

Rutabaga and Turnip

VEGETABLE CROPS PRODUCTION GUIDE

FOR THE ATLANTIC PROVINCES

Prepared by the ADVISORY COMMITTEE ON VEGETABLE CROPS

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Introduction

Both turnip and rutabagas are in the cruciferae (mustard family).

Brassica rapa Rapifera group (turnips) are closely related to Chinese cabbage and mustards. It is a biennial but is cultivated as an annual. It seems to have originated in areas of Europe and Siberia. It has been cultivated since ancient times. Turnips have a white or yellow fleshed root generally with a flattened globe shape. The root is less dense than the rutabaga and lacks a neck. It is also free of secondary roots which occur on the tap root of a rutabaga. The leaves are hairy and without the wax of a rutabaga. Turnips are sometimes used for fresh or cooked greens.

Brassica napus Napobrassica group (rutabagas) are closely related to cole crops and were an interspecies hybrid bred in Switzerland (summer turnip x winter white cabbage). The rutabaga was introduced into England about the end of the 18th century and was called the turnip rooted cabbage. Both white and yellow fleshed cultivars exist. The rutabaga root consists of both true root and true stem. The upper portion of the stem forms a neck. This neck distinguishes rutabagas from turnips. Rutabaga is a Norwegian term for a "Swede" turnip.

Turnips and rutabagas are well adapted to cool and humid growing conditions. The minimum temperature for germination is 5C, the optimum germination range is 15 to 29C, with an optimum germination temperature of 15C. They favour growing temperatures in the 15C to 20C range and are frost resistant but are not usually left in the ground later than the end of October. They can withstand dry periods if some soil moisture is available. Growth is reduced by an excess of water. Cracking of the root may occur with a fast growth rate brought on by excessive fertilization, wide spacings and hot humid weather. Sometimes these growth cracks become infected with soft rot bacteria.

Bolting or flowering can be a problem. Normally rutabagas are biennials, i.e., they form a swollen root during the first year of growth and flowering stems in the second year of growth after a cold period. If transplants are subjected to low temperatures (below 5C) when they are less than 10 weeks old, this will trigger the development of flowering stems. The duration of the low

temperature period required to cause flowering varies with the cultivar being grown. However, as little as 3 to 5 nights with temperatures around 3C are believed to result in development of flowering stems. Field plantings or seedlings can be affected by low temperatures but transplants more than 10 weeks old would require several nights of freezing temperatures to induce flowering.

These crops thrive on moist, well drained and moderately acid, sandy loams, loams and clay loams which are well supplied with organic matter. On sandy loams roots may tend to be elongated especially in dry weather and with dense plant populations. The best quality crops seem to come from clay loam soils which are well drained and that have not been intensively cropped. Soil "capping" can be a problem on heavy soils with poor rotation and problems with weather.

In the Atlantic area both turnips and rutabagas are grown commercially only for their roots. The turnip (white purple top) being earlier is marketed 2 weeks before the early rutabagas are available (July 1 - 14). Turnips may be grown throughout the growing season (especially with the aid of irrigation) from July 1st to the end of October. This crop may also be stored for short periods of time depending on the availability of markets. Yields of turnips could range between 25,000 to 35,000 kg per hectare. Rutabagas are marketed from mid July until the end of October from the field and are marketed from storages until the 1st of July (or later in some years). It is one of the few vegetable crops we can have on the market 12 months of the year. Rutabagas should produce marketable yields of 20,000 to 50,000 kg per hectare under good growing conditions with adequate pest control.

Turnips and rutabagas are important crops in the Atlantic area for domestic markets and for export. Maintaining and expanding markets for this crop with better quality and marketing techniques is probably the best development strategy. Small amounts of rutabagas are processed on a sporadic basis. Diced rutabaga is either frozen or canned. Specialty markets may exist for some types of turnips.

Nutrient Content: Good source of Vitamins A and C, potassium and small amount of other nutrients. Low in sodium. 250 mL (1 cup) rutabaga raw contains 42 kilocalories; cooked - 74 kilocalories.

