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Specialty Crop Profile:
Rhubarb

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Introduction

Rhubarb (*Rheum rhabarbarum*) is an herbaceous edible perennial and a member of the buckwheat family. It has also been classified as *Rheum rhaponticum, Rheum x hybridum,* and *Rheum x cultorum*, and there are many related, non-edible Rheum species. It is native to Siberia, and has been used as a medicinal plant in Asia for over 5,000 years. Rhubarb was once a very well-known and popular vegetable in this country. But it is not as widely grown as it was in the past. Introduced by European settlers in the 1700s, it is commonly known as "pie plant" and is grown for its edible, but very tart leaf petioles (leaf stalks), which can reach 12 to 18 inches long and one to two inches thick with a crispy texture similar to a large celery stalk (Figures 1a, b). The leaves are toxic because of their oxalic acid (soluble oxalates) content, which can cause human and animal poisoning and must be trimmed from the petiole prior to use.

Fig. 1a. Rhubarb stalks trimmed of leaves and bundled for market. Photos courtesy Hannah Stevens, Michigan State University IPM program, *http://www.ipm.msu.edu/CAT01_veg/V05-30-01Region3.htm*

Rhubarb has a mounding growth habit (two to four feet tall and wide) with large (up to 12 inches across), heart-shaped leaves (Figure 2). In the early spring, new leaves emerge erect from the center of the plant.

Fig. 1b. Rhubarb trimmed with some leaf tissue remaining. Photo courtesy ZoeAnn Holmes, Food Resource Center, Oregon State University, *http://food.oregonstate.edu/a/rhubarb.html*

Fig. 2. Large rhubarb plant showing the size of the leaves.
(Photo by A. Bratsch)

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They develop from buds on fleshy red/brown rhizomes (Figure 3) that form a large, slow-spreading, underground "crown" and a deep root system. The plant dies down with the first frost. Each year the crown increases in size and the number of leaves it produces. Once established, rhubarb requires minimal care as compared to other perennial vegetable crops such as asparagus. Plantings can be long-lived and if managed correctly, can last 10 to 15 years or more.

Fig. 3. Rhubarb crown piece and emerging leaf. Photo courtesy David Graper, John Bell Department of Horticulture, South Dakota State, Pest Alert Newsletter, May 1, 1999, *http://hflp.sdstate.edu/images/Rhubarb%20bare%20root%20plant2.jpg*

Like certain ornamental perennial species, rhubarb plants should be dug and divided every five to eight years to ensure vigor. These divisions are used to vegetatively propagate the plant, though it is sometimes grown from seed. Plants can develop a strong, vigorous root system that responds to good soil tilth and organic matter additions.

Rhubarb is a cool-season crop that has the potential to be grown successfully in most, but not all, parts of Virginia. It is extremely winter hardy. Depending on variety, it requires at least 500 hours of winter temperatures between 28° and 49°F (chilling hours) to adequately form new leaf buds. Thus its culture may be limited in the warmer southeastern Coastal Plain area, which may not experience duration of these temperatures. Cold requirements do vary among varieties, and "low-chill" varieties may perform adequately in warmer Virginia locations. However, this varietal characteristic is often not reported or well-known, and growers should plant several varieties on a trial basis to see how they perform. In Southside and the Lower Piedmont regions north to Richmond, winter temperatures may be sufficient to allow bud formation, but supplementary water application and the use of straw mulch should be considered to help plants withstand drought and the stress of summer heat. The Upper Piedmont and Mountain regions and parts of Northern Virginia are the best areas for rhubarb production.

Market Potential

Rhubarb is an overlooked vegetable that can be a good choice as a complementary spring vegetable, particularly for strawberry growers, and other early-season roadside marketing and farmers market situations. The thick, edible petioles have a strongly tart-sweet flavor and are used most commonly in pies and other baked desserts. Rhubarb has particular market potential with older or retired people more familiar with this vegetable (especially if they are from the Midwest and North Central states). Younger people may need education on the use of this once very popular vegetable, and the use of recipe cards can help to spur extra sales. Providing samples of freshly baked rhubarb pies, cobblers, or other products can also help increase customer awareness of this vegetable. A row or two planted near the market is an attractive harbinger of spring and may be all that is needed to supply local demand.

Rhubarb is grown commercially in the Pacific Northwest, California, and Michigan for both the fresh-shipping and processing markets (Figure 4). It is well-adapted to these regions that have mild summer temperatures. The shipping market is limited and competitive. The most promising wholesale market outlets are direct sales to restaurants and local or specialty grocery stores. As noted, for small-scale growers, direct marketing holds the most potential for sales. Besides fresh product, value-added uses for roadside and farm-

Fig. 4. Commercial rhubarb planting in Oregon. Photo courtesy Bill Mansour and ZoeAnn Holmes, Food Resource Center, Oregon State University, *http://food.oregonstate.edu/a/rhubarb.html*

ers market sales include baked goods, jams and jellies, and wine. Rhubarb also has potential as an organically grown crop. It has few pests and can be grown successfully with a limited pest management program and preventative production practices.

