Preface: Unearthing a World of Root Vegetables

I am thrilled to present the third installment of the Grower's Guides from the Market Gardener, which is all about the world of root vegetables. Personally, they are my favorites. Root vegetables are true gems growing in the depths of our fertile soils. They offer a wide array of flavors and textures just waiting to be explored. Some, like carrots, beets, and potatoes, are familiar classics, while others, like kohlrabi, winter radishes, and sweet potatoes, deserve more attention. Of course, we can't forget oca and root parsley, little-known treasures that would undoubtedly surprise and impress your friends and family!

Whether you are a keen home gardener looking to improve your yields in a small space or an experienced market gardener seeking out new opportunities, root vegetables are a sound choice. Because these vegetables grow underground, they allow growers to make the most of their available space while delivering bountiful and nutritious harvests. This practical guide will show you the secrets to growing root crops, from careful soil preparation to harvest.

You will learn precise seeding and transplanting techniques, as well as best practices to care for your crops and keep them healthy. To finish, I will share some storage tips, so that you can enjoy these delightful vegetables all year-round.

Now, let these extraordinary vegetables inspire you, and remember that the soil rewards skillful hands.

Happy gardening!

Jean-Martin Fortier, market gardener in Saint-Armand, Quebec

Root Vegetables: The Essentials

Vegetables that grow underground—grouped together under the sizable umbrella term "root vegetables," even though some are not in fact roots—include crops that are essential to our diet and other lesser-known plants with subtle flavors that make them just as precious. They are all treasures of the earth.

Vegetables tend to be classified by botanists and market gardeners according to the part of the plant that they represent, which is generally the part that we eat. For example, we eat the leaves of leafy green vegetables like lettuce and spinach, whereas with fruit vegetables like tomatoes or melons, we consume the fruit. When it comes to root vegetables (which, mind you, are not always true roots!), we eat the parts that grow underground.

All plants have roots, and the root system is essential for plant growth. It acts as an anchor in the soil, allowing the plant to withstand wind and to bear branches and foliage, as well as flowers and fruits. This dense network of roots (each one a different size) can make its way into even the smallest crevices in the soil, allowing the plant to absorb the nutrients (soil minerals) and water needed to develop aboveground organs like stems, leaves, flowers, and fruits.

Not all underground plant organs are edible. Some are unfit for consumption and may even be toxic, so it's best to get more information before eating them. Others have been identified as edible since the dawn of time, and some of them are especially interesting because they are flavorful, easy to grow, or quite simply, high-yielding. The underground organs of plants known as root vegetables are among these classics.

Botanically speaking, not all underground organs are roots. The catch-all term "root vegetables" refers to all vegetable species with organs that grow underground and at the soil surface. However, the parts of the plant that we eat are not always roots

in the true sense of the word. So, we need to distinguish true roots from plant organs that also grow underground or at the soil surface that aren't actually true roots.

The two vegetables described in this book that are most similar to a true root, i.e., a root that is not a storage organ, are scorzonera (a black root) and salsify (a brownish off-white root sometimes called vegetable oyster). These slender taproots are protected by thick black or brownish skin, with an appearance and flavor that have changed very little over the centuries.

Another category that is quite similar, from a botanical perspective, includes carrots, parsnips, turnip-rooted chervil, and root parsley, which are also known as conical roots or storage roots. These root vegetables can be distinguished from scorzonera and salsify by their slightly thicker and fleshier taproots, which serve as storage organs and can be found underground or partially buried. In the plant world, the process by which taproots become enlarged is referred to as root thickening or storage root formation. This allows the plants to build up nutrient reserves, especially to prepare for hard times ahead, like a cold season in our region. As soon as milder weather returns, they can regrow by drawing upon stored nutrients.

Carrots

Parsnips

Parsley tubers

These reserves lend the roots a thicker and fleshier appearance, and when the skin is colored, they look more appetizing. Beyond their physical appearance, storage roots also have an appealing flavor as the reserves are primarily made up of tasty sugars.

The word "tuber" comes from the Latin *tuberculum*, meaning "small swelling." In root vegetables, this refers to underground organs that appear enlarged, range in size, and store nutrients with a high starch content. Tubers grow along the roots, which keep them all connected. Unlike the taproots of true roots and storage roots, when dormant, tubers have all the necessary organs to develop a new plant if separated from the mother plant. Thus, each tuber is capable of producing roots, stems, leaves, and flowers that would allow it to be self-sufficient and, most importantly, to develop a plant identical to the one it originated from. Oca, mashua, sweet potatoes, potatoes, and yacon produce tubers with good flavor, high yields, and a long shelf life, which have made them some of the world's leading root vegetables.