Crop Establishment

Seed Treatment - obtain sized, registered seed of a high percentage germination and vigor. "Purple topped" cultivars are the standard accepted in the marketplace.

Seeding/planting - rutabaga seedlings for early market may be made as soon as soil can be worked. Use high quality, large sized seed. For the main storage crop, plant late in June or early in July, so that the plants will develop during the cool fall weather. Early seeded crops can develop into plants that are woody and of poor eating quality. Seed at the rate of 225 to 450 g per hectare and at a depth of 0.6 to 1.2 cm. Seed should be sown 10 to 17 cm apart in rows 50 to 90 cm apart. Use seeders that space the seeds to known intervals, or to stand. This will eliminate

thinning and produce a highly uniform crop. Where thinning is required, do so when the plants are 4 to 8 cm high. Space 15 cm apart in the row. Use the wide in row spacings for early production and the close spacings for producing small product for poly bag packs. (Spacing affects both the size and the harvest date.)

Also, module or cellular transplants for rutabagas are being used. Care has to be taken to grow short, sturdy transplants without too much cold which could promote bolting to seed. Plastic row covers can be used to increase earliness.

Mis-shaped roots (long cylindrical shaped) result from seedlings being grown under low light conditions and with large differences between day and night temperatures. It is essential to provide good ventilation during the day to help reduce temperatures when the days are bright and sunny. If temperatures can be raised at night with supplementary heating to above 10C so much the better, but the economics of doing this may be questionable. Delaying seeding may be useful in growing a crop that is less likely to bolt and will produce better shaped roots.

Turnips can be seeded or transplanted for earlier maturity than rutabagas (50 to 70 days after seeding). Best quality occurs when this crop matures under cool conditions. Some consumers prefer turnips for certain culinary uses.

Crop Management

Cultivate - start cultivation early for weed control, cultivate shallowly and frequently. Do not work in field when plants are wet.

Irrigation - may be used sometimes to cool and slow the growth of the crop as well as to promote growth and quality. Irrigation may activate soil insecticides or carry fertilizer to the plant roots.

Early crops - may be grown with the use of transplants. Transplants may be started in late March and field set or placed in tunnel houses in mid to late April. Turnips are earlier than rutabagas. There appears to be little difference in the earliness of maturity in rutabaga cultivars. "Laurentian" is more vigorous. These crops may be seeded in module trays or peat blocks.

Rotation - long rotation is critical in these crops to control diseases like clubroot and rhizoctonia.

Nutrition

ALL ADDITIONS OF LIME AND FERTILIZER OR MANURES SHOULD BE BASED ON RECOMMENDATIONS FROM A SOIL TEST.

Turnips and rutabagas require only moderate amounts of fertility. A better quality product is produced if the growth is moderate and uniform, and the crop matures under cool conditions.

Manures - Manures may be used but excessive levels coupled with wide spacings and hot humid

weather have led to excessive splitting and sometimes total loss of the crop. There are high risks in trying to produce rutabagas by early to mid July since they have to be heavily fertilized.

Lime - Lime should be applied to maintain the soil pH in the range 6.0 to 7.0. (Below pH 6.0 boron is more available).

Nitrogen - Too much can be detrimental to this crop in terms of growth cracks and the reduced storage life of the crop. Excessive nitrogen and high plant populations may also cause the rutabaga root to become elongated. Usually nitrogen is broadcast preplant and incorporated into the soil. Some early rutabaga growers may also sidedress their crop in June. In total, 50 kg/ha of actual nitrogen is usually applied at planting time.

Phosphorus - Is generally applied preplant and incorporated into the soil. High rates of phosphorus are thought to increase the growth rate of this crop in warm humid weather along with nitrogen resulting in more growth cracks.

Potash - These crops do not generally respond to potash. Generally potash is applied preplant incorporated.

Sulfur - On sandy soils with low organic matter that are intensively cropped without the use of manure, application of gypsum should be considered.

