Signatory (name in block letters): Signature Seal of competent authority			
13. Observations:			
(1) Where the goods are being re-exported, indicate the origin in box 9.			

Annex E (informative)

Collard or broccoli greens — Codex, EU and USA pesticide residue limits

Users are advised that international regulations and permissible Maximum Residue Levels (MRL) frequently change. Although this International MRL Database is updated frequently, the information in it may not be completely up-to-date or error free. Additionally, commodity nomenclature and residue definitions vary between countries, and country policies regarding deferral to international standards are not always transparent. This database is intended to be an initial reference source only, and users must verify any information obtained from it with knowledgeable parties in the market of interest prior to the sale or shipment of any products. The developers of this database are not liable for any damages, in whole or in part, caused by or arising in any way from user's use of the database.

Results Key

MRL values in *{Italics}* are more restrictive than US

--- indicates no MRL value is established.

Cod, EU, etc. indicates the source of the MRL and EXP means the market defers to the exporting market.

All numeric values listed are in parts per million (ppm), unless otherwise noted

	US 1	Cod	EU 2
Acetamiprid	1.2	---	<i>{0.01}</i>
	1. United States does not maintain a specific MRL for the Acetamiprid/Collards combination, but does maintain an MRL of 1.2 PPM for its "Vegetable, Brassica Leafy, Group 5" group.		
	2. European Union does not maintain a specific MRL for the Acetamiprid/Collards combination, but does maintain an MRL of 0.01 PPM for its "Brassica vegetables" group.		
	US 3	Cod	EU 4
Acibenzolar-S-methyl	1	---	<i>{0.02}</i>
	3. United States does not maintain a specific MRL for the Acibenzolar-S-methyl /Collards combination, but does maintain an MRL of 1 PPM for its "Vegetable, Brassica Leafy, Group 5" group.		
	4. European Union does not maintain a specific MRL for the Acibenzolar-S-methyl /Collards combination, but does maintain an MRL of 0.02 PPM for its "Brassica vegetables" group.		
	US 5	Cod	EU 6
Azoxystrobin	25	---	<i>{5}</i>
	5. United States does not maintain a specific MRL for the Azoxystrobin/Collards combination, but does maintain an MRL of 25 PPM for its "Brassica, Leafy Greens, Subgroup 5B" group.		
	6. European Union does not maintain a specific MRL for the Azoxystrobin/Collards combination, but does maintain an MRL of 5 PPM for its "Leafy brassica" group.		
	US 7	Cod	EU
Bensulide	0.15	---	---
	7. United States does not maintain a specific MRL for the Bensulide/Collards combination, but does maintain an MRL of 0.15 PPM for its "Vegetable, Brassica Leafy, Group 5" group.		
	US 8	Cod	EU
Beta-cyfluthrin	7	---	---
	8. United States does not maintain a specific MRL for the Beta-cyfluthrin/Collards combination, but does maintain an MRL of 7 PPM for its "Brassica, Leafy Greens, Subgroup 5B" group.		
	US 9	Cod	EU 10
Bifenthrin	3.5	---	<i>{0.05}</i>
	9. United States does not maintain a specific MRL for the Bifenthrin/Collards combination, but does maintain an MRL of 3.5 PPM for its "Brassica, Leafy Greens, Subgroup 5B" group.		
	10. European Union does not maintain a specific MRL for the Bifenthrin/Collards combination, but does maintain an MRL of 0.05 PPM for its "Leafy brassica" group.		
	US 11	Cod	EU 12
Boscalid	18	---	<i>{10}</i>
	11. United States does not maintain a specific MRL for the Boscalid/Collards combination, but does maintain an MRL of 18 PPM for its "Brassica, Leafy Greens, Subgroup 5B" group.		
	12. European Union does not maintain a specific MRL for the Boscalid/Collards combination, but does maintain an MRL of 10 PPM for its "Leafy brassica" group.		

