Overwintering Strategies and Best Management for Yukon fruit production

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Introduction
General siting considerations 3
Challenges and strategies 5
Strawberries 6
Currants and Gooseberries 7
Saskatoonberries 9
Haskaps 9
Cane fruits 10
Blueberries 12
Sea Buckthorn 13
Fruit trees
  Apples 14
  Site selection 15
  Nutrition 16
  Planting 17
  Fruiting and form 18
  Overwintering strategies 19
Other tree fruits
Pears 20
Plums and cherry plums 20
Bush Cherries 21
Shelters 22
Overwintering strategies 25
Other complimentary strategies
  old car tires, weeding 26
  insects / Mowing 27
  Hedge tunnels /snow removal 27
  Grapes, pine nuts and hawthorns 28

Contract requirements:
Develop fruit best management document for overwintering strategies
Described challenges to the winters including site selection, aspect and orientation when developing an orchard moisture fertilizer and pruning management entering and exiting winter what modifications can be conducted

Introduction

When a person begins a new horticultural undertaking, ones enthusiasm is greatest and the reality of the effort, knowledge and dedication needed to achieve success is not yet known. Anyone with a few seasons growing experience in the Yukon will know there are climatic challenges to overcome with many crops and berries and fruit are no exception. Keep in mind as you consider the various crops and options that much of the work and knowledge is required wherever one would grow a given fruit. The following suggested strategies are just local ways of overcoming regional challenges. However, some challenges, like the severe cold of mid winters nights ensure that many southern pests are not an issue here.

In another positive note, as with everything else, agricultural researchers are hard at work developing new varieties of fruit some with hardier characteristics that make them suitable for more northern culture. The introduction of Haskaps and the new bushy dwarf sour cherries are good examples of this and work is moving along with cold-hardy grapes that may one day be grown here more readily too.

The following document attempts to describe to growers and those interested in fruit production, conditions that will promote success with of a variety of fruits. Where the growing of these crops is very similar to typical southern practices and the growing of these crops is well covered by existing crop guides then only a brief summary is provided along with those differences or considerations that characterize our northern situation. The cane fruits like raspberries, strawberries, currants, haskaps, saskatoonberries and sea buckthorn are in this category. For more marginal tree fruits, apples, cherries, dwarf cherries and plums, greater direction is provided as the cold climate considerations are greater. The growing guidelines presented for apple are applicable to any of the tree fruits in general so the descriptions for planting and pruning will not be duplicated except where required to define major differences. Many of the same methods, strategies and siting choices apply to bush fruits. Where native plants offer a viable alternative or additional option their habits and the collection of is discussed too.

With most non native plants, issues of hardiness and adaptation to our long summer daylight will be evident. In these cases, lack of cold tolerance is often a major limiting factor to survival and normal growth. Also, our long summer days are an issue for plants that are adapted to shorter days. These issues express themselves with active growth, (new leaves being produced) that continues beyond when the plants can mature their woody tissues in the fall. Decreasing temperatures and day length trigger temperate plants into metabolic changes that result in hardiness. By growing for too long, this new growth does not completely mature to a hard woody state necessary to survive cold, dry winter conditions. This results in a characteristic called ‘winter kill’ which can occur in fruit trees, raspberry canes, berry bushes, all manner of plants introduced here from more southerly locations. So it is imperative to undertake such measures you can to facilitate full summer growth and the onset of wood maturity typically observable by abscission or dropping of the leaves before hard freezes begin for any fruit or berry plants you wish to grow. Leaf drop alone does not define the complete readiness of a deciduous plant to accept the full blast of winter. Native trees develop their full hardiness rapidly after leaf drop in a response to colder, longer nights. Introduced species from southern locations typically start the transition later because day length is a stronger stimulant than temperature reduction and our days are still ‘read’ as being long enough for them to continue growing when northern plants ‘know’ otherwise. The introduced plants then require additional weeks to complete the same transition, that makes them vulnerable to damage when cold weather rolls in early and those additional days or weeks are unavailable. Those fruiting plants which are only slightly too maladapted to survive under regular culture can often be grown under some kind of seasonal shelter. The ultimate success in producing fruit

under modified environments is in direct relation to the effort one is willing to take to overcome issues to achieve success. As with much of Yukons agriculture scene, a keen eye for observation, imagination, patience and determination are required to succeed.

