Chestnut Farming For Profit

Planning Your Orchard

Regardless if you are looking for land to plant nut trees, or you already own land, you need to be aware of the climate, soil and the conditions and where the nut trees you wish to plant will flourish. You must focus on the trees that meet the hardiness and suitability requirements of your climatic region. Walnut trees that are hardy enough for California will linger and die in the mildest Ontario climates. Chestnuts too have degrees of hardiness to consider. European chestnut trees are suited for zone 6b-8 while Chinese chestnuts will do well in climate zone 6a-8, even 5b where there is some protection, like a woodlot, a tall fence row or a large body of water.


A Chestnut Orchard in Bloom

We favour planting Chinese chestnuts because the nuts are higher in sugar and the trees have greater resistance to chestnut blight than European hybrids. The two species should not be planted in the same orchard either. There is some indication that cross pollinizing results in internal kernel breakdown, a malady that is not associated with any disease.

We generally recommend planting seedling Chinese chestnut trees (grown from seed and not cloned). This is the most resistant species to chestnut blight and the nuts have superior flavour and peeling quality. Grafted trees should be planted sparingly since they are subject to incompatibility and sometimes die years later from any added stress. Often they develop chestnut blight at the graft union. They sometimes lack winter hardiness, so grafted trees are a risky choice. They are better when they are grafted several years after planting in the orchard. In an orchard that is planted “double-double” (as shown in chart below), there is a better chance of selecting the better trees as permanent trees. All of our seedling trees are from improved parents, so the off-spring will be better than average. Since seedling trees are all individuals and are not clonally propagated, they can all pollinate each other.

Some chestnut selections can be grown from cuttings but few selections ever become vigorous. This characteristic is cultivar dependent and this has only been demonstrated with European hybrid cultivars. Tissue cultured trees can be planted as well, but there are no labs that are producing chestnuts commercially in this way in North America.


Chestnut Blight

Chestnut blight, *Cryphonectria parasitica* is a fungus that originated in the Orient. The Chinese chestnut developed resistance over the millennia that they co-existed. As a result a small percentage of seedlings are affected by this disease. All of our seedlings from pure Chinese parents have a high degree of blight resistance. On trees that have little or no resistance, the blight will eventually girdle the trunk and kill the tree to the ground. Sucker sprouts from the root will often form but they too would soon be killed, so the tree needs to be removed or replaced.

It was discovered in Europe and later in Michigan that some American trees were surviving the blight even though blight was found in the trees. Blight cultures showed that this blight was infected with a virus, weakening it so that the trees survived. It was also found that unless a matching strain of the virus was used, the virus was unable to pass into another fungal strain making it difficult for the virus to spread.

In Michigan, grafted European chestnut trees that were susceptible to blight, were planted in commercial orchards. The Michigan State University scientists developed their own "shotgun approach" antidote for the trees. When a canker appeared on the trunk, a slurry of lab produced virally diseased blight strains was placed on the canker. When the matching diseased blight strain passed the virus into the fungus, the virus spread into the canker and the tree began to heal over. Each year scouting is necessary to catch cankers before they become killing ones. This is not practical without a lab to produce the virus infected blight & constant orchard scouting.

Selecting the Land to Plant

Choose land that is gently sloping without low spots where water can collect and pool. This is very important for chestnut trees since they are prone to "wet feet" and will not survive without good surface and underdrainage. Chestnut trees grow best in well-drained, deep, fertile, moist loam to sandy loam soil with good aeration and a soil pH of 5 to 6.4. They prefer soils and climatic conditions that peach trees and other stone fruit require. Do not plant in heavy clay soils and soils with a pH above 6.5. If the pH is high, annual applications of agricultural sulphur and/or a sulphur based fertilizer like ammonium sulphate instead of ammonium nitrate should be applied. This will help to reduce the pH. Modifying the pH is a slow process and the soil needs to be tested and adjusted annually.