	US 13	Cod	EU 14
Captan	0.05	---	{0.02}
	13. United States does not maintain a specific MRL for the Captan/Collards combination, but does maintain an MRL of 0.05 PPM for its "Vegetable, Brassica Leafy, Group 5" group.		
	14. European Union does not maintain a specific MRL for the Captan/Collards combination, but does maintain an MRL of 0.02 PPM for its "Brassica vegetables" group.		
	US 15	Cod	EU 16
Carbaryl	10	---	{0.05}
	15. United States does not maintain a specific MRL for the Carbaryl/Collards combination, but does maintain an MRL of 10 PPM for its "Vegetable, Brassica Leafy, Group 5" group.		
	16. European Union does not maintain a specific MRL for the Carbaryl/Collards combination, but does maintain an MRL of 0.05 PPM for its "Brassica vegetables" group.		
	US 17	Cod	EU 18
Carfentrazone-ethyl	0.1	---	{0.01}
	17. United States does not maintain a specific MRL for the Carfentrazone-ethyl/Collards combination, but does maintain an MRL of 0.1 PPM for its "Vegetable, Brassica Leafy, Group 5" group.		
	18. European Union does not maintain a specific MRL for the Carfentrazone-ethyl/Collards combination, but does maintain an MRL of 0.01 PPM for its "Vegetables Fresh or Frozen" group.		
	US 19	Cod	EU 20
Chlorantraniliprole	11	---	{0.01}
	19. United States does not maintain a specific MRL for the Chlorantraniliprole/Collards combination, but does maintain an MRL of 11 PPM for its "Brassica, Leafy Greens, Subgroup 5B" group.		
	20. European Union does not maintain a specific MRL for the Chlorantraniliprole/Collards combination, but does maintain an MRL of 0.01 PPM for its "Leafy brassica" group.		
	US 21	Cod	EU
Chlorpyrifos	1	---	{0.05}
	21. United States does not maintain a specific MRL for the Chlorpyrifos/Collards combination, but does maintain an MRL of 1 PPM for its "Vegetable, Brassica Leafy, Group 5" group.		
	US	Cod	EU 22
Clethodim	3	---	{1}
	22. European Union does not maintain a specific MRL for the Clethodim/Collards combination, but does maintain an MRL of 1 PPM for its "Leafy brassica" group.		
	US	Cod	EU
Cryolite	7	---	---
	US 23	Cod	EU 24
Cyfluthrin	7	---	{0.3}
	23. United States does not maintain a specific MRL for the Cyfluthrin/Collards combination, but does maintain an MRL of 7 PPM for its "Brassica, Leafy Greens, Subgroup 5B" group.		
	24. European Union does not maintain a specific MRL for the Cyfluthrin/Collards combination, but does maintain an MRL of 0.3 PPM for its "Leafy brassica" group.		
	US 25	Cod 26	EU 27
Cypermethrin	14	{1}	{1}
	25. United States does not maintain a specific MRL for the Cypermethrin/Collards combination, but does maintain an MRL of 14 PPM for its "Brassica, Leafy Greens, Subgroup 5B" group.		
	26. The MRL is established for the sum of cypermethrin and zeta-cypermethrin.		
	27. European Union does not maintain a specific MRL for the Cypermethrin/Collards combination, but does maintain an MRL of 1 PPM for its "Leafy brassica" group.		
	US 28	Cod	EU 29
Cyprodinil	10	---	{0.05}
	28. United States does not maintain a specific MRL for the Cyprodinil/Collards combination, but does maintain an MRL of 10 PPM for its "Brassica, Leafy Greens, Subgroup 5B" group.		
	29. European Union does not maintain a specific MRL for the Cyprodinil/Collards combination, but does maintain an MRL of 0.05 PPM for its "Brassica vegetables" group.		