Two conflicting principals come into focus when one enters the fruit growing game in such a challenging environment as Yukon offers. The first is the old adage that the best time to plant a tree was ten years ago. The other local principal is that one needs to study ones land to learn well its various soils, sites, winds and moisture variables to name a few, and this can take a few years of observation to achieve. Life usually dictates that both happen simultaneously and so this leads to mistakes that can frustrate and discourage further growing. So one should accept that mistakes will be made in relation to experience, strategy and good implementation of this and luck. So get planting the hardy, easiest to grow fruits first where a suitable site appears to exist and success is likely. If you want to grow more challenging fruits plant a few in the most sheltered, warmest site, provide the best soil available, lots of water and be prepared to loose, move or modify the plants or their environment on the path toward fruitfulness.

General siting considerations

Overall, Yukon hosts marginal conditions or worse for most fruit crops so growers need to consider many factors in making good site and crop choices. Dry, cool, windswept locations are typical for the south-west Yukon where water for irrigation is necessary. Raspberries, haskaps, and Saskatoon berries are best bets on such sites, currents will do fine with adequate moisture and shelter from the wind. Strawberries can be grown where snow cover is maintained or where mulches can be used that do not blow away. Within this region though can be found sheltered sites, with mild summers and winter nights that rarely see -40 C temperatures. On these lands the new 'Romance' series of dwarf sour cherries, apples, sea buckthorn and more become possible. Wild fluctuations in temperature rather than extreme cold can be the killer in this region. Temperatures that fall from above freezing to -25 C overnight can damage and kill less than fully hardy plants during a single sudden chill event.
The eastern and central regions typically experience more summer heat and precipitation but extended periods of severe winter cold can a serious obstacle for some crops. Many hardy fruiting plants can be more easily grown without irrigation, but considerations to mitigate winter related cold damage must be made. Raspberries, haskaps, currants, Saskatoon and strawberries are readily grown. Sea buckthorn can be grown on good sites and fruit will mature often, but winter-kill can be an issue.

As with all else location is the big apple. For commercial operations distance to a viable market, good transportation infrastructure and reasonably priced, available energy are all important. On the farm or homestead where fruit production is envisaged; sun exposure, soil quantity, quality and moisture availability are main themes. Matching these attributes with crop type to achieve fruitful success is the goal. Having a mild enough growing season for the intended crops is absolutely necessary and often the hardest to predict as the agricultural landscape is large and growing sites flung far afield across a landscape where much inhospitable ground is present and good knowledge of a particular site thin to non-existent.
While the usual south facing, gently sloping land is the ideal, most growers are not so fortunate and we all make do with what we have and take from it what success we can achieve with it. There is no substitute for well drained soil. It warms up quickest and best promotes rapid root growth. Finding a

property with acres of it is a great start. It can be created in small quantities by mixing organic materials with native soils for small sites. The most gifted places are hillsides of loess soils where structure and fertility are well above average and soil depths can reach many meters. However such deep soils must be well drained and have good southerly exposure or permafrost is often encountered. Knowledge of existing micro climates and wind patterns on a site is valuable to gain. Daytime wind directions can be very different from frosty mornings when cold air flows on calm mornings.
Much can be done on wet bottom lands to dry and warm soils, such as ditching, planting of moisture hungry windbreaks and raised bed development. Make the best of any slopes whether southerly inclined or not by matching plants to the sites.