The first things on your bucket list are to; select appropriate land, plan the row layout, consider the location of field tile lines, identify the water source for irrigation and test the soil to determine soil fertility and pH, so proper amendments are made before planting. Determine what was planted on the land the previous year. What herbicides were used, and do they persist in the soil? If so, they may affect newly planted orchard trees in negative ways. Atrazine, for example, can persist for more than one year.

Cover crops, planted a year in advance also called green manures, are a great way to add nitrogen and humus, improve soil aeration and texture, and encourage microorganisms as well as earthworms. Earthworm tunnels are nature's soil aerator allowing tree roots to obtain the water vapour and nutrients they need. The cover crop can be tilled under prior to planting to improve soil quality and health.

Tile Drainage & Irrigation

Most soils will benefit from the installation of a tile drainage system and it should be in place before planting. Aside from the benefits to the trees, tiling will make the soil conditions better for all orchard work by preventing tractor ruts or tracks, and wet spots. It is important to maintain relatively smooth, level ground for orchard work and harvesting. Tile drainage spaced between the rows, and not under where the trees will be planted, will drain excess water from

Tiling a Field for Planting Trees

the orchard. Tile contractors can be a year behind in getting to your job, so planning ahead is essential. It also helps to order trees a year or more in advance for large plantings.

The spring and summer of 2016 will long be remembered by some as the year to have irrigation in place at planting time. The 3 months of drought from May to mid-August left some newly planted orchards in distress or dead. Plans need to be made for providing water. If a good well or other water source is not available then a pond will need to be dug. This is best done when the tiling is installed. Place the pond at the low end of the slope and have the tiles feed into it, and then out again into the outlet for the tile system. An outlet is needed to prevent the water from backlogging in the tiles or overflowing the land when the pond is full. Water that is used during the dry periods would be replaced by the tile drainage system above the pond the following winter.

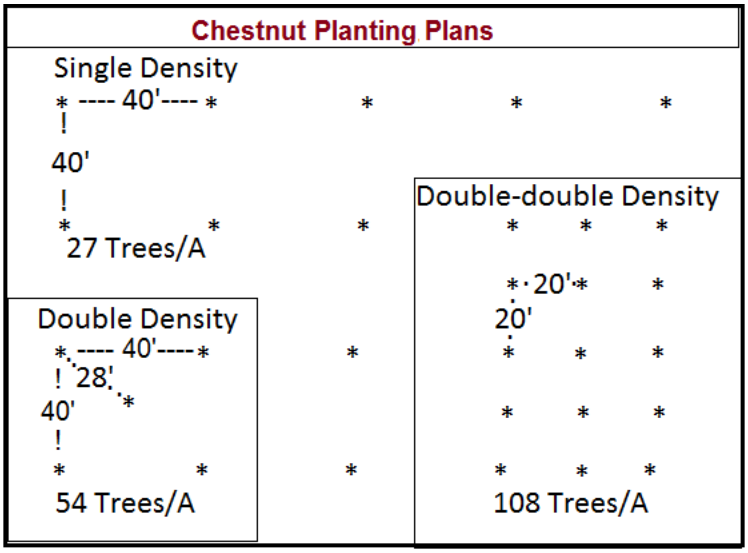
If a pond is your only source of irrigation water, be sure to make it large enough. To put one inch of water on one acre of land in one application will take 27,000 US gallons of water. In a dry year, you may need to apply water at crucial times, possibly 3-6 times or more. If only the tree row is watered with a drip system, about 10 times less water is needed to sustain the same acre. Irrigation specialists should be consulted before pond construction begins to determine your pond requirements. Also consult a pond specialist for natural ways to control algae that will invariably form. Of course, fish can be added too. There is a grant for farmers to install ponds. Apply to: Ontario Soil and Crop Improvement Association
Telephone: 1-800-265-9751 Fax: 519-826-4224 www.ontariosoilcrop.org


Surface Drip Irrigation

Once the pond or water source is chosen, arrange with an irrigation contractor to install your system. It would best done before or as soon as the trees are planted. We favour underground drip irrigation as a system that is most efficient for water use and keeps the water lines out of the way at harvest. Surface drip is also good. If there is no shortage of water then underground pop-up sprinkler systems are next best. A temporary system is one that uses overhead irrigation. Once the trees are too tall for an overhead system then it needs to be replaced.

