UNIVERSITY OF FLORIDA
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Cabbage: Uses and Production[1]

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BOTANY

Origin

Cabbage is from a group of plants known as the cole crops. The word "cole" derives from the Middle English word "col". The Romans called these crops "caulis", and the Greeks called them "kaulion". All these words mean "stem". This group of plants includes cabbage, cauliflower, broccoli, kale, collards, kohlrabi, and Brussels sprouts. Wild cole crops are found growing along the Mediterranean and Atlantic coasts of Europe. Cabbages and kale presumably originated in Western Europe; cauliflower and broccoli in the Mediterranean region. Cabbages and kale were the first of the cole crops to be domesticated, probably about 2,000 years ago. Before these crops were domesticated they were collected from the wild and used primarily as medicinal herbs. The other forms of the cole crops were domesticated at later dates, and Brussels sprouts are the most recent crop, having come into existence less than 500 years ago.

Taxonomy

Cole crops are from the family Cruciferae, a large family which contains many vegetables. It is also called the mustard family. The family name comes from the Latin word for "cross" and was given to members of this family because the flowers are cross-shaped (Plate 1). Cole crops are herbaceous, biennial, dicotyledonous plants specifically from the genus and species, *Brassica oleracea*. There are many different groups within this species:

acephala - kale, collards
botrytis - cauliflower
capitata - cabbage
gemmifera - Brussels sprouts
gongylodes - kohlrabi
italica - sprouting broccoli

Cauliflower, cabbage, broccoli, and Brussels sprouts all have similar cultural requirements, although the climatic range differs. The different groups have different environmental requirements for growth. These crops are grown as summer crops in the North and winter crops in the extreme south. In the intermediate zone often two crops are grown each year.

THE CABBAGE INDUSTRY

Cabbage is one of the world's most important vegetables, especially in the temperate zone. Below is a list of the principal cabbage production areas in the world, followed by the amount of land on which cabbage is grown.

Europe	364,000 hectares

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The term "plates," where used in this document, refers to color photographs that can be displayed on screen from CD-ROM. These photographs are not included in the printed document.

USSR	257,000 hectares
Japan	117,000 hectares
N. Amer.	63,000 hectares

In the U.S. fresh market cabbage ranks sixth in area planted and fifth in dollar value among all vegetables grown. In the northern states cabbage is a summer and fall crop; a winter and spring crop in the southern states. Cabbage is grown throughout the year in California. For the processing market about 10,000 acres are grown, primarily in the northern states. Wisconsin is the leading state in production of cabbage for processing. Most processed cabbage goes for the production of sauerkraut.

Florida is the leading state for winter and spring production of fresh market cabbage. In 1988-89 cabbage was harvested from 15,500 acres in Florida with the harvest valued at $30,433,000. Most cabbage is planted in the winter (60 percent), followed by spring planting (33 percent), then fall planting (seven percent). About 25 percent of the total cabbage acreage is planted in the Hastings area, but production is moving to other areas of Florida as well. East and West Central Florida and South Florida have significant acreage of cabbage. Harvest usually begins in November, peaks in January to March, and ends in June.

CULTURE

Climate

Cabbage is a cool season crop. The optimum temperature range for cabbage production is 15 to 20°C. Above 25°C growth stops. The minimum temperature is 0°C (freezing), but cold hardened plants can tolerate temperatures as low as -10°C. Young plants less than six millimeters in diameter can tolerate both colder and warmer temperatures than older plants. These young plants are said to be in the juvenile phase of growth. Plants which have matured past the juvenile phase will flower if temperatures are less than 10°C for five to six weeks. This is a response to temperature, and daylength is not involved.

Poor environmental conditions during growth can lead to quality problems when the cabbage is harvested. High temperatures and low moisture can cause small plants which give low yield. These conditions can also lead to long stems in the head and can cause the outer leaves to drop. Cold temperature during growth can also lead to long stems in the heads and bolting (Plate 2), or flower stalk formation.

Cultivars

There is a large number of cabbage cultivars available to growers. The selection of the cultivar to be grown depends on the time of the year and market conditions that the grower will face at harvest.

