

Growing

BROCCOLI

in hawaii

50
UNIVERSITY OF HAWAII
FIFTIETH ANNIVERSARY

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About the Author

Mr. Nakagawa is an Assistant Specialist in Horticulture with the Extension Service. He has been a staff member of the University since 1941, with the exception of the 1951-53 years when he was with a private firm. He has prepared this leaflet as part of a series for the farmers of Hawaii.

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Foreword

Broccoli is a popular green vegetable. The harvested part of the crop is the flower buds with its young, tender portion of the stems.

Approximately 350,000 pounds of broccoli were produced and marketed in 1954 with 50,000 pounds of fresh and 116,000 pounds of fresh frozen broccoli imported in the same period.

Varieties

The proper choice of varieties is very important in broccoli growing. The elevation, which governs the average temperatures during the growing period, and the market demand for small sprouts from side shoots or large sprouts from the central shoots, should determine the choice of the varieties to plant.

The varieties of broccoli are classified into early, medium, and late types. These types denote the earliness in sprout formation. In the warm lowlands (below 1,500 feet elevation), the early varieties are preferred since the warm temperatures will allow for a rapid plant growth and earlier harvest period. In the higher elevations (over 1,500 feet), the early varieties are not adaptable, especially during the winter months, because the cool temperatures retard the plant growth and the early varieties will form sprouts before the plants can make normal growth.

In the higher elevations the medium varieties should be grown in the late spring to early fall months, and the late varieties during the late fall to early spring months. This will allow the plants to make normal growth before sprouting.

The late varieties will produce vigorous plant growth with hardly any flower bud formation when grown in the lowlands.

The different varieties of broccoli are bred for either their central heads with little side shoots or for both central heads and side shoots.

The early varieties, De Cicco and Texas 107, are best adapted to the lowland growing conditions because of their ability to produce a fairly large central head and numerous lateral shoots. The medium variety, Calabrese, is best adapted to the higher elevations during the warm late spring to early fall months. The late varieties are best adapted to the cold late fall to early spring months in the higher elevations (3,000–4,000 feet).

Climatic Requirements

Broccoli makes its best growth under moderately cool conditions (60°–70°F), especially toward the harvesting stage. The compactness of the head (bud formation) which is an important characteristic in broccoli quality is developed best under cool temperature conditions even though the plants may have been growing in fairly warm weather. For this reason, the broccoli crop is best planted during the warm season, with harvest coming on in cooler weather.

Soil Requirements And Preparation

Broccoli will do well in any soil type which has a fair degree of fertility, a high water-holding capacity, and good drainage with a pH range of 6.0 to 7.0.

The soil should be deeply plowed wherever practical. Manure or other organic matter should be plowed in to a depth of 6–8 inches, if available.

If the soil must be fumigated for nematode control with DD or EDB, it should be done after the soil is prepared, and an interval of 2–3 weeks should be allowed after treatment before the field is planted.

Seedling Bed Preparation And Maintenance

Broccoli is seeded in seedling beds or flats and transplanted to the field. The seeds should be treated for the seed borne Black Rot or bacterial disease either by the hot water method or with the agricultural antibiotics, Agrimycin, Phytomycin,

or Agri-strep. The seeds should also be treated with a seed disinfectant such as Arasan just before planting to protect them from the damping-off disease.

Well-rotted manure or other organic matter, if available, should be mixed with the seedling bed soil at the rate of a gallon to 2 square feet of area. If manure is not available, apply 1 pound of 5-10-10 or other similar commercial fertilizer to 50 square feet and mix it thoroughly with the soil.

The seeded soil should preferably be sterilized with methyl bromide at 1 pound to 100 square feet, or with a formaldehyde drench using a 1-30 dilution at the rate of $\frac{1}{2}$ -1 gallon per square foot. These treatments will rid the soil of root-knot nematodes, weed seeds, and the damping-off organisms, and help in the growing of healthy seedlings.

The seeds are planted $\frac{1}{2}$ -inch deep, either by the broadcast method, lightly, or in rows spaced 2-4 inches apart in the seedling beds.

The seeds will sprout in 4-7 days and the seedlings will be ready for transplanting (4-6 inches high) in 4-6 weeks. The seedling bed should be watered regularly, in the morning hours, to allow the plants to dry as soon as possible. Seedlings that are overcrowded and kept wet will often become infected with Rhizoctonia or Black leg disease.