Rhizomes, often found in flowering perennials like irises or shrubs like bamboo, are underground organs that grow horizontally. *Helianthus strumosus* (paleleaf woodland sunflower) and Jerusalem artichokes are two that have an edible rhizome, so they are considered to be vegetables. In fact, they are quite often listed as both perennial vegetables and perennial decorative plants, grown for their flowers or foliage. Botanically speaking, rhizomes are underground stems. They are cylindrical, range in thickness, and have a dented surface that features rough dark skin, in general, quite similar to roots (for which they may be mistaken). However, rhizomes can be distinguished from roots by the fact that they have buds and small roots that allow them to grow new stems, leaves, and flowers every year. Such plants are therefore perennial and independent organs that, if cut into fragments, may continue growing and produce a new plant. This can make them a little invasive, especially if they are not killed off by frost.

The last category of root vegetables is not in fact a root since the edible organ, the hypocotyl, grows at the soil surface, well above the root system. It sits between the base of a plant, called the crown (where the root and shoot systems meet), and the cotyledons (the first 2 leaves to appear during germination). This category has the largest number of root vegetables: beets, kohlrabi, celeriac, turnips, rutabagas, and radishes, including daikon radishes. The flesh of these root vegetables, although protected by a layer of skin, is more exposed to light as the storage

organ grows aboveground. These crops should be covered with soil through regular hilling to prevent cracking and hardening.

Beet

Kohlrabi

Radish

Note: Bulb-producing vegetables like garlic, onions, and shallots are a separate category from root vegetables because the underground organ consists of leaves compressed into densely packed scales around a vegetative growing point. Edible bulbs used in vegetable gardens will be the subject of a specific book in this collection.

Root vegetables are mainly intended for human consumption, but some species are cultivated specifically for livestock. These are known as fodder roots or forage roots.

You might, understandably, wonder why we eat these underground organs that don't look particularly appetizing at first glance. Some of them, like turnip-rooted chervil, root parsley, Jerusalem artichokes, and salsify, could have remained a marginal part of our diets, or even been forgotten—and they were, for a while—but they are making a comeback, showcased and celebrated by creative chefs. So how did root vegetables come to be so successful? It is likely due to their origins.

Humans have probably been eating underground plant organs since the Neanderthal period. When analyzing the teeth of Neanderthals, researchers found both plant matter and tuber residue. Later, in European prehistory down through the Middle Ages, the harvest and consumption of edible roots from

wild plants—initially gathered in nature and later domesticated and cultivated—were common practices. Don't forget that the variety of vegetables we know today did not exist then. Most fruiting vegetables, such as tomatoes or eggplants, which were brought to Europe from South America in the 17th century, were not yet a part of daily diets. People simply gathered and ate leaves, wild fruits, and roots. Since roots were relatively fibrous, offered little sustenance, and had poor flavor, we can speculate that they were primarily used to provide a little variety and perhaps some beneficial nutrients.

Root vegetable cultivation continued and developed further most likely due to improvements made to these crops over the centuries. Unlike leafy vegetables, characterized by their freshness and appetizing colors, most root crops probably looked unenticing (filiform organs, encased in rough, cracked, and dark skin—you really had to be hungry to eat them!). But they kept well and could therefore be consumed long after harvesting, when they were far from fresh. And thus, they became the staple of many diets, for centuries, and especially in times of famine and war, as they were easy and inexpensive to cultivate.

It was only much later, starting in the 17th century, and then in the 18th and 19th centuries, that the roots increased in color, flavor, and yields, thanks to crossbreeding with species that came from other continents in the luggage of traveling botanists. Carrots are the best example of this change. Originally, wild carrots were white, purple, and red, but not orange. Orange varieties first appeared in the 17th century when they were created by Dutch seed producers looking to pay tribute to the House of Orange-Nassau, a family that ruled the United Provinces, known today as the Netherlands. To achieve this, they crossed red wild species with yellow wild species from the East. Over the centuries, improvements in root vegetables multiplied, and even today, seed farmers are constantly improving and perfecting these underground plant organs, elevating them to the status of treasures of the earth.

Root vegetables tend to grow slowly and develop inconspicuously, hidden in the bowels of the earth. And once harvested, their sometimes unattractive appearance is not the most appetizing. And yet root vegetables have been dietary staples since the dawn of time. The most common ones—with potatoes in the lead—are cooked year-round. Others, such as radishes, beets, celeriac, and turnips, make seasonal appearances at market stalls. Some, rarer or forgotten, like salsify and parsnips, are rich with subtle flavors that are now being reimagined and showcased by the greatest Michelin Star chefs.

Twenty root vegetables in particular are high on my list of must-have crops. They deserve to be allotted 1 or 2 beds—or even more—on a vegetable farm, or a few rows in home gardens. In the pages that follow, you will find 14 classic root vegetables that we grow and sell at markets and are used in our restaurant. Each one comes with a detailed description of growing, harvesting, and storage methods. You will also find 6 more unusual crops, which I encourage you to try.