Spacing Chestnut Trees

Sweet chestnut trees are medium size trees. They reach a height of 11m-17 m (35'-55'). In Ontario we recommend a final planting space of 12 m x 12 m (40' x 40') or 27 trees per acre. Many people are also choosing to plant in what is being termed as "double-density" by planting double the number of trees in each row or even higher density. For double density, a tree is planted in the centre of the square created by the 40' x 40' initial spacing requiring 54 trees per acre. Once the trees are mature and crowding, the intermediate trees can be removed. By planting the trees at 6 m x 6 m (20'

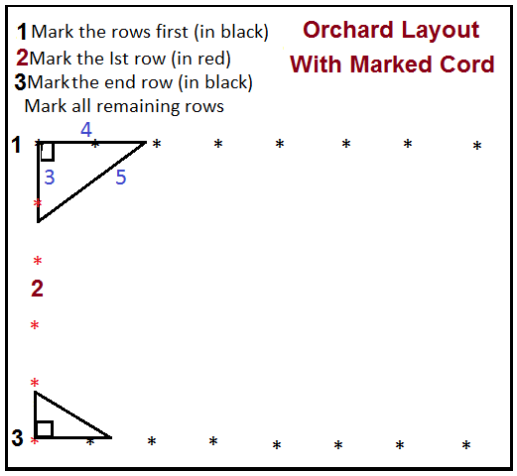


x 20'), the density is doubled again requiring 104 trees per acre (double-double density). As the trees begin to crowd by 10-15 years, intermediate trees can be removed. Any trees that have blight or small nuts can be tagged and be the first removed. Some trees in permanent planting sites can be grafted over to better selections. Check with us on the best method to graft these trees. If you choose to remove these trees, a grafted tree can replace it. By planting double or double-double density, the costs are higher upfront, but the return is also earlier since the trees should be starting to produce in 4-6 years and thinning crowding trees out could take up to 15 years.

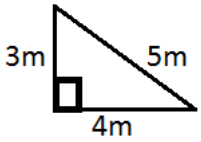
Plan Your Field Layout

If you are planning a large orchard, we need to know at least a year in advance so we can have enough trees for your planting. We can then offer you seedlings from the best parent sources available.

After cultivating the field and preparing the soil for planting you will need to mark the tree spaces in advance. This is an important step in establishing the orchard. Establish how far in from the edge of the field the tree rows will be first, and then mark the four outside corners of the planting, allowing for tractor turning and other management activities. The most accurate way to lay out an orchard is with a surveyor's transit & compass or laser.



For do-it-yourself-ers, the next best way is to prepare a cord or rope with markers (e.g. colored tape) each distance the rows will be apart. Mark a second rope with the tree spacing distance marked on to be used at right angles to the line of rows. For 20' x 20' spacing, a second marked rope is not necessary. DO NOT USE NYLON CORD - it has too much "give." Binoculars would be useful to ensure straight lines.



1. Lay out the base line first, marking where each row will go with flags or stakes.
2. Then lay out the first tree row at right angles to the base line ensuring that it is straight and true. The "3,4,5" triangle or multiples of this form can be used to create a 90 degree angle for your tree row.
3. Go to the end of the field or your rope length and repeat the row spacing with markers, completing a square. Use the 3,4,5 triangle as needed.
4. Move row by row across the field marking all of the tree locations with coloured flags or stakes. If grafted trees are included in the planting, then you need to identify the cultivar to be planted there. To do this, place a different second stake or use an up-side-down paint mark near the planting site. Once the hole is augured, the stake may be lost, so the necessity of second marker for the grafted tree sites. The colour coded paint mark near the stake will ensure that mix-ups can't occur. Be sure that the planters are all familiar with this.
5. Repeat the 1-4 routine as needed to complete the whole field.

