

College of Agriculture & Life Sciences
Department of Horticultural Science

BROCCOLI PRODUCTION

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Broccoli is a cool-season crop, closely related to cabbage, cauliflower, kale, and mustard. It can be grown as either a spring or a fall crop. Broccoli is a high-quality vegetable for fresh use and is one of the more popular frozen vegetables. Broccoli is highly nutritious and has been deemed an anti-cancerous food by the American Cancer Society. This vegetable is a good source of Vitamin A, calcium, and riboflavin (or vitamin B₂). The edible portion of the broccoli plant consists of the tender stem and the unopened flower buds. Sprouting broccoli should not be confused with broccoliraab (or Italian turnip), which is grown for early leafy greens and with much smaller flower shoots. (For more complete information consult Extension Bulletin AG-487, *Commercial Cabbage, Broccoli, Cauliflower and Greens Production*.)

Transplant Production

Plants may be started in hotbeds or greenhouses. In a hotbed, the seedlings need a loose, easily pulverized loam that is not too fertile. If the plants are started in hotbeds, soil fumigation is needed to control weeds, soil borne diseases, and insects. Check Plant Pathology Note 170, *Soil Treatments for Greenhouse and Plant Beds - Vegetable and Ornamentals*. Plant the seeds one-quarter to one-half inch deep in rows 4 to 6 inches apart, with 2 to 4 seeds per inch. Thin the seedlings at the two-leaf stage; allow 1/2 inch between plants. Water twice daily and fertilize

with soluble fertilizer at least every 2 weeks. Proper ventilation is important and can be maintained by raising the sash or plastic covering during the hottest portion of the day. In the hotbed, if properly handled, 3 or 4 oz of seed will produce enough seedlings to plant 1 acre. When seed is planted in beds, it requires about 6 to 8 weeks from seed to plants for the spring crop, and about 4 to 5 weeks for the fall crop. In the greenhouse, a variety of plant-growing containers may be used (i.e. plastic cell packs, peat pots, and seedling trays). These containers should be filled with an artificial media— usually a combination of peat, perlite, vermiculite, and in some instances bark. The seeds can be sown directly into the containers and thinned upon emergence to 1 plant per cell or pot. In the greenhouse, it will require 5 to 6 weeks from seed to plants for the spring crop and 4 to 5 weeks for the fall crop. **Note:** See Extension publication AG-337, *Production of Commercial Vegetable Transplants*, for detailed information on plant production.

The fall crop of broccoli can also be direct seeded in the field using a precision planter such as an Accord, Stanhay, Gaspardo, or Nibex. Seed required for one acre is 0.75 to 1.25 lb when using a precision seeder.

Soils — Soils that are well-suited for the production of broccoli are fertile, well drained, and have texture ranging from sandy loam to

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clay loam. Soil pH should be 6.0 to 6.5. Lime according to soil test recommendation. Organic soil does not require such a high pH.

Spring Crop Time to Plant				
Region of State	Sow Seed in Frames	Sow Seed in Green-house	Set in Field	Direct Seeding in Field
Coastal Plain	Dec.-Jan.	mid-Jan.	late Feb.	mid-Feb.
Piedmont	Jan.-Feb.	Feb Feb	mid-March	early March
Mountains	Feb.-July	March July	mid-March to early Aug.	mid-Aug

Transplanting is preferred for the spring crop since it results in a more uniform stand and earlier harvest.

Fall Crop Time to Plant			
Region of State	Sow Seed in Fields or Bed	Set in Field	Direct Seeding in Field
Coastal Plain	early July	Aug. 1-31	Aug. to mid-Sept.
Piedmont	early July	Aug. 1-10	mid-July to mid-Aug or direct seeding

Irrigation will be essential when transplanting the fall crop.

Fertilizer— Take a soil test and fertilize according to the soil test recommendations. A general recommendation would be 85 to 120 lb of nitrogen, 170-240 lb P₂O₅ and 170-240 lb K₂O₅, plus 15 to 20 lb of borax per acre. Without boron, small buds, hollow pithy stems with internal brown discoloration, and low yields can result. Sidedress after 3 and 5 weeks with 30 lb of actual nitrogen per acre. Home gardeners should mix 2 level Tbsp of borax to 5 qt of fertilizer and apply this to each 100 ft of row before planting. Apply 100 lb per acre of calcium nitrate when heads are about the size of a quarter. This will reduce large stem diameter and, to some extent, rots. The distance between leaves should be ³/₄ to 1 inch to indicate rapid growth; if not, apply more nitrogen.

Weed Management* — Consult the current *North Carolina Commercial Vegetable Recommendations* (AG-586) or your local county Extension center for weed management recommendations. Cultivation is often necessary.

Transplanting — Plant on medium- ridged (8 to 10 inches tall) rows 36 to 42 inches apart with 2 rows per bed (9 to 12 inches apart) and 4 to 6 inches between plants in the row. This requires between 43,560 and 29,869 plants per acre. Mechanical transplanters, hand transplanters, or hand trowels may be used. Double rows will require that mechanical transplanters be set up in tandem or offset, and the field driven twice. To ensure proper settling of soil around the roots, water the plants well. Use about 1 pint of starter solution (5 lb of 5-20-10 or 12-48-8 fertilizer per 100 gal of water) on each transplant, or use commercially prepared starter solution according to manufacturer's instructions. This will produce heads and stalks of acceptable quality for the bunching/shipping trade. Home garden, local sale, and large single-head crops should be spaced further apart for larger head size.