The seedling bed should be sprayed once a week with a fungicide-insecticide combination to control insects and diseases.

A teaspoonful of a water soluble complete fertilizer dissolved in a gallon of water may be used in watering the seedling bed once a week if manure or commercial fertilizer is not mixed with the seedbed soil.

Watering frequency should be lessened after the seedlings reach the transplanting stage to harden them for transplanting, especially during the summer months.

Transplanting

The seedlings should be transplanted to the field 3-4 feet apart between rows and 2-3 feet apart within the rows, depending upon the varieties grown. The early varieties require less space than the medium and late varieties. Leggy and spindly seedlings should be planted deep to prevent them from toppling over.

If the terminal growth is to be pruned for side shoot production, it should be done at or before transplanting. Pruning experiments conducted at the Washington Experiment Station in 1950 showed that pruning out the center shoot in every case reduced yields by $\frac{1}{2}$. It is not recommended unless required to maintain shoot size (market objects to large central sprouts in some cases).

Cultivation And Irrigation

The field should be cultivated frequently enough to control weeds and to prevent surface crusting of soils that cake and prevent water penetration. Cultivation should be shallow to prevent root injury. General contact weedicides such as paint thinners, and pentachlorophenate and oil may be used in controlling weeds between the rows if used with care when the weeds are small.

Irrigate regularly, or whenever necessary, to avoid allowing the plants to wilt from lack of water. Irregularity in irrigation may cause hollow stem conditions just below the sprouts.

Sprinkler irrigation should be avoided during late afternoons because the leaves will not dry out during the night and will expose the plants to Downy mildew infection.

Fertilizer Applications

Broccoli requires a good level of soil fertility to make the large amount of vegetative growth necessary for a large plant and heavy production of shoots. Apply 1,500–2,000 pounds of 8-12-14 or 8-12.5-6 fertilizer to a crop in 2–3 applications.

The first application of fertilizer at the rate of 500–700 pounds per acre is made at transplanting time in two 3-inch bands, 2–3 inches to the side and 2–3 inches deep, one on each side of the plants.

The second application of fertilizer at the rate of 1,000 pounds per acre is made about 4–5 weeks after transplanting and placed 6–8 inches to the side in two 4-inch bands, 4–5 inches deep on both sides of the plants.

The third application of fertilizer is made at the rate of 500 pounds of a complete fertilizer per acre, 12–14 weeks after transplanting, if the crop shows signs of producing for a month or more.

Side dressing of nitrogen may become necessary using sulfate of ammonia at 100–200 pounds per acre once a month after harvesting begins. Foliar applications of nitrogen, using Urea or Nugreen at the rate of 3–4 pounds Urea in 100 gallons of water once in two weeks, may be applied instead of ground applications.

In areas where the soil is low in boron, this element should be mixed in the fertilizer and applied at the rate of 20 pounds (of borax) per acre, or as a foliar spray using 2 pounds of borax in 100 gallons of water.

Insect And Disease Control

The insects most commonly found infesting the broccoli plants are these: aphid, cabbage looper, cabbageworm, cabbage webworm, and the red spider mite. The cabbage webworm, cabbage looper and cabbageworm can be controlled by the use of DDT sprays or dusts. For sprays, use 2 pounds of 50 percent DDT in 100 gallons of water. For dusting, use a 2½–5 percent dust. Aphids can be controlled by the use of TEPP* (Vapotone) or Malathion sprays or dusts. For sprays, use ½ pint of 20 percent TEPP in 100 gallons of water, or 2 pounds of 25 percent wettable Malathion in 100 gallons of water. For dusting, use a 2 percent Malathion dust.

The red spider mite can be controlled by sulfur sprays or dusts. The spraying or dusting should be done thoroughly and at regular intervals to control them.

The most common diseases of broccoli are wire stem and black leg disease in the seedling stages, black rot and Downy mildew in the maturity stages.

The wire stem disease is caused by the *Rhizoctonia* fungus and can best be controlled by seed treatment with a seed disinfectant, or by drenching the seedlings with a 1–2,000 solution of mercuric chloride if the disease appears in the seedling bed.

Black leg and black rot diseases are usually transmitted through the seed. The best control is by hot water seed treatment at 122°F. for 25 minutes.