Planting

Be sure to have all of the planting sites ready before the trees arrive. When they do arrive, plan to plant them as soon as possible. Be sure to keep the tree roots wet at all times. Cover the roots with wet blankets and store in a in a cool dark but above freezing place until planted. If they need to be stored for a period longer than two or three days, they can be “heeled in” in the ground on the north side of a building or in a shady location. Dig a shallow trench, lay the tree bundles in and cover all exposed roots with soil.

Once everything is marked it is time to plant. Bare root trees are labelled and bundled and ready in April to be planted. Grafted trees will have an identification tag. It may also be possible for some large orders of trees to be ready for fall planting in early November.


A tractor mounted auger with teeth to prevent glazing

Our growers have implemented various planting methods. You can use a 20 inch auger, but be sure to weld a piece of metal or something similar that will scratch the side of the hole to avoid leaving a glazed edge on the hole that prevents water and roots from penetrating. Auger the hole only as deep as the tree needs. Going too deep will cause the tree to sink as the ground settles, leaving it in a “sink hole”. Hand digging is a good option but this requires lots of shovels and hand labour. The fastest way is with a tractor mounted tree planter equipped with a planting distance marker. Planting contractors can be hired to perform this task.

When planting, you can add ½ cup bone meal or superphosphate to the soil that is backfilled into the hole. This helps to stimulate root growth. Once the hole is backfilled the roots should be well covered and you can gently tamp the ground around it, but do not stomp or you can damage the roots. Do not plant the tree deeper than the root collar. Topmost side roots should be about 5 cm (2”) below ground.

It is important that the bare root trees are not left in the sun or wind. Both elements can dry out the roots and begin to kill the trees before you have even planted them. Wet the roots of the trees before taking them to the planting area and only take as many trees as can be planted within a half hour. When planting, keep the trees covered in a wheelbarrow or enclosed trailer or a trailer covered with a large wet blanket. Only pull the trees out from this protection when ready to place in the hole.

Our trees have already been pruned to a single stem to allow the energy to be used for new top growth. There will not be any pruning necessary on our trees in the first year.

We have seen a planting method such as this that worked well:

- Person 1: augers the holes.
- Person 2: Plants the trees. Several planters will be necessary.
- Person 3: waters the tree.
- Person 4: puts on a layer of mulch about 2” thick and 2- 3 feet in diameter or use weed barrier mats. Two or more workers may be needed.

- Person 5: puts on a tree shelter or stakes the tree if necessary.

There are companies that offer a water soluble fertilizer to help reduce tree shock. You can add this to your first watering if you would like. Check with your local farmer's co-op for what is available.

Mulches can vary but are essential to keep weed and grass competition away from the roots. Mulch also keeps the water from evaporating so the roots can absorb more from rain or irrigation. It will also help reduce or eliminate hand weeding during the summer months, a normal necessity. A wood chip covering of 8 cm (3") works well. Biodegradable or perforated plastic squares can also be used to prevent any emerging weeds, for season long control. Earthworm activity is enhanced under a mulch too.

Tree shelters are optional, but many growers find they help keep rodents away in the winter and keep herbicides off the tree when spraying. They report that the trees have a better start each spring compared to those without tree shelters. Deer are attracted by the leaves and new growth on chestnut trees. They will chew off any new growth as soon as it appears. A 5 foot Plantra™ tree shelter will prevent deer browsing. A fence around the chestnut orchard will be needed in time if the deer pressure is high.


Above Ground Drip Irrigation

Irrigation

It is important to ensure the trees are properly irrigated in the first summer. The trees are not established and will quickly die or be stunted in a drought. Hand watering is labour-intensive and sometimes ineffective. It is a wise choice to install drip lines as soon as the trees are in the ground. Contact *Vandenbussche Irrigation in Delhi, Ontario,* Heartnut Grove in Mount Brydges, Ontario and *Zwart Systems in Beamsville, Ontario for irrigation information, supplies and/or installation contractors. Either can assist you in setting up a complete system.