Magnesium - On soils low in pH, especially sandy soils, magnesium levels may be low. Apply magnesium in the fertilizer, apply dolomitic limestone and/or apply foliar sprays of magnesium sulphate (epsom salts).

Micronutrients - *Boron* deficiency causes brown-heart or watercore. (When acutely deficient rutabagas may have an alligator-like skin). In storage, brown-heart may become white and spongy in appearance. Apply 3.5 kg per hectare of actual boron with the fertilizer at the time of planting; also apply two sprays of solubor at 5.5 kg per hectare, each at 28 and 42 days after planting. It is suggested that a surfactant be used with these sprays. Foliar sprays are essential especially if soil pH is over 6.0 or moisture stress occurs during the 3 to 6 week period after planting. "Laurentian" is more susceptible to boron deficiency than other cultivars. *Manganese* - may be a problem where pH's are extremely high on sandy soils. Control may be obtained with two sprays of manganese sulphate at 4 kg per hectare for each spray.

Application Method - Fertilizers at high rates are best broadcast and incorporated prior to planting. Fertilizer placed too close to the root will result in excessive root formation, misshapen roots and consequently high cullage rates.

Pests and Pest Control

Weeds

Herbicides recommended for use on rutabagas will not provide total weed control, therefore, it is

important to grow rutabagas in soil where the weed seed population is low. This is best accomplished by a crop rotation program utilizing crops where weeds can be thoroughly controlled for a year or two prior to rutabagas. Stale seedbed technique can be used to considerable advantage on late seeded rutabagas. Care must be taken to avoid fields where residual herbicides from previous years persist in the soil as crop injury may occur. Cultivation is required to supplement chemical weed control.

There are many common weeds in the Cruciferae family, including shepherds purse, yellow rocket, wild mustard, wild radish, pennycress, worm seed mustard, hare's ear mustard, false flax, etc. Since they are closely related to rutabaga and turnip, they serve as hosts for many insects and diseases that attack these crops. They often become serious weed problems because of their tolerance to herbicides used in these crops. Crop rotation, herbicide rotation, cultivation, and clean culture will help reduce cruciferous weeds in these crops.

Diseases

Downy Mildew (fungus)

Characteristics: Shows as a white, fuzzy fungus in patches on underside of leaves. The fungus overwinters on seed, in cruciferous weeds and perhaps soil. May cause internal discoloration of roots.

Control: Avoid thick or heavy seedings. Plow crop residue following harvest. If infections are severe rotate with non susceptible crops.

Powdery Mildew (fungus)

Characteristics: Causes a white, powdery, superficial patchy growth on the upper surface of leaves later spreading to the underside of leaves. Leaves turn light green, then to yellow and finally to tan. Leaves may die and fall off the plant. Disease development is favored by low relative humidities and water stress.

Control: Rotate and eradicate cruciferous weeds. Fungicides are available for control.

Clubroot (fungus)

Characteristics: Causes wilting and yellowing of above ground parts. Large spindle shaped galls form on the roots. The fungus causing clubroot in rutabagas and cole crops is usually present in areas where these crops have been grown for many years. Land will remain infested for 7 years or longer after a diseased crop. Certain weeds of the mustard family, such as wild radish and wild mustard (cadlock) will maintain or increase the level of infestation year after year. Every effort should be made to control weeds of this family. Soil pH of less than 7.2 favors the disease.

Control: Avoid fields known to be infested and practice a rotation of 7 years once infestation has been encountered. Do not use manure from animals fed on infected crops on land intended for

rutabagas or any cole crop. Put manure back on the fields that contained the infected roots and do not grow any cole crop on the field for at least 7 years. Grow resistant varieties. "York" is resistant in most areas of P.E.I. and southern N.S. A strain of the organism present in a number of areas in Nova Scotia, the Sussex area of New Brunswick and in parts of Newfoundland, will cause clubbing in "York". Even when growing a resistant variety, practice a 3 year rotation between cruciferous crops. Do not rely on resistant varieties alone. Plant on well drained fields. Maintain high soil calcium and magnesium soil test levels and a pH over 7.2. (In Atlantic Canada this means a calcium level of 5000 to 6000 kg per hectare and a magnesium level of over 800 kg per hectare using the current testing method).