Planting Considerations

Varietal Characteristics and Sources

Most commercially available varieties of rhubarb have been around for many years, and some are considered "heirloom" varieties. Few new varieties are being developed in the U.S. though some new varieties are being released in Europe, where the crop enjoys more attention. Generally, nurseries offer one or two varieties. The characteristics of available varieties are well known, but their performance in the various parts of the state are not widely reported. Growers are encouraged to plant a number of different varieties and conduct their own on-site performance evaluations.

Growers select varieties based on stalk color (which can range in hue between red and green), plant size, stalk thickness and length, flavor and tartness, yield, depth of dormancy (winter chilling requirement), and the tendency to form seed stalks. Resistance to root or crown rot is also important, especially in heavy soils. Finding a particular variety of rhubarb is often a challenge, though a number of online nurseries carry specialty types. A few examples of more common varieties are listed below, and a nursery source list for some, but not all of these varieties is provided in Table 1.

Tilden. Good red color, not upright, spreading, thick stalks.

Victoria. French variety, good vigor, tart, long stalks, green with pink speckling, many seed stalks.

Valentine. Medium vigor, good red petiole color, few seed stalks.

MacDonald. Fair pink-red color; very upright; many thinner, tender, moderate seed stalks; some resistance to crown rot problems, best for heavier soils.

Crimson. Red color throughout stalk, thick.

Canada Red. Cherry red through stalk, higher sugars, for cooler regions.

Red Cherry. Reportedly low in chilling requirement, dominant California variety.

Ruby Red. Long red stalks, deep red color, retains color well when cooked, vigorous, few seed stalks.

Site Selection and Field Preparation

The site should have an open sun exposure, though in warmer parts of the state, a site that provides protection from the late afternoon sun with a tree line can help limit heat stress. Rhubarb does best in deep, well-drained, fertile loam soils that supply plants with ample organic matter. Soils should have a slightly acidic pH of 6.2 to 6.8. However, rhubarb is adaptable and can be grown in heavier clay soils, provided internal drainage is sufficient. Very sandy soils should be avoided unless significant organic matter additions can be made. A soil test should be conducted prior to planting to determine pH, phosphorus (P), and potassium (K) levels. Lime may be needed to adjust pH, and P and K levels should be amended to "moderate" soil-test levels. A minimum preplant application of 50 to 75 pounds P (as P_2O_5) per

Table 1. Nursery sources for rhubarb.

Source	Contact information	
Nourse Farms, Deerfield, Mass.	(413) 665-2658; *http://www.noursefarms.com/catalog/rhubarb*	2 varieties
Daisy Farms, Dowagiac, Mich.	(269) 782-7131; *http://www.daisyfarms.net/index.html*	1 variety
Gourmet Seed International, Tatum, N.M.	(505) 398-6111; *http://www.felcopruners.net/index.html*	seed only, 2 varieties
Johnny's Selected Seeds, Winslow, Maine	(877) 564-6697; *http://www.johnnyseeds.com/Home.aspx*	1 variety
Indiana Berry and Plant Company, Huntingburg, Ind.	(800) 295-2226; *http://www.inberry.com/index2.html*	4 varieties

acre and 150 pounds K (as K_2O) per acre should be made. Rhubarb is responsive to high organic matter levels, and when possible, an application of compost, old manure, or other form of degraded organic matter is recommended.

The site should be moldboard- or chiseled-plowed, incorporating all preplant amendments. Crowns are susceptible to fungal problems and are not tolerant to water-logged, poorly drained soils. Soil drainage can be assessed by digging a 12-inch deep hole and filling it with water. It should percolate through within two to three hours. In heavy soils with high clay content, raised beds may be beneficial and increase internal drainage. Beds can be formed using a moldboard plow, disc-hillers, or hand constructed. Beds should be six to eight inches high and from three to four feet wide with a flat "table" or surface to discourage bed erosion. Rows or beds should be made at least five to six feet apart on-center but, depending on equipment, can be wider to allow access. Between the beds or rows, a permanent sod can be seeded to support equipment traffic. A weed-free strip should be maintained between and around plants in the row.