Jean-Martin Fortier's 20 Favorite Root Vegetables

Data Sheet

COMMON NAMES: Beet, table beet, red beet, beetroot, garden beet.
SCIENTIFIC NAME: *Beta vulgaris* subsp. *vulgaris*.
FAMILY: Amaranthaceae.
REQUIREMENTS: Undemanding, adapts well to changes in temperature, easy to grow. Sensitive to boron deficiencies, which causes black spots in beets. Prefers loose, deep, organically rich, and fast-warming soil.
SPACING: 3 rows per bed, set 8 inches (20 cm) apart with a 5-inch (12 cm) in-row spacing (after thinning).
SEEDING: From mid-March to late June, early July.
DAYS TO MATURITY: 50 to 60 days (early and main-season beets), 100 to 120 days (storage beets).
ENEMIES: Cercosporiosis (foliar disease), beet leaf miner, slugs in early crops, and rodents (pre-harvest).
VARIETIES: Boro, Red Ace, Moneta (monogerm), Early Wonder, Touchstone Gold (yellow), Chioggia (our favorite).
NOTE FROM JEAN-MARTIN FORTIER
Traditionally, beets have been known as winter root vegetables, valued for their sweet taste, which is especially comforting in the height of the cold season. However, they are increasingly eaten in spring and summer, especially grated raw or for the young leaves.

Beets

Sea beets *(Beta vulgaris* var. *maritima)*, were native to Southern Europe and cultivated by Egyptians and Romans, but the varieties we know today, selected for their flavor or root color, appeared much later, in the 19th century. Beets are biennial species, with a growth cycle that typically occurs over 2 years. However, because the edible part of the plant develops in the first year, it is grown in a single year, like an annual.

While beets grown for fodder or sugar develop larger roots, those grown as root vegetables (garden beets) are more rounded, sometimes flat, or cylindrical. They grow at the soil surface and produce a rosette of green or red stalks topped by green and sometimes red leaves with very pronounced and colorful veins. The flesh is red, but varieties range from pale yellow to an orangish-yellow. This root vegetable contains pigments, betanin and anthocyanin, that are used as dyes in the food industry. Garden beets can be eaten raw and grated, or steamed, cooled, and cubed or sliced, then tossed with a vinaigrette. A cross-section of the root reveals concentric circles, which are characteristic of this vegetable. Young, still-tender leaves can be eaten in salads, like mesclun.

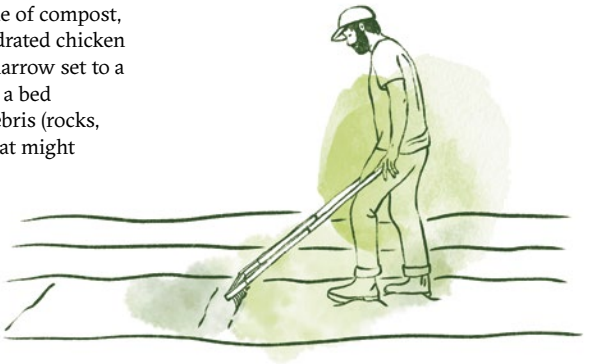
Beets

"Although beets can be a little fussy, they are actually easy to grow. Eaten raw or cooked, this root vegetable is slowly making its way into our kitchens!"
Jean-Martin Fortier

Planting

Preparing the Soil

Loosen the soil with the broadfork, then apply a fertilizer mixture made of compost, alfalfa flour (2-0-2), and dehydrated chicken manure (5-3-2). Use a power harrow set to a depth of 1.5 inches (4 cm) and a bed preparation rake to remove debris (rocks, clods of soil, crop residues) that might interfere with seeding.



Seeding

For early and main-season crops, direct seed beets in a single row or in 3 rows, from mid-March (with a row cover to protect against late frosts) until mid-May. Beets intended for storage are sown in June and July so that they will reach maturity roughly 1 week before the first fall frost dates. Beet seeds will be in the ground for several weeks, so they need clean, weed-free soil. Use the stale seedbed technique ahead of time to prepare the beds.

To avoid thinning, which is time-consuming, it is preferable to seed with a single-row seeder (Jang JP-1). Start by seeding the middle row, then seed the outer rows 8 inches (20 cm) away from it.

Caring for Seedlings

Water immediately after seeding, then keep the soil moist for the next 7 to 10 days until the seeds germinate. Afterwards, be very consistent with watering because a lack of water in hot weather can cause the crop to go to seed and lead to root cracking, in addition to making the flesh more fibrous.