Watering 2 times a week should be enough but this can be modified if there is a rain of 10 cm or more. Be sure that enough water is reaching the roots by digging down near a tree and observing if the water is wetting the earth in the root zone. This can help you decide how long to water each time. A fertilizer injector can be used to fertilize while watering.

Follow Up

Once the trees are planted and all of the tree needs are established, the orchard floor needs your attention. Plant material is needed. We prefer a grass that can stand some traffic along with clover or other nitrogen fixer. We also like a grass that is not deep rooted so it doesn't compete with the tree roots. Dwarf perennial rye grass has been suggested as a suitable ground cover. A grass surface is ideal for a harvester that sweeps the nuts from the ground. We use a modified Savage pecan harvester for our harvesting. On the west coast where rain at harvest is infrequent, they sweep and blow the nuts into windrows that are then picked up with a Flory harvester from bare ground.

In preparation for planting a grass cover, the orchard needs to be disked and harrowed to get it smooth and free of pot holes and deep tractor tracks. Rocks that would damage a mower should be removed. The cover crop of grass seed is then ready to be spread. Once the grass is growing well, the area where surface driplines are placed need to be to be kept weed free. A non-selective weed killer and a longer term weed control product can be used to control the growth in the tree rows. Avoid spraying close to the trees the first year. Refer to *OMAFRA Publication 75, Guide to Weed Control* www.omafra.gov.on.ca/english/crops/pub75/pub75toc.htm for products that can be used on nut crops.

The rest of the first year requires scouting for problems, irrigating, mowing, and row weed spraying. Look for insect and animal damage, poor tree colour and any other unforeseen problem. Tree spraying may be necessary to control aphids, leafhoppers, caterpillars and invasive species like the Japanese beetle and the brown marmorated stink bug that have become serious pests in Ontario. Orchard grass should be kept short to remove foliage cover, allowing predators like hawks and owls to reduce populations of rabbits, squirrels, moles and mice that can be tree pests. Put up raptors nest for them so they can nest near your orchard.

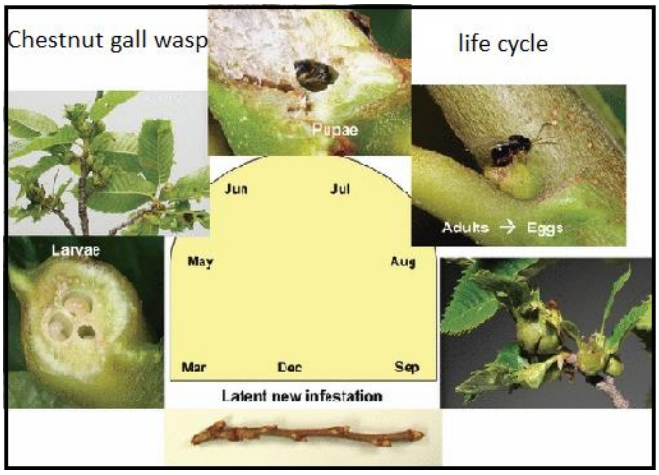
Future Follow Up


White Paint Protection

In the fall each year we recommend coating the trunk with cheap white high gloss latex paint. This will prevent bark splitting that is caused by "south-west injury". You can put it on with a brush but the fastest way is to use a car wash mitt and put it on with the hand protected with a rubber glove.

In March on a sunny day, when there is still snow on the ground and the temperature goes above freezing, conditions are set up for south-west injury. The warming southern side of the trunk is stimulated by the sun's rays reflecting from the snow. Sap begins to rise up the tree. As the day progresses and the sun sets, the air temperature drops below freezing again. The sap has not had enough time to return to the roots and freezes in the trunk, splitting it. The white paint reflects the sun's heat from the tree so it doesn't heat up and the sap remains in the roots. It also helps to have low branches facing south to shade the trunk.