Handling and Setting New Plants

The most common method of establishing a planting is using crown divisions. New plants (crowns) or divided crowns from older plants can be used. Crowns are divided by cutting them into pieces with two to three buds each. Nursery stock should be ordered as soon as possible to ensure availability. Some nurseries advertise seed, and plants can be started a year in advance in the greenhouse for planting the following year. If the site or weather is not conducive to planting, crowns should be kept under refrigeration. The package should be monitored regularly to make sure crowns do not become moldy during temporary storage. Crowns that have been recently cut and divided should be allowed to open-air dry for a day or two before planting, and/or dipped in a dry fungicide (such as Captan™) to help reduce the chance of fungal infection.

Planting can begin as soon as the soil can be worked in the spring. Small plantings are usually set by hand. Planting holes approximately 4 to 6 inches deep (depending on crown size) can be dug using a spade or post-hole digger. A field with plants spaced three feet apart in rows six feet apart requires 2,400 crowns per acre. New crowns are set in the holes with the crown buds positioned just below the soil surface (approximately one inch). The soil is backfilled around and over the crown and firmed. Newly planted crowns should be irrigated to settle them in; however, a two- to three-day delay in watering may also help prevent root rots and allow fresh cut areas to heal over. The water should have a water-soluble fertilizer at transplant solution rates as indicated by the material label (i.e. 20-20-20 at one to two pounds per 100 gallons). An organic mulch such as straw will conserve moisture and help establishment. No harvesting should be done in the first year (see below).

Seasonal Care

Fertility and Irrigation

Rhubarb is responsive to applied nitrogen (N) and develops vigorous and heavy growth under optimum fertility levels. Crop needs approach 75 to 100 pounds N per acre annually. Broadcast or banded applications on established plants should be made with the total rate split into three side-dressings: prior to growth in the spring, after growth starts, and again after the last harvest. Rhubarb has minimal response to applied surface P; however, a soil test should be conducted every three years to determine K levels and supplemented if needed. Rhubarb responds to surface manure applications, and fall-applied "manure mulches" are beneficial to the crop. Nitrogen rates should be reduced by one-quarter to one-half when manure applications are made.

Because of a strong root system, rhubarb is tolerant of moderately dry soils. However, irrigation should be provided during periods of summer drought, with weekly rainfall and applied water equaling one to two inches per week. The soil type will determine irrigation frequency and the need for mulch. Lighter, well-drained soils will require more frequent irrigation than heavy soils and mulching will be more beneficial in reducing surface moisture loss.

Weed and Pest Management

Rhubarb curculio and crown rot can be problems, depending on the site. The rhubarb curculio can be managed by eliminating nearby curly dock weeds, which are a key host for the insect (Figure 5). Crown rot can be prevented by the selection of a well-drained site, planting in raised beds for increased water drainage, and careful inspection of planting stock to ensure "clean" material, no soft spots, decay, or discoloration on the surface and cut areas of crowns. As noted, dusting roots with a fungicide may help prevent planting losses.

Fig. 5. Curly dock plant which serves as alternate host for rhubarb curculio. Photo courtesy Mary Smith, New York State College of Veterinary Medicine, Cornell University, *http://web.vet.cornell.edu/CVM/HANDOUTS/plant/oxalates05_files/frame.htm*

After rhubarb plants have been set, shallow cultivation or mulching can help control any weeds. The large leaves will eventually shade the soil, and provide a good measure of weed control. Mulching with strawy manure each dormant season also will help to keep weed germination down and the soil moist and cool during the summer months.

Weed, insect, and disease control guidelines are not currently provided for the state of Virginia with this crop. Recommendations can be found in the "Midwest Vegetable Production Guide for Commercial Growers" from Purdue University (see Additional References).

Renovation and Other Management

Rhubarb is a perennial crop that will remain productive for many years before it requires renovation or crown divisions. Dividing the crowns keeps plantings vigorous and productive. If plants are not divided periodically, they will steadily decrease in productivity and be more prone to insects, diseases, and bolting (see below). Renovation can be a significant undertaking, depending on the size of the planting. In larger commercial plantings, growers may simply kill the crop by herbicide application in mid-summer, and replant the following spring with newly purchased crowns in a new location. Renovation is done during late winter or early spring and involves digging and lifting whole crowns or splitting them in place with a sharp spade. If the crown is lifted whole, it is divided into pieces and replanted using sets that have at least two to three buds. Replanting can be done in the same site or a new site, though the latter is recommended. If the crown is split in place, a piece is lifted out and a piece is left in the ground where it will regrow and renew the planting. The divisions should provide many new crowns for a second planting and significantly increase the acreage. Crown divisions can also be sold to other growers, garden centers, or home gardeners. Avoid replanting any diseased, soft, or rotten crowns.