	US 30	Cod	EU 31
Cyromazine	10	---	{0.05}
	30. United States does not maintain a specific MRL for the Cyromazine/Collards combination, but does maintain an MRL of 10 PPM for its "Vegetable, Brassica Leafy, Group 5" group.		
	31. European Union does not maintain a specific MRL for the Cyromazine/Collards combination, but does maintain an MRL of 0.05 PPM for its "Brassica vegetables" group.		
	US 32	Cod	EU 33
DCPA	5	---	{0.5}
	32. United States does not maintain a specific MRL for the DCPA/Collards combination, but does maintain an MRL of 5 PPM for its "Vegetable, Brassica Leafy, Group 5" group.		
	33. European Union does not maintain a specific MRL for the DCPA/Collards combination, but does maintain an MRL of 0.5 PPM for its "Leafy brassica" group.		
	US 34	Cod	EU
Diazinon	0.7	{0.05}	{0.01}
	34. United States does not maintain a specific MRL for the Diazinon/Collards combination, but does maintain an MRL of 0.7 PPM for its "Vegetable, Brassica Leafy, Group 5" group.		
	US	Cod	EU 35
Diflubenzuron	9	---	{1}
	35. European Union does not maintain a specific MRL for the Diflubenzuron/Collards combination, but does maintain an MRL of 1 PPM for its "Brassica vegetables" group.		
	US 36	Cod	EU 37
Dimethomorph	20	---	{0.05}
	36. United States does not maintain a specific MRL for the Dimethomorph/Collards combination, but does maintain an MRL of 20 PPM for its "Brassica, Leafy Greens, Subgroup 5B" group.		
	37. European Union does not maintain a specific MRL for the Dimethomorph/Collards combination, but does maintain an MRL of 0.05 PPM for its "Brassica vegetables" group.		
	US	Cod	EU
Emamectin	0.05	---	---
	US	Cod	EU 38
Endosulfan	2	---	{0.05}
	38. European Union does not maintain a specific MRL for the Endosulfan/Collards combination, but does maintain an MRL of 0.05 PPM for its "Brassica vegetables" group.		
	US 39	Cod	EU 40
EPTC	0.1	---	{0.05}
	39. United States does not maintain a specific MRL for the EPTC/Collards combination, but does maintain an MRL of 0.1 PPM for its "Leafy Vegetables" group.		
	40. European Union does not maintain a specific MRL for the EPTC/Collards combination, but does maintain an MRL of 0.05 PPM for its "Brassica vegetables" group.		
	US 41	Cod	EU 42
Fenamidone	55	---	{0.02}
	41. United States does not maintain a specific MRL for the Fenamidone/Collards combination, but does maintain an MRL of 55 PPM for its "Brassica, Leafy Greens, Subgroup 5B" group.		
	42. European Union does not maintain a specific MRL for the Fenamidone/Collards combination, but does maintain an MRL of 0.02 PPM for its "Brassica vegetables" group.		
	US	Cod	EU 43
Fenvalerate	10	10	{0.02}
	43. European Union does not maintain a specific MRL for the Fenvalerate/Collards combination, but does maintain an MRL of 0.02 PPM for its "Vegetables Fresh or Frozen" group.		
	US 44	Cod	EU 45
Flonicamid	16	---	{0.05}
	44. United States does not maintain a specific MRL for the Flonicamid/Collards combination, but does maintain an MRL of 16 PPM for its "Brassica, Leafy Greens, Subgroup 5B" group.		
	45. European Union does not maintain a specific MRL for the Flonicamid/Collards combination, but does maintain an MRL of 0.05 PPM for its "Brassica vegetables" group.		
	US 46	Cod	EU 47
Fluazinam	0.01	---	0.05
	46. United States does not maintain a specific MRL for the Fluazinam/Collards combination, but does maintain an MRL of 0.01 PPM for its "Vegetable, Brassica Leafy, Group 5" group.		
	47. European Union does not maintain a specific MRL for the Fluazinam/Collards combination, but does maintain an MRL of 0.05 PPM for its "Vegetables Fresh or Frozen" group.		