Beet Seeds

These seeds do not have a typical smooth and even shape. They feature several angular facets and are called clusters, each containing 3 to 7 germs (multigerm). If the clusters have not been split apart, through genetic or mechanical intervention, the variety is referred to as multigerm (2 to 4 germs), double-germ (1 to 2 germs), or monogerm (1 germ). Germination occurs within 8 to 10 days when temperatures are 64°F to 68°F (18–20 °C).

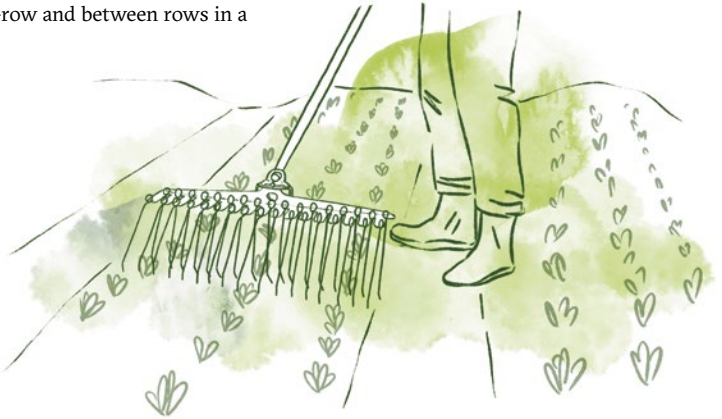
Tip from Jean-Martin Fortier

Beets are particularly sensitive to boron deficiency that affects crop development and causes black spots to form in the flesh.
Apply boron twice as a precaution: once 3 weeks after seeding, then again when the beets are 1 inch (2.5 cm) tall. These treatments can be combined with an algae solution application. It's best to apply the boron early in the morning to encourage absorption of the solution by the leaves.

Maintenance

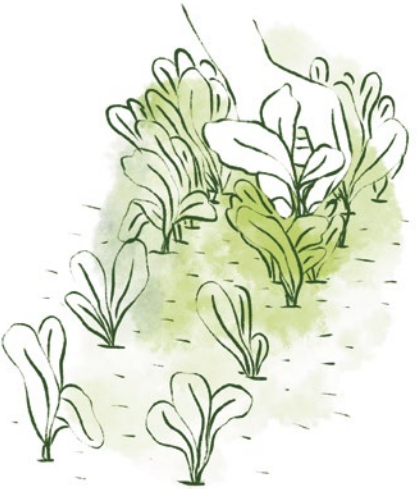
Weeding

Run a flex tine weeder down the bed as soon as the plants have grown a true leaf, about 10 to 15 days after germination, to loosen the soil while weeding both in-row and between rows in a single pass.



Weed again 10 to 15 days later using a wheel hoe with bio-discs so that you can weed both along the row and in the row in a single pass. Then, 7 to 10 days after using the bio-discs, and before weeds form 2 leaves, cultivate the bed with a 5-inch (13.5 cm) stirrup hoe.

You can also take this opportunity to thin the beets, with the hoe or by hand (opposite), leaving about 5 inches (12 cm) between them.



Plant Protection

Cercospora leaf spot is a common foliar disease in the Amaranthaceae family. It emerges when temperatures are hot and humidity runs high. For disease prevention, establish a crop rotation and wait 2 to 3 years before growing beets again in any given bed. It should be noted that using drip irrigation avoids wetting the foliage and creates a drier environment that is less favorable to this disease.

Usually, the beet leaf miner is no longer a problem by the end of summer as growers cut the foliage off storage beets. A certain level of purely aesthetic damage can thus be tolerated as long as it does not affect yields. However, with spring crops—especially those grown for baby greens used in mesclun—it's a good idea to cover beds with insect netting.

Harvest

Early and Main-Season Beets

Beets can be cultivated practically year-round, allowing growers to harvest young leaves to be eaten raw in salads or cooked like spinach. When harvesting early and main-season beets to be eaten raw, lift them with a spading fork and pull the plants out by gently grasping the stems. They are small, only about 2 inches (5–6 cm) in diameter, tender, sweet, and remarkably tasty. Gather them into bunches for market or store them loose at home.

Storage Beets

Harvest storage beets when the weather is dry. Use a broadfork to lift all the roots at the same time, then remove the foliage and leave it on the bed. Place the beets in a harvest crate.

At this stage, the sorting and quality control process must be rigorous. Remove any beets showing signs of disease or injury, as well as those smaller than 2 inches (5 cm) in diameter, and store them separately, to be sold or eaten sooner.

Storage

Do not clean these beets during harvest, as they should be stored unwashed. Home gardeners keep them in sand, while professionals use a cold room maintained between 36°F and 39°F (2–4°C). Later, take the roots out of storage and soak them in water for a few minutes to remove the dirt.

Tip from Jean-Martin Fortier

Depending on how long you are storing beets, you may need to sort through them and remove damaged roots so that they will not affect the rest of the harvest.