Bolting or seed-stalk formation is induced by physiological stress and the age of the planting (Figure 6). The tendency to bolt is also a varietal characteristic. The green-stalked varieties are more susceptible than red varieties. Environmental stress factors that cause bolting include low fertility levels, excessive heat, intervals of heat and cold, shorter day lengths (for sensitive varieties), and drought. The age of the planting is also a factor, and excessive bolting is often an indicator that renovation and crown division are needed. Bolting usually occurs midway through the season after the plants have developed a full canopy. The flower stalks should be cut out while they are still young and not allowed to mature and develop seeds. Removing seed stalks will increase crown bud formation and yields in the following year.

Fig. 6. Early seed stalk formation in rhubarb. (Photo by A. Bratsch)

Prior to the first freezing temperatures in the fall, the top growth can be mowed using a Bush Hog® or flail type mower. This can help decrease foliar diseases. A two- to three-inch mulch of wheat straw or sawdust/bark (or manure mix) over the row decreases the potential for the soil to frost heave during the winter months.

Harvest and Handling

Harvesting Notes

Rhubarb will begin to emerge early in the spring after temperatures have consistently reached the upper 40°F range for several weeks (Figure 7). Leaves should be allowed to fully develop, late April into May depending on location, before harvesting. As noted, no har-

Fig. 7. Rhubarb emerging in the early spring. Photo Courtesy Susan Mahr, University of Wisconsin, *http://www.hort.wisc.edu/mastergardener/Features/fruits/rhubarb/rhubarb.htm*

vesting (also termed "pulling") should be done the first year, and only a light harvesting (two to four stalks per plant) should be done in the second year. In the third year, four to six weeks of pulling can be tolerated, depending on plant vigor. Established plantings can be harvested for eight to 10 weeks or longer if the plant is growing vigorously. A good rule of thumb for harvest is to never remove more than two-thirds of existing stalks at any given time and always leave at least 10 to 12 stalks. New, but full-size stalks are harvested by pulling upward with a light sideways twist, which fully breaks the stalk from the point of attachment. Stalks should not be cut as the remnant stalk base decays and may create entry points for disease. A mature plant can produce an average of two to three pounds of stalks per season. Rhubarb can easily be over-harvested, resulting in loss of vigor and greater susceptibility to diseases.

Handling Notes

Stalk quality is highest and fiber lowest in the early spring; however, a well-cared for planting can be harvested sporadically throughout the summer months. The leaf blades should be trimmed off and the stalks bundled in one- to two-pound units for sale. Harvested stalks may be stored for two to four weeks at 32°F and 95 percent relative humidity. Quality for culinary use or freezing is best when stalks are first harvested versus after a storage period.

As rhubarb begins growth early in the spring, emerging growth and new leaves often become damaged by frost. Frost-damaged leaves should be removed and discarded, as oxalic acid in the leaves can migrate into the stalk under freezing stress. The soluble oxalates found in fresh leaves and frosted stalks are toxic to humans, and they should not be fed to livestock. The soluble oxalate content in rhubarb leaves has been measured at 5.8 percent. It is estimated based on poisoning studies with sheep and Halogeton, a rangeland weed with high oxalate content, that approximately 18 ounces of rhubarb leaf could be fatal, with less causing sub-lethal organ damage. A good source of information on oxalate poisoning of livestock is provided by the Poisonous Plants Course at New York State College of Veterinary Medicine, Cornell University (see Additional References).

Notes on Off-Season Greenhouse Forcing

Rhubarb is unique in that crowns can be dug and "forced" during the winter months. After the crowns have reached their chilling requirement in the late fall, they are dug and placed in a heated (50° to 56°F) greenhouse. They are placed on a dirt floor, tightly packed with covering soil, kept moist, and allowed to grow. Plants are usually harvested twice a week for four to six weeks. Detailed information on greenhouse rhubarb forcing can be found in the Oregon State University Commercial Vegetable Production Guides (see Additional References).

Summary

Rhubarb represents a unique crop that has a place in most direct-market settings, with limited wholesale potential to restaurants and local grocery stores. The popularity of this crop has fallen, partly due to less in-home processing. It suffers from lack of familiarity by young consumers; however, through education in the marketplace, sales can be increased. It is a perennial crop that can be productive for many years with the right field setting and management. Compared to many crops, rhubarb is relatively easy to grow, with only a few important insect and disease problems.

Additional References

Poisonous Plants Course links to Oxalates PowerPoint presentations, New York State College of Veterinary Medicine, Cornell University, *http://web.vet.cornell.edu/CVM/HANDOUTS/plants/index.htm*

Midwest Vegetable Production Guide for Commercial Growers, Purdue University, *http://www.entm.purdue.edu/entomology/ext/targets/ID/id56PDF/rhubarb.pdf*

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