	US 48	Cod	EU 49
Flubendiamide	5	---	{0.01}
	48. United States does not maintain a specific MRL for the Flubendiamide/Collards combination, but does maintain an MRL of 5 PPM for its "Brassica, Leafy Greens, Subgroup 5B" group.		
	49. European Union does not maintain a specific MRL for the Flubendiamide/Collards combination, but does maintain an MRL of 0.01 PPM for its "Brassica vegetables" group.		
	US 50	Cod	EU 51
Fludioxonil	10	---	{0.05}
	50. United States does not maintain a specific MRL for the Fludioxonil/Collards combination, but does maintain an MRL of 10 PPM for its "Brassica, Leafy Greens, Subgroup 5B" group.		
	51. European Union does not maintain a specific MRL for the Fludioxonil/Collards combination, but does maintain an MRL of 0.05 PPM for its "Brassica vegetables" group.		
	US 52	Cod	EU 53
Fosetyl-Al	60	---	{10}
	52. United States does not maintain a specific MRL for the Fosetyl-Al/Collards combination, but does maintain an MRL of 60 PPM for its "Vegetable, Brassica Leafy, Group 5" group.		
	53. European Union does not maintain a specific MRL for the Fosetyl-Al/Collards combination, but does maintain an MRL of 10 PPM for its "Brassica vegetables" group.		
	US 54	Cod	EU 55
Glyphosate	0.2	---	{0.1}
	54. United States does not maintain a specific MRL for the Glyphosate/Collards combination, but does maintain an MRL of 0.2 PPM for its "Vegetable, Brassica Leafy, Group 5" group.		
	55. European Union does not maintain a specific MRL for the Glyphosate/Collards combination, but does maintain an MRL of 0.1 PPM for its "Brassica vegetables" group.		
	US 56	Cod	EU
Imidacloprid	3.5	---	{0.3}
	56. United States does not maintain a specific MRL for the Imidacloprid/Collards combination, but does maintain an MRL of 3.5 PPM for its "Vegetable, Brassica Leafy, Group 5" group.		
	US	Cod	EU
Indoxacarb	12	---	{0.2}
	US 57	Cod	EU 58
Malathion	8	---	{0.02}
	57. United States does not maintain a specific MRL for the Malathion/Collards combination, but does maintain an MRL of 8 PPM for its "Vegetable, Brassica Leafy, Group 5" group.		
	58. European Union does not maintain a specific MRL for the Malathion/Collards combination, but does maintain an MRL of 0.02 PPM for its "Brassica vegetables" group.		
	US 59	Cod	EU 60
Mandipropamid	25	---	{0.01}
	59. United States does not maintain a specific MRL for the Mandipropamid/Collards combination, but does maintain an MRL of 25 PPM for its "Brassica, Leafy Greens, Subgroup 5B" group.		
	60. European Union does not maintain a specific MRL for the Mandipropamid/Collards combination, but does maintain an MRL of 0.01 PPM for its "Brassica vegetables" group.		
	US	Cod 61	EU 62
Maneb	10	15	{0.5}
	61. The MRL is established for the sum of dithiocarbamates.		
	62. European Union does not maintain a specific MRL for the Maneb/Collards combination, but does maintain an MRL of 0.5 PPM for its "Leafy brassica" group.		
	US 63	Cod	EU
Metalaxyl	0.1	---	0.2
	63. United States does not maintain a specific MRL for the Metalaxyl/Collards combination, but does maintain an MRL of 0.1 PPM for its "Vegetable, Brassica Leafy, Group 5" group.		
	US 64	Cod	EU 65
Metaldehyde	2.5	---	{1}
	64. United States does not maintain a specific MRL for the Metaldehyde/Collards combination, but does maintain an MRL of 2.5 PPM for its "Vegetable, Brassica Leafy, Group 5" group.		
	65. European Union does not maintain a specific MRL for the Metaldehyde/Collards combination, but does maintain an MRL of 1 PPM for its "Leafy brassica" group.		