Downy mildew may become serious in the cool, wet areas and seasons. It appears as fluffy, purplish-white growth on the undersides of the leaves, leaving yellow spots on the top surfaces. This disease can best be controlled by spraying with a fungicide such as Zineb, or Captan.

**Caution:* TEPP is a very toxic insecticide. Use with great care. Read the label carefully and follow the directions on containers. Do not apply within 3 days of harvest.

When applying insecticides and fungicides read the label carefully and follow directions accurately. Do not use chemicals which are not registered for use on broccoli. Apply the chemicals only in the amounts specified and at the times specified.

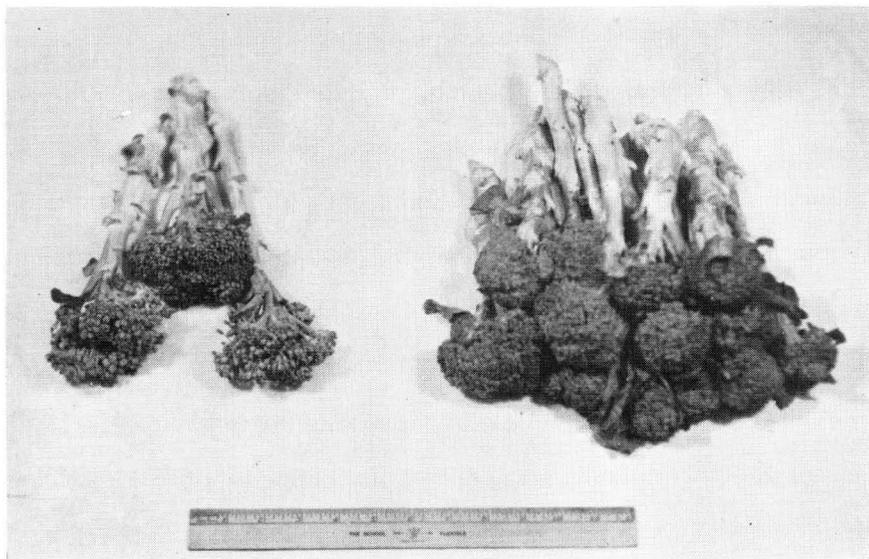
If the instructions specify two pounds in 100 gallons of water per acre, use this amount and no more. If a period of 14 days is called for between last spray and harvest, do not harvest in a lesser number of days. This will enable you to remain within the residue tolerance limit established under the Pure Food and Drug Act.

Harvesting

Broccoli is ready for harvest when the heads, whether large or small, central or side, are well developed, compact, and the buds unopened. Any indications of the appearance of the yellow flower petals in the heads show overmaturity.

The heads are harvested with 8-10 inches of the stems, the leaves trimmed, and stems tied in bunches usually, with "twistems." In cutting the central head, the cut should be made diagonally. Any hollow-stemmed portion on the plant should be cut off to prevent the accumulation of water and eventual rotting.

The harvested heads should be packed in ice or refrigerated immediately after packing for market to enable the heads to retain their turgidity and green coloring. Heads stored in the open and left unrefrigerated usually turn yellow and wilt, becoming unsalable.



Left: Sprouts slightly past harvest stage. Right: Sprouts at right stage for harvest.

NOTES

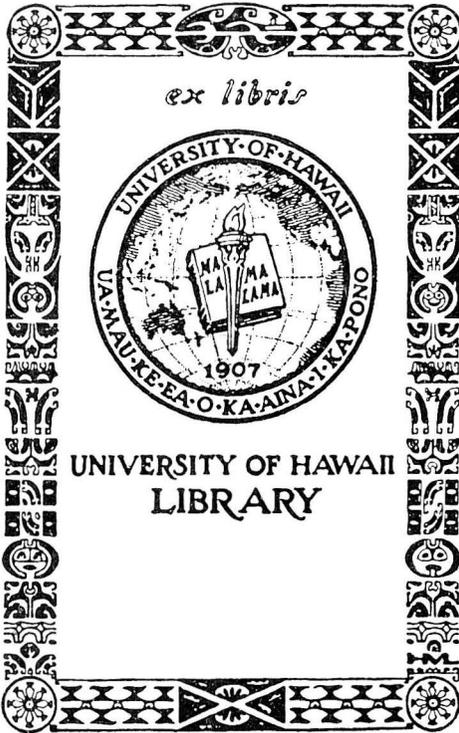


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