Plants that requires a long season with a tolerance to spring frost should be grown where they get off to a fast start in the spring while they are tolerant to cold, subsequently developing the crop and hardening off before fall cold arrives. Late raspberries and black raspberries are examples of such plants. Raised beds or terraced slopes can be employed to achieve early and rapid growth. Small plants with shallow root systems can be situated on raised beds in otherwise wet soil to promote growth and speed development. Large plants or trees will benefit too as raised ground promotes stronger growth all season and provides a more dry environment for the base of the tree as it matures even though roots grow out into cooler, more moisture laden ground.

Challenges and strategies

When trying to get the best out of row grown crops, whatever they are, remember that rows planted in a north south orientation will receive the most sunlight exposure early in the day when the air is coldest and will be kept exposed latest to the evening light. This matters most in spring when buds are first coming out and in the fall when ripening a crop or hardening wood. It matters little in mid June when the sum traverses most of the sky but in winter plants are least exposed to sun when drying and sun scald is an issue.

For a greenhouse in a wide open space, a north/south alignment means earlier warming in the morning, in the spring and fall than one laying east west. It also has the smallest face to the noon sun when extra heat is needed least.
Where hills and trees obstruct some of the sky, observe locations and times where the sun clears high objects when plants are leafing out and plan accordingly to make very best use of light, then adjust for slope, wind and other considerations.
Where high trees obscure the morning and evening light then the best aspect can be an east west alignment to make the most of the mid-day sun!

After all has been done to locate the right place to plant and things are growing the challenges of winter and wind come into play.
If winter wind is expected consider planting a row of dense growing hardy spruce trees just windward of the growing area, then incorporating shrubs like willow or vilosa lilacs or setting up snow fence to further slow wind and accumulate snow within the rows of fruiting plants. Alternately plant a rugged shrub or dwarf spruce at the windward end of each row of other fruiting plants in order to capture snow that will provide insulating protection and increased moisture when the snow melts.
Snow is a great insulator and this can be used to advantage in protecting tender fruiting plants. It works very well but it has a downside in the spring when it settles in the process of thawing. This settling will

drag down limbs trapped within the snow and will break them off if the structure of the plant and snow load combines poorly. With shrubby bushes, little can be done unless the branches extend above the snow line, then as thaw happens in small plantings, the branch tips can be given a tug or jostled on a warm afternoon in order to free the branches from the drag. This can make a big difference. The breakage that does result may help direct pruning when the snow is gone. Preventing snow and cold damage can also be alleviated by building simple shelters with poles and some covering material. This will be discussed later separately.

Raised beds, well known in vegetable gardening are equally useful in growing fruits. The warmer root zone has very positive effects on growth and early ripening of woody tissues. Mounds or rows of soil on which bushes are planted will increase productivity and can mean picking is easier on low shrubby fruits. It will also move sensitive blossoms up out of the coldest frosty air in spring. However for taller growing trees the extra height may be problematic. These techniques are especially helpful on damp bottomlands. Annual heavy mulching in the summer after the ground has warmed up can be used to create low mounds for shrubby or cane fruits that readily root into new material. This is not recommended for grafted trees as burying the grafted portion can result in rooting of the lower fruiting selection which is not desirable. These new roots are most likely not cold hardy and will die in winter and with it the buried portion of trunk which is the end of the tree.

Fencing is prudent on most sites. To protect fruiting trees and shrubs from dogs and hares, 5 foot will do the job. For bears, deer and moose deterrence, 7 or 8 foot fencing is required, but that may need to be augmented with electric fencing. Keeping out gophers is nearly impossible if they are well established in a large area.

Beware that any contact of warm fluids with small diameter hard frozen woody plants will result in death of the affected portions and potentially of all portions above the frozen area. The incidence of death is in proportion to the thickness of the bark, the size of the trunk or branch and the amount and temperature of the fluid. By example if a dog urinates on a large spruce trunk occasionally in the winter there is little damage done, the bark being thick enough to insulate the living tissues beneath. However a single splash of water or urine on a frozen young fruit tree is likely the end of it. While the sudden warming is not the problem, the quick freeze immediately afterwards begins a fatal process to cells thus treated. Also do not move around or amongst any fruiting plants at temperatures below -36 C. Aside from causing branch breakage the slight jostling can cause immediate freezing in otherwise unfrozen tissues that can kill portions of plants.

