



FACULTY OF AGRICULTURAL SCIENCES AND ALLIED INDUSTRIES

SPROUTING BROCCOLI

Broccoli is an important cool season vegetable crop in which the terminal heads are edible. Besides this, slender and smaller heads which appear in the axil of leaves are also harvested. It is a highly nutritious crop and grows well in temperate climate. The present chapter will make the students understand regarding its production technology, importance, seed production techniques and plant protection measures.

BOTANICAL NAME : *Brassica oleracea var. italica*

COMMON NAME : Broccoli

FAMILY : Cruciferae

CHROMOSOME NUMBER : 2n=18

ORIGIN : East Mediterranean and Italy (Main center of diversification)

- The word broccoli is derived from the Latin word Brachium meaning an arm or branch. Broccoli contains 3.3 per cent protein, high content of vitamin A and C and appreciable quantities of thiamine, riboflavin, niacin, calcium and iron.
- Broccoli refers to green buds and thick fleshy floral stalks arising from the main stem.
- In Italy, these have been used as a vegetable from early times but their economic importance become appreciable only since thirties of last century when this vegetable became popular in the U.S.A.
- A larger part of the produce in the U.S.A. goes to the freezing industry.
- It is also becoming popular in other parts of the country very rapidly.
- Sprouting broccoli is sometimes briefly called as broccoli though this name is also used for broccoli rape (the sprouts which develop on turnips) and for winter cauliflower (winter broccoli or heading broccoli).
- In U.S.A., it is also known as Italian broccoli pointing to its Italian origin.
- Morphologically, sprouting broccoli resembles cauliflower.
- The plant forms a kind of head, consisting of green buds and thick fleshy flower stalks.
- A main head is produced terminally and comparatively smaller heads in the shoots arise from axils of leaves laterally.
- The terminal head is rather loose, green in colour and the flower stalks are longer than cauliflower.
- The sprouts in the axils of leaves develop strongly, especially after the removal of terminal bud or head.
- Both terminal head and the sprouts with bud clusters are consumed as human food.

NUTRITIVE VALUE (per 100 g of edible portion)

| | | | |
|--------------|------|----------|-----|
| Moisture (%) | 89.1 | Vitamin- | 113 |
|--------------|------|----------|-----|

| | | | |
|-------------------|-----|-------------|-----|
| | | C (mg) | |
| Energy (K cal) | 32 | Niacin (mg) | 0.9 |
| Carbohydrates (g) | 5.9 | Ca (mg) | 103 |
| Proteins (g) | 3.6 | P (mg) | 78 |
| Fat (g) | 0.3 | Fe (mg) | 1.1 |

CLIMATE

- Broccoli is a cool season crop.
- Seed germination takes place at 12-16°C and optimum temperature for growth is 16-20°C.
- Hot weather results in development of small and thin leaves in the head. Generally, the plants of broccoli are hardy, can withstand fairly heavy frosts.
- It is generally biennial, while the annual cultivars are slightly sensitive to frost.

SOIL

- The requirement of broccoli is not that specific as in other cole crops though the soil should be sufficiently fertile and rich in organic matter for the development of seedlings after transplanting.
- Broccoli is slightly tolerant to acidic soils (pH 5.5-6.5).
- Soil should be well cultivated so that it becomes friable and suitable for planting.

CULTIVARS

Different Types of Broccoli

| | |
|---------------------------|--|
| Purple sprouting broccoli | Biennials, branched, purple spears, variable |
| Purple cape broccoli | Biennials, single purple heads, variable |
| White sprouting broccoli | Biennials, branched, white spears |
| Purple Sicilian broccoli | Single heading pale-purple heads also known in |

| | |
|----------------|--|
| | horticulture as purple cauliflower |
| Couve broccoli | 'Roxo de Cabeça' Tall purple heading, sprouting type from Portugal |
| Calabrese | Green sprouting broccoli from Calabrian region. Now a world wide crop and virtually single heading |
| Black broccoli | Highly branched annual with dark green spears and sickle shaped leaves, from Rome area |

- In Broccoli, purple and green variants occurs though in U.S.A, only the green types are grown.
- The purple types are fairly hardy and can be harvested during winter.
- The green sprouting broccoli is classified in accordance to their maturity i.e. early, medium and late cultivars.
- Though a very sharp distinction is not possible but the cultivars may differ in the size of plant, size of clusters and buds, firmness of heads, colour of heads and foliage.
- The demand is more for a firm head with small dark green buds while demand for the side shoots have decreased in recent years possibly due to difficulty in harvesting.
- Cultivars like De Cicco, Green Bud, Spartan Early etc. are early types and can be harvested in 6-7weeks after transplanting.
- These cultivars may not perform well under unfavourable conditions especially at lower temperature.
- Cultivars like Waltham 29, Green Mountain, Coastal Atlantic etc. are sensitive to buttoning and can be grown as an early or late crop.
- The medium strains like Green Sprouting Medium take about 100days to maturity, while the late strains like Green Sprouting Late are biennials and may be harvested on the onset of winter or after its end.
- At present a large number of F₁ hybrid cultivars are being marketed by the different seed companies of Japan, U.S.A. and Europe.