Rhizoctonia Rot (fungus)

Characteristics: The fungus *Rhizoctonia solani* causes damping-off and wirestem of other crucifers as well. On rutabagas, the fungus causes a superficial dry rot. Lesions may be sunken, shiny and brown with purplish rims that may develop into large irregular black craters with faint zonation and a scabby appearance. On turnips the lesions are circular to elliptical and often zonate and vary from grey to brown in color.

Control: Infection may occur in the field or during storage. Field infections may be more severe where insecticides are not applied to control root maggot. The amount of decay increases rapidly as the temperature is raised above 4C. Good control can be achieved by storage at 0C to 2C. Excessive soil in storage bins can aggravate the problem.

Common Scab (bacterium)

Characteristics: Scab, caused by *Streptomyces scabies* is a well known disease of potato and may cause severe damage of rutabagas. Infection results in circular to oval lesions scattered over the surface of the root and lesions frequently coalesce to form a band around the root just beneath the soil line. Affected tissues may consist of a tan-colored, superficial or raised layer, or tissues may become pitted and dark following secondary decay.

Control: Disease develops in dry soils and so adequate moisture should be maintained during the period of rapid expansion of the roots when they are most susceptible. A rotation of potatoes, grain, and one year of hay or other green manure crop, followed by rutabagas is effective. High lime application, resulting in high soil pH, is effective in controlling clubroot but it may aggravate scab. Manure from animals fed on diseased roots should not be used on land to be sown to crucifers. Scab tends to be most severe where wood ashes have been applied to the soil and/or where manures containing wood fibre have been used.

Blackleg (fungus) and Black Rot (bacterium)

Characteristics: Early signs of blackleg appear as small spots on leaves of young plants. On stems the spots are more linear and often surrounded by purplish borders. Stem lesions at the soil line usually extend to the root system causing dark cankers. The fibrous root system may be destroyed although new roots sent out above the lesion may keep the plant alive. Plants may wilt

abruptly and die. Dark cankers may develop in fleshy roots of turnip and rutabaga or may develop as a dry rot on stored roots.

Black rot lesions first appear at margins of leaves. The tissue turns yellow and the lesion progresses toward the center of the leaf, usually in a v-shaped pattern with the base of the v toward the mid rib. The veins become dark and discoloration frequently extends to the main stem and proceeds upward and downward. Black discoloration of rutabaga roots may occur.

Control: Practice a 4 year rotation. Destroy cruciferous weeds as they may harbour the black rot organism. Do not work in the field when plants are wet.

Water-Core or Brown Heart

Characteristics: Caused by boron deficiency. Appears at first as firm, dark, water soaked patches in the rutabaga flesh. May eventually turn brownish and spongy inside, especially in storage.

Control: Apply boron with the fertilizer and as foliar sprays.

Insects

Cabbage Maggots and Other Root Maggots

Characteristics: The adult is a two-winged, ash-grey fly with black stripes on the mid-section. It is smaller than the housefly. Larvae are white, legless maggots. They are wedge-shaped with dark feeding hooks at the front end. The pupae are 6 mm long, oval, hard and dark brown. There are two to three generations a year. Pupae overwinter in the soil near the roots of the host plant. Adult flies emerge in the spring and crawl to the surface. (Emergence of the first generation coincides with the bloom of such plants as amelanchier and yellow rocket). The adults fly close to the ground near host plants and lay oval shaped white eggs at the base of the stem or in nearby crevices in the soil. Eggs hatch in three to seven days. Maggots then enter the roots and feed by rasping the plant tissue with a pair of hook-like mouth parts. They mature in three to four weeks and then pupate. Flies emerge in two to three weeks. Larvae or maggots feed by tunnelling into the roots. Plants may be killed, weakened or stunted, and yields reduced. Severely infected plants wilt and remain in place in the row unlike those severed at ground level by cutworms. A small amount of tunnelling in rutabaga renders the crop unmarketable.