It is advisable to get a farmer's spray license if you don't have one now. Go to https://www.opep.ca/ and find all of the information you need to know. The spray materials that you can use on chestnut trees are listed in *Publication 360-Chapter7, Tree Nuts* http://www.omafra.gov.on.ca/english/crops/pub360/pub360ch7.pdf .



Sprays for leafhoppers should be applied each year. They will cause the leaves to curl and dieback on the edges if they are not controlled. Every few years, a spray will be needed for scale and European red mite and/or two-spotted spider mite. Look for the telltale bronzing on the chestnut leaf surface.

Chestnut gall wasp, accidentally introduced from China on scion wood, cannot be sprayed effectively, since it spends most of its life inside buds. The introduced parasitoid *T. sinensis* has expanded its geographic range in North America along with expanding gall wasp populations. *T. sinensis* produces one generation per year. Adults emerge in early spring and parasitize newly developing galls. The parasitoid overwinters in vacated galls as pupae and larvae, emerging in spring in time to parasitize newly forming galls. Other natural parasitoids are also attacking the chestnut gall wasp. In China, where the oriental gall wasp originated is a minor problem. We expect in time it will be minor here too.


Chestnut weevil


Chestnut weevil larvae & exit hole

Other pests are mentioned in the spray calendar as well as their controls. We have not had the chestnut weevil at Grimo Nut Nursery. This pest lives in the soil and emerges during the summer. Eggs are laid on ripening nuts and the larvae burrow into the nuts and feed. The larvae mature, burrow an exit hole and fall to the ground where they stay until the next year. If the problem arises, consult the Ontario spray calendar. More information is available at:
*http://msue.anr.msu.edu/news/chestnut_weevil_a_potential_pest_of_michigan_chestnuts

Spraying will be necessary for weed control in the tree rows. Do not spray close to the trees. The mulch will control weeds there. Herbicides are listed in *Publication 75 – Weed Control:* www.omafra.gov.on.ca/english/crops/.../pub75toc.htm *

Some effort will be needed especially in the winter and spring to reduce deer damage. Deer will eat the branches and new growth on chestnut trees. It is important to control the deer population if the population is high. Encourage hunting in deer season and get a gun acquisition licence and a license to hunt in deer season too.

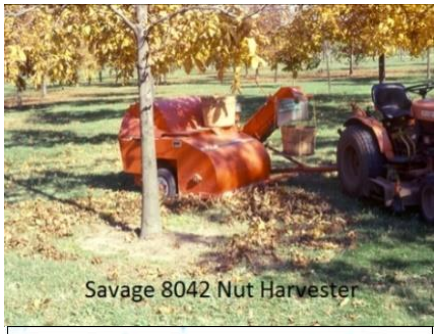
Put out the human scent in the form of strong deodorant s or perfumes on small sponges or tie small bars of aromatic soaps like the ones used in motels and station them around and within the orchard tied to branches. Renew them as needed. Deer equate these aromas with the human scent. A dog trained in a dog fence perimeter can also be a deterrent.


A Typical Deer Fence

Check for a possible grant for the construction of a deer fence with woven wire at the bottom (six feet high) and two or three strands of high tensile visible wire at the top. Deer do not have good eyesight, so might not see the wires. The fence will be about 8 feet high, so wooden posts spaced out with steel post between will need to be 12 feet long, with four feet in the ground (8 feet sticking out above the earth). Once the fence is installed, as an added defense, release one or two Jack Russell terriers in the fence area to control squirrels and other critters that might wander in.

It is always good to scout your orchard from time to time for any problem that may exist. In winter rabbits and mice can strip the bark from trees. A tree shelter can reduce this problem.

Set out a trap line in the orchard for squirrels. Trapping and shooting are some means of control. A 20 gauge shotgun is much safer than a rifle. Trap squirrels in the off-season when they are scrounging for food. Place a baited Conibear trap on a level platform or tree branch. Squirrels like to feed at a relatively level spot with their backs to a tree or post, so they can look out for predators with their backs protected.