Strawberries

The general growing guide covers the crop production well. The following attempts to add local experience to this

Those so fair and precocious fruits grown so close to the bosom of earth are they.

Modern strawberries are marvellous and easy to grow. While they need good moisture to flourish and fruit well, they require well drained soil to prevent crown rot. However the Yukon being more arid than damp, rotting of crowns is less of a problem than it is where long wet fall and spring situations persist. Therefore the mantra of do not plant too deep need not be foremost in ones mind. Preventing moose, mice or voles from wiping out the crop while the long winter passes is a greater consideration.

Most general practices for growing strawberries apply here. Plant in the spring on previously weeded and amended ground. Avoid areas where heavy infestations of stoloniferous grasses are established or deal with this a year in advance. Raised beds are a good idea on cool damp ground. Covering the rows

with a woven row cover like 'Remay' ensures extra warmth and provides frost protection. Strawberry blossoms are insect pollinated so best fruit development occurs when flying insects have good access to the blooms. If left on during bloom, coverings can diminish pollination so remove at this time. Overhead irrigation can also be used as frost protection. Follow established growing practices…

In the first fall after establishing a new site, or whenever plant densities are low, winter losses are more serious. At such times special care can be worthwhile. One strategy to keep in mind is to pour a 1/4 cup of fine sand directly onto the bud cluster/crown of the plants before the snow flies/ground freezes hard. The fine sand will work into the gaps between leaves and buds, freeze there and make the important crowns more unpalatable to browsing rodents. If the surrounding leaves are eaten while under snow cover the plants will still recover quickly and fruit if the crowns are still intact. Spring rains and irrigation will wash the sand into the soil.

Further mulches of clean straw, pine needles, wood chips or spruce boughs can be added overtop of plants afterwards. Grass clippings are not equivalent to straw! It will lay much more densely and moulds readily so do not use it over the plants in the fall or under the plants in summer without some other material to keep berries off the grass. Protective mulches are a double edge sword when snow cover lasts 5 or six months. If your site usually gets snow before serious cold sets in, mulches can invite damaging rodents particularly if meadows or forest cover is nearby. If snow is late arriving and or in short supply during the winter then mulching is strongly recommended. If the plants are left exposed then desiccation and freezing to death is most likely. Accepting some losses from rodents is a fair trade off with a mulch cover.

Stay off strawberry patches in the winter, especially early on when snow cover is thinner than a foot deep. After this level is achieved snowshoeing a trail over the area will do no harm. After 2 feet of snow has accumulated it can be beneficial to walk through a patch, particularly if plant densities are getting too high. The snow in the area underfoot will be packed and freeze more densely than surrounding snow. This adds a level of protection against vole browsing to those plants under the packed regions and leaves the other areas more vulnerable. In this way a more distributed pattern of vulnerability is established. Similarly, running a snow machine over long rows of plants can stabilize snow and prevent winds from blowing it away if this is likely.

When winter snow has accumulated heavily, cast a dusting of wood ash or sand over the snow in the spring to melt the snow more rapidly. Neither of these materials should alter the soil chemistry or structure with the small quantities required to do the job. Quicker snow loss will help prevent moulding of the crowns and get the plants off to an early start.

Currants and Gooseberries.

These shrubby fruits are moisture loving plants preferring to live in sheltered sites. Keep this in mind when planting them. Being low growing bushes they are easily given shelter using fencing or hedging of Saskatoon's or haskaps on the windward side. By example the author has grown black currants in an open damp field for ten years. Exposed plants grew very slowly and were removed after 4 years to another site. Those under the shelter of a broad Schubert cherry have flourished and fruited heavily every year.

As with all fruits, discovering the right plants and site to match is critical to success. Black currants and gooseberries in particular can suffer heavy fruit drop or blossom failure if the plants are not happy with conditions. Cold nights as the plants approach bloom time can have a very negative impact on fruit pollination and retention. This appears to be a problem with gooseberries in particular as many growers report having strong established plants and yet see little fruit.