Control: Practice crop rotation, and grow the current year's crop as far as possible from fields used for rutabagas or cole crops in the previous year. Do not grow crops of early and late rutabagas close together or near early broccoli, cabbage, cauliflower or other cruciferous crops. Separate them by at least 200 metres.

Insecticide application for root maggots can be timed to coincide with the start of egg-laying activity of each generation of adults. This generally means drenches in early May to mid-June, early July to late August, and mid-September for the three generations, respectively, of the cabbage maggot. Actual time and severity of infection fluctuate according to soils, locality and

weather. Inspect for signs of egg-laying activity on or near the base of the plant where the stem meets the soil.

Apply insecticides as listed in the Guide to Pest Management or use materials such as floating mulch that exclude the insect from laying eggs near the rutabaga plant.

Wireworm

Characteristics: Early in the spring, adult wireworms (click beetles) lay their eggs around grass roots. The larvae hatch in about a week and, depending on the species, will live for 1 to 5 years in the ground feeding on roots and seeds. Wireworms require 3 or more years to complete their life cycle. Wireworms of all sizes and ages are present in the soil throughout the year as there is always an overlapping of generations. The wireworms, or larvae, are yellow, white or darker shades of brown. Fully developed larvae may be 1.2 to 4 cm long and have a hard, smooth surface. When a larva is mature, it pupates in the fall. It then becomes an adult beetle and waits until spring to emerge. Wireworms are often numerous in land that has been in sod for several years. They are also more abundant in heavy poorly drained soil.

Wireworms are sometimes confused with millipedes. Millipedes have numerous pairs of legs and coil up when disturbed, while wireworms have three pairs of legs near the front of the body and do not coil up.

Control: Plant treated seed and avoid planting crops highly susceptible to wireworms in a field that has been recently in sod. See appendix III in the Guide to Pest Management for Vegetable Crops.

Aphid

Characteristics: Aphids are small, soft-bodied, slow-moving insects. They are often found in large colonies on the undersurface of leaves. A colony consists of winged and wingless adults and various sizes of nymphs. Aphids may be black, yellow, or pink but mostly are various shades of green. Aphids feed by sucking plant sap. Saliva injected while feeding may carry plant viruses or may be toxic to the host plant. Feeding by large numbers discolours foliage, curls leaves and damages developing buds. The plants may be covered by a sticky substance, called honeydew, which is excreted by the aphids.

Control: Spray only if aphids are so numerous as to cause wilting of leaves during dry weather. Predators such as ladybird beetles (coloured with black spots or stripes) and their larvae (black or purple with orange or white markings) may control aphid aphids.

Imported cabbageworm, Cabbage looper, Diamondback moth larvae, Purplebacked cabbageworm

Characteristics: The adult of the imported cabbageworm is a white butterfly, seen fluttering from plant to plant laying eggs during the summer. The eggs become velvety-green larvae with

one yellow stripe down the centre of its back and a paler broken stripe along each side. Cabbageworm larvae do not loop when they walk. They are generally the most prevalent larvae on cabbage.

The cabbage looper gets its name from the way it loops as it walks. It is a smooth green larvae with white stripes along the back and sides. They are heavy feeders and since they migrate into this region are usually only a problem in late summer.

The diamondback moth is much smaller than the other cabbage worms. Three to six generations of 1.1 cm long green larvae may develop each year. The larvae squirm actively when disturbed and produce many small holes in leaves of the host plant. Under high population conditions when leaves are severely eaten, the crown is then damaged. Hot, dry conditions can cause populations of this insect to explode. Under cold, wet conditions this pest is not much of a problem.

The purplebacked cabbageworm is not as commonly seen as the others but it can cause serious damage in high numbers. The larvae are purple on the back and pale yellow along the sides. There are two generations per year.

Control: If larvae are causing severe leaf damage, use one of the recommended insecticides.