Some of F₁ hybrids are

- Extra Early and Early : Southern Comet, Premium Crop and Laser
- Mid season : Cosair, Excalibur and Emerald Corona
- Late : Late corona, stiff, kayak and Green surf

Some of the important varieties grown in Northern India are

Pusa Broccoli Kt. Sel. 1:

- Developed through selection at IARI, Regional Station Katrain (Kullu Valley).
- Compact light green heads, weighing around 250-400g, plant height 40-50cm and ready for harvesting in 85-95days after transplanting.

Palam Samridhi (DPGB I):

- Sprouting broccoli having compact green heads, free from yellow eyes and bracts, average head weight is 300-400g, plant branched.
- It also bears sprouts in the axil of leaves which adds to the total yield, ready for harvest in 85-90days after transplanting, average yield 150-200q/ha.

Palam Haritika:

- Sprouting broccoli having dark green straight leaves, the main head formed deep inside the leaves.
- Late in maturity and gets 150 days for harvesting, free from yellow eyes, average yield 200-250q/ha

Palam Kanchan:

- Yellow coloured heading type broccoli, leaves are large, green and straight with white midrib.
- Gets ready for harvesting in 140days, average yield 250-300q/ha.

Palam Vichitra:

- Purple coloured heading type broccoli, medium foliage, open green leaves having green tinge, heads are firm and solid.
- Gets ready for harvesting in 115-120days, average yield 225-250q/ha

Punjab Broccoli 1:

- This variety is developed by PAU, Ludhiana, matures in 65-70days, bears large number of spears, foliage dark green with smooth leaf surface, heads and spears are dark green with bluish tinge.

NURSERY MANAGEMENT

- Same as for cabbage

SEED RATE

- The seed rate for raising seedlings to plant in one hectare area is about 300-400g.

SPACING

- 45 x 45 or 60 x 45 cm

SOWING TIME

- It varies in different parts of the country.
- In plains, sowing is done in October whereas in mid hills it is done in September.
- In high hills, seeds are sown in month of May-June.
- The time of transplanting depends upon the climatic condition and the kind of variety.
- The sowing of an autumn crop is limited and sowing is undertaken in autumn to harvest them in late spring or early summer by over wintering them.

NUTRIENT MANAGEMENT

- Light soils should be supplied with heavy quantity (200-250q/ha) of organic matter either through incorporation of farmyard manure or compost or through green manuring.
- Requirements of manures and fertilizers depend upon soil fertility, soil status and cultivar.
- Besides this, apply 100-125kg N, 60-80kg P₂O₅ and 25-50kg K₂O per ha should be applied depending
- It is better to apply nitrogen in split doses.
- It has been reported that warm weather, heavy fertilization and wide spacing results in hollowness of main stem.
- Besides macro nutrients, broccoli has light requirement for molybdenum and boron.
- The deficiency symptoms are likely to appear if fertilizers are not applied.

IRRIGATION

- Broccoli requires more water than cauliflower however, care should be taken that light irrigation at regular intervals is done.
- After transplanting irrigation are done at 10-15days interval.
- Uneven moisture after the heads have formed, cause head splitting or head bursting.

HARVESTING

- The broccoli heads resembles with cauliflower consisting of clusters of green flower buds.
- Early types mature in 45-50days, mid in 60-100days and late after 100days of transplanting.
- The head is cut along with a few leaves and stem (10-15cm).
- From the remaining main stem, lateral shoots are formed and these produce comparatively small heads.
- Usually only the central head is harvested.

- It is very important that broccoli is harvested at the correct time i.e. it is picked up before the buds open and when the bud clusters are compact.
- The heads are cut-off long with 15cm of the stem attached.
- The head may be 15-25cm in diameter and weigh about 200-600g.

YIELD

- The yield of broccoli ranges from 50-150q/ha depending on variety, time of planting and length of harvesting period.

PACKING AND STORAGE

- Broccoli is more perishable than cauliflower.
- Just after harvesting, heads and shoots are kept in cold storage until they are sold.
- Otherwise the buds and leaves become yellowish and give an unattractive appearance.
- The yellowing could be avoided by storing the broccoli in an oxygen free atmosphere. Broccoli emits ethylene in storage.
- For freezing, stems are cut to 10-15cm in length.
- The shelf life of broccoli heads & sprouts is significantly affected by temperature and not much influenced by relative humidity. Broccoli can be stored at 32°F for 8-10 days.
- At temperature 12–17°C and RH between 75%. It can be easily stored for 3 days. Under cool storage (3°C & 88% RH) the shelf life of heads can be extended up to 31 days.
- Packaging in LDPE (Low density polyethylene) bags helps in keeping the broccoli more fresh and green under low temperature.