	US	Cod	EU 66
Methomyl	6	---	{0.05}
	66. Methomyl and Thiodicarb (sum of methomyl and thiodicarb expressed as methomyl) European Union does not maintain a specific MRL for the Methomyl/Collards combination, but does maintain an MRL of 0.05 PPM for its "Leafy brassica" group.		
	US 67	Cod	EU 68
Methoxyfenozide	30	---	{0.02}
	67. United States does not maintain a specific MRL for the Methoxyfenozide/Collards combination, but does maintain an MRL of 30 PPM for its "Brassica, Leafy Greens, Subgroup 5B" group.		
	68. European Union does not maintain a specific MRL for the Methoxyfenozide/Collards combination, but does maintain an MRL of 0.02 PPM for its "Brassica vegetables" group.		
	US	Cod	EU
Naled	3	---	---
	US 69	Cod	EU 70
Napropamide	0.1	---	{0.05}
	69. United States does not maintain a specific MRL for the Napropamide/Collards combination, but does maintain an MRL of 0.1 PPM for its "Vegetable, Brassica Leafy, Group 5" group.		
	70. European Union does not maintain a specific MRL for the Napropamide/Collards combination, but does maintain an MRL of 0.05 PPM for its "Leafy brassica" group.		
	US 71	Cod 72	EU 73
Paraquat dichloride	0.05	0.07	{0.02}
	71. United States does not maintain a specific MRL for the Paraquat dichloride/Collards combination, but does maintain an MRL of 0.05 PPM for its "Vegetable, Brassica Leafy, Group 5" group.		
	72. Codex does not maintain a specific MRL for the Paraquat dichloride/Collards combination, but does maintain an MRL of 0.07 PPM for its "Leafy vegetables" group.		
	73. European Union does not maintain a specific MRL for the Paraquat dichloride/Collards combination, but does maintain an MRL of 0.02 PPM for its "Vegetables Fresh or Frozen" group.		
	US 74	Cod	EU 75
Pymetrozine	0.25	---	{0.2}
	74. United States does not maintain a specific MRL for the Pymetrozine/Collards combination, but does maintain an MRL of 0.25 PPM for its "Brassica, Leafy Greens, Subgroup 5B" group.		
	75. European Union does not maintain a specific MRL for the Pymetrozine/Collards combination, but does maintain an MRL of 0.2 PPM for its "Leafy brassica" group.		
	US 76	Cod	EU 77
Pyraclostrobin	16	{1}	{0.02}
	76. United States does not maintain a specific MRL for the Pyraclostrobin/Collards combination, but does maintain an MRL of 16 PPM for its "Brassica, Leafy Greens, Subgroup 5B" group.		
	77. European Union does not maintain a specific MRL for the Pyraclostrobin/Collards combination, but does maintain an MRL of 0.02 PPM for its "Leafy brassica" group.		
	US	Cod	EU
Pyridate	0.03	---	0.2
	US 78	Cod	EU 79
Pyriproxyfen	2	---	{0.05}
	78. United States does not maintain a specific MRL for the Pyriproxyfen/Collards combination, but does maintain an MRL of 2 PPM for its "Brassica, Leafy Greens, Subgroup 5B" group.		
	79. European Union does not maintain a specific MRL for the Pyriproxyfen/Collards combination, but does maintain an MRL of 0.05 PPM for its "Brassica vegetables" group.		
	US 80	Cod	EU 81
Sethoxydim	5	---	{1}
	80. United States does not maintain a specific MRL for the Sethoxydim/Collards combination, but does maintain an MRL of 5 PPM for its "Vegetable, Brassica Leafy, Group 5" group.		
	81. European Union does not maintain a specific MRL for the Sethoxydim/Collards combination, but does maintain an MRL of 1 PPM for its "Leafy brassica" group.		