Plant any of these bushes on land that remains moist well into the spring and early summer if possible, on dry sites be prepared to irrigate, drip lines work very well as they do not dampen the foliage. At the

same time this should not be in a frost pocket. Testing several varieties may be required to find one that works at your location. Gooseberries in particular it seems need a site that remains mild at night suggesting plants should be close to a wall or other object that warms up in the day and releases heat at night. Pixwell is a gooseberry variety that appears to perform better in the north than others. Plant red currants and gooseberries 2-4 feet apart, blacks need 3-5 feet between plants. Allow 6 feet or more between rows. Prune new, spring-planted bushes hard, down to 4-6 inches. To start new plants take the cut portions of the bushes, trim to 6-8 inches and strike them into warm sunny soil 4-6 inches deep so only one or two buds are visible, in a bed to root. These can be moved in the fall or next spring to a permanent location. Black currants are grown as multi stemmed bushes, where red currants and gooseberries are best with a short single stem that branches widely to form a short shrub. All require annual pruning of thin tips and some older wood to promote new shoot and limb growth and to keep plants open to light and air. Typical, specific pruning methods are readily found on the internet and gardening books.
For black currants Titiana, Wellington and several of the 'Ben' series have been recommended. Red lake is the usual red currant available.

Our native red and Black currants can be cultivated readily also. They adapt to new conditions much better than our native 'blueberries'. Wild plants grow in semi shaded humus rich damp sites where they can readily be dug or lifted with a garden fork out of the native material.Black currants often are found growing right in shallow streams on woody, mossy debris. Move plants in the spring or fall, keeping their roots damp from the harvest location till planting time! As noted earlier, cut them back hard and keep well watered. Heel in or strike 4-6 node long cut portions in a moist bed to start further plants. Additionally, learn how to prune these plants to keep a cycle of new wood being produced, thinning 1/4 of the oldest stems out each year to maintain a healthy flow of new wood and good light penetration. These plants are very well adapted to our climate and local fungal populations.
Currants in particular can have problems with disease, particularly mildew that adversely affects production, it can seriously affect the red and white selections. Their issue as participants in the White pine blister rust cycle is not a problem here.

In a similar failure of production as blueberries, many northern growers report failure of gooseberries to produce more than a few fruits on otherwise healthy bushes. It is the authors opinion that the fault lies likely with nights that are intolerably cold prior to and during bloom and fruit set. Gooseberries are very sensitive at this time to cold nights and most Yukon sites have this problem. So keep this in mind and locate the bushes in a moist location, near or under objects that radiate warmth at night.

Saskatoon berries

Saskatoon berries have been grown in the region successfully for decades. Like currants, strawberries and raspberries these plants have wild ancestors growing on hillside over much of the territory. Very adaptable to many conditions, mean that growing guides produced for the prairies are very applicable to our conditions. Being dependable and useful as they are, no new developments have taken place in

breeding for many years and so the same varieties that were selected twenty and thirty years ago are still going strong today. The best of these are not far different from wild plants grown under good garden practices. However some southern selections are not fully winter hardy in the central Yukon. Thiessen and Smokey are likely the hardiest.
Space plants at least 3 feet apart, in rows spaced to suit cultivation methods or equipment on any suitably drained ground. Fruit will be produced in the third year increasing in quantity till the plants are seven or eight.
Pruning can begin on plants as young as five, removing some shoots to keep the growth more open. By year 7 or 8 a few older, congested limbs can be removed every other year to promote new replacement shoots. Annual spring applications of compost or nutrients high in potassium are recommended.
While the plants are dependable, recent infestations of sawfly larvae and fly maggots that develop in the berries making them useless, have been occurring with greater frequency in some areas of the territory, particularly in the Dawson region. As the sawfly larvae defoliate plants from the bottom of the leaves they are less visible to predators and not readily seen or washed off. Hand picking them is futile unless bushes are very small. This leaves spraying or dusting as the only options for stopping a serious infestation at the time. As small growers are often not prepared for this, the last option is to loose the crop and work on pest reduction as part of the annual clean-up of debris in the fall to reduce numbers naturally over the winter. Raking away leaves and grass from below and around the plants in the fall or early spring when the ground is still frozen can reduce pest numbers significantly. Burn or bury the infested material.