For processing, total weight is the most important consideration and quality characteristics are of secondary importance. For processing growers will select large-headed, late maturing types. Wide spacings are used between the plants and the average weight should be around six pounds per head. Most processed cabbage is transplanted, but it can also be direct seeded. In recent years there has been a great deal of mechanical harvest of cabbage for processing.

For the fresh market, total yield is an important consideration, but quality considerations are foremost in cultivar selection. The size and the shape of the head is very important. Since family sizes have shrunk in recent years, consumers want cabbage heads that weigh around 2.5 pounds per head. This means that fresh market growers will use earlier maturing cultivars that naturally have smaller heads. They will also use closer spacings between plants. Growers generally receive a premium price for a 53 pound crate of cabbage that contains 18 to 22 heads. Fresh market cabbage is usually transplanted and hand harvested, and most of these cultivars are F_1 hybrids.

Cabbage cultivars are classified by maturity, shape, leaf texture, and color. These classifications are given below:

1. maturity - early, mid-season, late
2. shape - round, flat, pointed
3. color - red, green (green contains many different shades)
4. texture - smooth, savoy (wrinkled)

It is possible to get cultivars with any combination of these traits.

Establishing the Crop

In Florida 90 percent of the cabbage crop is transplanted. In the Fall four-to-five-week-old plants are used, while in the Winter six-to-eight-week-old plants are used. Recent research showed that transplant age and the size of the transplant cell are

critical factors in determining cabbage tolerance of pre-emergence herbicides.

Many cabbage transplants are grown outdoors in open beds. Nationwide, and in all crops, there has been a trend to direct seeding, rather than transplanting. The benefits of direct seeding are:

1. avoids intensive labor needed to raise transplants
2. growers often have trouble obtaining high quality transplants due to disease problems
3. supply often is a problem when grower wants to put transplants in the field.

The drawbacks of direct seeding are:

1. stands are often uneven and plants are not at same stage of maturity
2. labor is needed for thinning
3. the cost of hybrid seed

When growing cabbage transplants outdoors in Florida, the biggest production problem is black rot (Plate 3). This is a disease caused by the bacterium *Xanthomonas campestris*, and is also called black spot or black leg. It attacks all cole crops and good sanitation of the transplant operation is essential to produce disease free plants. These practices include:

- use clean flats
- do not move contaminated soil
- use disease free seed
- buy certified transplants
- fumigate or rotate transplants beds
- destroy diseased plants and crop residue after harvest
- irrigate from a well, not an open ditch
- eliminate cruciferous weeds
- do not mow plants to harden
- do not wet plants

Soil, Nutrition, and Irrigation

Cabbage can be grown on a wide range of soils, but the crop is sensitive to soil acidity. The optimum pH is six to 6.5, and at pH's greater than seven the disease club root can be present. Cabbage is a heavy user of nitrogen and potassium and requires frequent side-dressing. Cabbage is considered a hard crop on the land, and many growers will rotate to other crops that do not have such high fertility requirements. Cabbage is grown on mineral, sand and muck soils.

In Florida, on sandy soil where there is a high water table, cabbage is irrigated by sub-surface irrigation. On deeper sands it is a perfect crop for drip irrigation since fertigation can be used. In many new fields where cabbage is grown on sandy soil, plastic mulch is being used to prevent wind damage from blowing sand particles. This will increase the use of drip irrigation. Regardless of the method used, cabbage requires about one inch of water per week. The supply of water should be even throughout the growing season to prevent cracking of the heads.

Harvest

For the fresh market multiple hand harvests are used (Plate 4). There is a minimum amount of grading that is done, and this is often done in the field. For first quality cabbage, however, re-packing at a packing shed is recommended. Cabbage does not require pre-cooling before it can be shipped.

NUTRITIVE VALUE

Cabbage is fairly low in calories, but is also relatively low in protein content. It is a good source of many minerals, particularly potassium, and is also relatively high in vitamins A and C. Green cultivars tend to have more vitamin A than red cabbage cultivars, and savoy types tend to have more vitamin A than smooth types.