	US 82	Cod	EU 83
Spinetoram	10	---	{0.05}
	82. United States does not maintain a specific MRL for the Spinetoram/Collards combination, but does maintain an MRL of 10 PPM for its "Brassica, Leafy Greens, Subgroup 5B" group.		
	83. European Union does not maintain a specific MRL for the Spinetoram/Collards combination, but does maintain an MRL of 0.05 PPM for its "Brassica vegetables" group.		
	US 84	Cod 85	EU 86
Spinosad	10	10	{2}
	84. United States does not maintain a specific MRL for the Spinosad/Collards combination, but does maintain an MRL of 10 PPM for its "Brassica, Leafy Greens, Subgroup 5B" group.		
	85. Codex does not maintain a specific MRL for the Spinosad/Collards combination, but does maintain an MRL of 10 PPM for its "Leafy vegetables" group.		
	86. European Union does not maintain a specific MRL for the Spinosad/Collards combination, but does maintain an MRL of 2 PPM for its "Brassica vegetables" group.		
	US 87	Cod	EU 88
Spiromesifen	12	---	{0.02}
	87. United States does not maintain a specific MRL for the Spiromesifen/Collards combination, but does maintain an MRL of 12 PPM for its "Brassica, Leafy Greens, Subgroup 5B" group.		
	88. European Union does not maintain a specific MRL for the Spiromesifen/Collards combination, but does maintain an MRL of 0.02 PPM for its "Brassica vegetables" group.		
	US 89	Cod	EU 90
Spirotetramat	8	---	{2}
	89. United States does not maintain a specific MRL for the Spirotetramat/Collards combination, but does maintain an MRL of 8 PPM for its "Brassica, Leafy Greens, Subgroup 5B" group.		
	90. European Union does not maintain a specific MRL for the Spirotetramat/Collards combination, but does maintain an MRL of 2 PPM for its "Leafy brassica" group.		
	US 91	Cod	EU
Tebuconazole	2.5	--	{0.05}
	91. United States does not maintain a specific MRL for the Tebuconazole/Collards combination, but does maintain an MRL of 2.5 PPM for its "Brassica, Leafy Greens, Subgroup 5B" group.		
	US 92	Cod 93	EU 94
Tebufenozide	10	10	{0.5}
	92. United States does not maintain a specific MRL for the Tebufenozide/Collards combination, but does maintain an MRL of 10 PPM for its "Brassica, Leafy Greens, Subgroup 5B" group.		
	93. Codex does not maintain a specific MRL for the Tebufenozide/Collards combination, but does maintain an MRL of 10 PPM for its "Leafy vegetables" group.		
	94. European Union does not maintain a specific MRL for the Tebufenozide/Collards combination, but does maintain an MRL of 0.5 PPM for its "Leafy brassica" group.		
	US 95	Cod	EU 96
Thiamethoxam	3	---	{0.2}
	95. United States does not maintain a specific MRL for the Thiamethoxam/Collards combination, but does maintain an MRL of 3 PPM for its "Brassica, Leafy Greens, Subgroup 5B" group.		
	96. European Union does not maintain a specific MRL for the Thiamethoxam/Collards combination, but does maintain an MRL of 0.2 PPM for its "Brassica vegetables" group.		
	US 97	Cod	EU 98
Triflumizole	40	---	{0.1}
	97. United States does not maintain a specific MRL for the Triflumizole/Collards combination, but does maintain an MRL of 40 PPM for its "Brassica, Leafy Greens, Subgroup 5B" group.		
	98. European Union does not maintain a specific MRL for the Triflumizole/Collards combination, but does maintain an MRL of 0.1 PPM for its "Brassica vegetables" group.		
	US	Cod	EU 99
Trifluralin	0.05	---	0.5
	99. European Union does not maintain a specific MRL for the Trifluralin/Collards combination, but does maintain an MRL of 0.5 PPM for its "Leafy brassica" group.		
	US 100	Cod 101	EU 102
Zeta-Cypermethrin	14	{1}	{1}
	100. United States does not maintain a specific MRL for the Zeta-Cypermethrin/Collards combination, but does maintain an MRL of 14 PPM for its "Brassica, Leafy Greens, Subgroup 5B" group.		
	101. The MRL is established for the sum of cypermethrin and zeta-cypermethrin.		
	102. European Union does not maintain a specific MRL for the Zeta-Cypermethrin/Collards combination, but does maintain an MRL of 1 PPM for its "Leafy brassica" group.		

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