Savage 8042 Nut Harvester

Harvesting Chestnuts

Chestnuts drop to the ground when they are ripe. It is important to gather them every day or two. Every day if weevils are present, to get them out of the orchard before they leave the nut and enter the ground.


Savage Nut Cleaner

If you are close to a large city, this can be a 'pick your own', and a hand gathered crop, that is, if plenty of cheap hand labour is available. This is the easiest way to gather the crop, otherwise investment in a harvester and cleaner are necessary. These two items are needed to remove the trash and hulls from the nuts. The nuts then can be sized and sold according to size with the largest nuts at a premium price.

There is no customer putoff worse than finding a worm in a chestnut. The culprit is the chestnut weevil. If weevils are found, there are some measures that need ot be taken. Be sure to collect the nuts almost daily to prevent the weevils from exiting the nuts and going into the ground. For information on the lifecycles of the two chestnut weevils that attack ripening chestnuts go to the site below. One of the procedures that is recommended there is to hot water treat the freshly harvested nuts. The water bath need to be heated to 49°C (120°F) for 20 minutes to kill the weevil eggs before they hatch and the small hatched ones. The temperature is critical, higher and the flavour and seed germination is affected, lower and the grub may survive. For information on building a hot water treatment bath go to: http://www.centerforagroforestry.org/weevil.pdf .*

Storing Chestnuts

Some chestnuts will start to spoil within a week or more after harvest if not properly stored. Freshly harvested chestnuts need to be cured after cleaning away debris, washing and sanitizing. Sanitizing can be done by dipping the chestnuts in a ventilated bin into a bleach solution of 200 parts/million. After draining, the nuts can be allowed to stand for up to 3 days to drain and cure. In the curing process the nuts lose some of their moisture and starches change to sugar. At this stage they need to be refrigerated in lightly ventilated vegetable bags or thin plastic bags like grocery bags. They store for longer periods at -2°C (28°F).

Fresh chestnuts can be stored, sealed in freezer bags in a household freezer for several months. They should not be thawed before cooking. They canbe boiled or scored and roasted in an oven at 400°F. or in a microwave on high for 2 minutes more or less depending on the wattage.

Marketing Chestnuts

Fresh home grown product draws customers for miles. Ours come from as far away as Toronto and Rochester, NY. Most have experienced the poor quality that comes from the imported chestnuts in the grocery stores. After

being soaked for a week in the European storage areas so they can withstand a long voyage, then left in open bins without refrigeration for 2 months or more, the imported product soon loses quality, putting Ontario fresh product in high demand.

Chestnuts can be taken to the Toronto Food Terminal on a daily basis to wholesale the nuts or to local distributors or farmers markets. There is a high demand for chestnuts in season. Small or surplus chestnuts can be dried and sold as a convenience food for rehydration and also ground into flour for a variety of recipes.

An on-farm store to sell the nuts and value added chestnut products will attract visitors from far and wide. Dried chestnuts, chestnut flour, chestnut wood products and other nuts can be brought in to be sold. A good example of such stores are "Kernel Peanut" south of Simcoe, Ontario; the numerous "Picard's" stores selling peanuts and a wide variety of other products; and the "Big Apple" located near Colborne, Ontario with a restaurant, bakery, train ride and mini golf as well as a store to show you what can be done.*

For the farmer it is a win win situation. A well maintained orchard can produce 1 tonne per Ha (1 ton /A) at 10-12 years of age, and more as the orchard matures. The retail price for chestnuts in 2016 has been $4 for large (1.2 to 1.5 inch) down to $2 for 0.7-0.8 inch size. The wholesale price is not much less. Value added products are also a profitable way of increasing income through an on-farm store or an on-line one or both….

*Please note, we do not endorse any supplier, product, contractor, or website that were mentioned in this information. It is simply a way of supplying contacts and information to growers who need assistance.