Direct Seeding — Row spacings are similar to transplanting but in-row spacing should be reduced to 4 to 6 inches. Always use a precision seeder like an Accord, Gaspardo, Stanhay or Nibex (Earthway Planters can be used by small growers). Seed ¹/₂ to ³/₄ inches deep and irrigate frequently to keep surface moist until plants are established. Monitor insects closely during this time.

Irrigation — Be prepared to irrigate 1 to 1 ¹/₂ inches of water per week if natural rainfall is lacking to help ensure a high-quality broccoli crop. Broccoli requires above average moisture, and when this is lacking it responds with slow growth and poor appearance.

Insect Management* — Several species of caterpillars attack broccoli. Cabbage loopers, the imported cabbage worm, diamondback moths, cabbage webworms, and corn earworms are commonly found feeding on leaves and stems. The cabbage aphid is also a very destructive pest on broccoli. Flea beetles also attack broccoli and can severely damage small seedlings. The severity of insect attack is much greater in fall crops. It is suggested that the control program start early (emerging seedlings) and continued on a regular basis. Consult Entomology Insect Note No. 12, *Cabbage Worm Complex*.

Disease Management* — Diseases are not usually serious to broccoli. The exceptions are such diseases as black rot which may spread from cabbage or related crops or weeds, and may also be carried on seeds. Powdery and downy mildew are often found but only rarely are they a serious problem. *Alternaria* leaf spot may also be found on broccoli. Soft rot can be serious in years of high precipitation; domed heads with certain varieties will help reduce this disease.

Harvesting — Spring broccoli should be harvested in the early morning, because it wilts very rapidly in the sun. Field crates or baskets should be immediately removed to a packing shelter where it is bunched and iced. The broccoli head should be cut before the flower buds open. If the buds begin to open and the yellow flower petals begin to show, the head is over-mature and unfit for market. Cut the heads with a length of 9 to 10 inches from the base of the stem to the top of the head. The central heads vary from 3 to 6 inches in diameter. A few days after the central head is cut, small lateral, or side, shoots grow out and produce small heads measuring 1 to 3 inches in diameter. These side shoots are seldom of the quality for commercial sale. Small heads produced by the side shoots are very desirable for freezing and use in the home. In order to harvest at the correct stage, the field should be cut every 2 or 3 days. It requires 4 to 5 man-hours per acre for each cutting. An average commercial field is cut 4 to 6 times; for home use the number of harvests is more numerous, because more of the small side shoots can be utilized. Light frosts do not hurt broccoli appreciably; therefore, harvest in the fall generally continues until the first freeze.

Field packing is becoming more popular with the advent of in package icing. Here, broccoli is cut and packed on a harvest aid directly in the field. The boxes are palletized and taken to a central icing facility.

Preparation for Market — A good job of grading, trimming and bunching is needed to compete with western broccoli. Stems are usually trimmed to 6 1/2 to 8 inches in length, leaves are removed and enough heads included to make 1 1/4 to 1 1/2 lb per bunch. The heads are tied or held together with either tape, rubber bands or paper-covered wires, called “twist-ems.” It is important to make the bunch tight. Broccoli can be packed in crates and hampers although wax-impregnated cartons are preferred. A standard carton contains 14 to 18 bunches with a net weight of 21 to 23 lb. Since broccoli is a highly perishable

commodity, subject to rapid color and quality deterioration, it should be precooled to about 32°F by vacuum cooling, hydro-cooling or packing in ice as soon as possible after harvest. For medium- to long-distance shipping, refrigerated transportation and package icing are absolutely essential. Slush ice (40% ice and 60% water) is forced into each box by a special machine. This is a very efficient system and yields a top-quality product. Machines exist to ice whole pallets full of boxes at one time. Approximately 5 to 8 lb of crushed ice should be placed in each carton before shipping.

Yield — Central heads will vary in size, depending on variety, spacing and growing conditions. The central head weights will range from 0.3 to 1.0 lb each, while side shoots will average between 0.1 to 0.3 lb. The commercial trade only accepts 2 to 5 heads in a 1.25- to 1.5-lb bunch. Under good management and good growing conditions, per-acre yields should average between 400 to 500 cartons (21 lb net).

Varieties — Varieties that have proved reliable in recent variety tests are listed below:

Name	Type
Baccus	Early
Green Comet	Early (home garden/ pick your own)
Early Dawn	Early
Galleon	Early
Packman	Early
Emperor	Midseason
Legend	Midseason
Mariner	Midseason
Premium Crop	Midseason
Green Duke	Midseason
Arcadia	Late
Green Valiant	Late
Green Defender	Late
Southern Comet	Single Head
Decathlon	Late
Marathon	Late

* Refer to the *1999 North Carolina Commercial Vegetable Recommendations (AG-586)* for additional information.