Flea Beetles

Characteristics: Flea beetles are small shiny black beetles which feed on the leaves of various cruciferous plants. Flea beetles are prevalent mostly in the spring. Adult beetles winter over and feed on emerging seedlings. They can severely damage seedlings. On larger leaves damage appears as small holes. Hot sunny weather favours the adult beetles and damage is most severe during such periods. The larvae feed on the root and are capable of causing scarring to the root surface. There is one generation per year.

Control: If necessary, apply a foliar spray when damage appears. Controls applied for root maggot will also control flea beetles.

Cutworms

Characteristics: Occasionally, black and dark sided cutworms may cause considerable damage to rutabagas and turnips. They feed on the crown, and leave deep scars, or burrow into the root. Damage may occur in the spring, and also later in the growing season. These late season infestations are difficult to detect, and often are not noticed until harvest time.

Control: Cutworms are normally kept under control by chemicals used for maggot control. If cutworm damage is likely, drenches of Lorsban can be applied.

SPECIFIC CHEMICAL CONTROLS FOR THE VARIOUS CROP PESTS DISCUSSED MAY BE FOUND IN THE "GUIDE TO PEST MANAGEMENT FOR VEGETABLE CROPS."

Harvesting and Handling

The quality and flavor of rutabagas are much improved when the roots are fully matured and are exposed to frosts before harvest. Immature roots have a bitter taste, and if early seeded rutabagas are left in the field until late fall, the roots tend to become fibrous and woody.

Certain types of potato diggers can be readily adapted for harvesting rutabagas. But before you start to dig, remove the tops with the aid of a topping device. Crops can also be harvested by using a modified sugar beet or carrot harvesting machine. In preparation for long-term winter storage (6 to 8 months), trim the tops to within 1 cm of the body (do not leave any leaf tissue as severe rot can occur that will rot the crown, such that it is unmarketable) and cut off the bottom of the taproot and the fibrous side roots. Protect newly harvested rutabagas from sunburn and freezing at all times and handle them gently to avoid bruising. Do not harvest under wet conditions or place wet rutabagas into storage.

Mechanical harvesters tend to spread bacterial and fungal organisms (particularly if the crop is not surface dry within a week of harvesting) to crowns and mechanical wounds on roots. To minimize rot in the crown, rutabagas should be topped a week or 10 days before harvesting, with a hoe, knife or mechanical topping machine.

Turnips are harvested when they are over 5 cm in diameter and are then marketed as quickly as possible maintaining similar storage conditions to rutabagas. Polybags may be used to maintain high quality and present an attractive product.

Storage and Conditioning

Never store rutabagas infected with disease and sanitize the storage area each spring.

Rutabagas may be piled up to 2 m deep over a slatted floor with an air circulation system to keep the temperature uniform. Perforated plastic sheeting placed horizontally at 45 cm intervals helps to reduce moisture loss and excessive accumulation of moisture at the top of the pile or on the roof of the storage area. Avoid bruising.

To obtain best results, lower and maintain the storage temperature close to 0C and keep the humidity at 95% or higher. Under these conditions, rutabagas keep for over 6 months. The flavor of rutabagas is improved by the conversion of starch to sugar, reducing strong or bitter flavors. This conversion occurs when rutabagas are held at temperatures of 0 - 5C and may occur in the field or in storage.

In Atlantic Canada rutabagas are commonly washed. In Central Canada they are frequently waxed following storage to prevent loss of moisture during marketing. Waxed rutabagas are considered to have a greater eye appeal and greater consumer demand than unwaxed ones. Temperatures must be kept low after waxing as waxed rutabagas spoil quickly at room temperature.

An alternative method is to place rutabagas in perforated plastic containers to prolong shelf life. Rutabagas in plastic bags have been kept at room temperature for 6 weeks without apparent deterioration compared with 3 to 4 days for waxed ones under the same conditions.

Peeled and cut rutabagas (diced or sticks) have a storage life of 3 to 4 weeks when packaged in plastic bags and held at 0C.

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