Haskaps

Good production guides exist now on the web and as these very hardy plants have been proven to be productive as far north as Dawson using typical bush fruit methods, little in the way of special northern practices need defining. (what a relief) Some local experience and methodology is outlined following.

These sweet fruited blue honeysuckles are the newest and least known commercial crop in Canada. The advances in quality brought about by a major effort in breeding in the last decade have taken the plants from the near unpalatable to the highly desirable. These extraordinarily tough and very adaptable plants begin producing at three to four years of age depending on the size and age of the plants when purchased. Large numbers of plants are best purchased as 1 year old plugs. Have patience with small plants, they may grow for 4 years before giving any kind of crop, but by the 4th or 5th year production will kick in so get your marketing plans in order. Beware that old varieties (pre 2000) rate very poorly in taste and texture. With no other crop it is essential to use modern selections to grow acceptable fruit. Those selections with arctic themed names are presently some of the best. They ripen early July and onward for several weeks depending on variety, about the same times as strawberries.

Grow a few around the yard like shrubs with at least two different named varieties, or in rows. They need to be planted about 5-6 feet apart in rows 10 feet apart to ensure good light penetration as the plants mature. If planting large numbers of plants for commercial production, plant in rows spaced to suit the expected harvesting equipment that will be required! Depending on the variety they can grow to 4 feet or more in height. Bush size increases more slowly when berry production becomes more generous.They adapt to wet or dry ground and will be productive in accordance with conditions. The pale yellow, paired flowers are born on smaller branches throughout the canopy, are insect pollinated showing up with the early leaves well before last frost which will not damage them. Repeated hard freezing in June will damage the crop and plants.The plants suffer some from mildew in wet seasons and sun scald in sunny windy conditions but this damage is cosmetic. Neither adversely affects growth or

productivity. Insects do not appear to be a problem with the plants in the north, nor do voles cause much damage in winter once the plants are well established. It is not clear how long the bushes remain productive as they are a new crop, but with good management 15 to 20 years is not unrealistic.
Young bushes 2-4 years old will benefit from pruning low growing branches back 1/2 length to promote more vertical shoot development closer to the base. These are less likely to break off under snow load and help build more vertical structure earlier in the bushes development. Low growing limbs are also more difficult to pick and make clearing of grasses and weeds more difficult and provide better cover for pests.
Older bushes + 8 years, benefit from thinning out of the oldest 20 % congested wood every 2-3 years. Prune long horizontal branches back to a branch rising more vertically to promote upright shoots.
Large scale producers need to look into mechanical harvest equipment usually modified from other berry harvesting units that shake the bushes. For this, varieties that do not hang fiercely on the bushes need to be planted.

Cane fruits

The present guide for raspberries is quite comprehensive and the cultural practices outlined are very applicable to Yukon conditions. A short summation of similar and small scale practices follows.

Raspberries are among the most easily grown fruit and are adapted to limited commercial production in the territory. They are readily grown in rows or in smaller beds for home use. Old push ups from land clearing operations are favourite sites for wild raspberry growth. Use this knowledge in planting.
Raspberries thrive where organic matter is very high and drainage is good, so they are well suited to raised bed or wood mound culture, known as *Hugelkultur*.
As with most fruits soil fertility plays a large roll in maintaining high productivity over the long term. Amendments of compost, manures and other organic matter should be incorporated in the rows in the fall, while conventional fertilizers are best applied early as possible in the spring. Rapid growth and early fruiting help assure that the plants are well developed by the fall in order to be best prepared for cold.
Rapidly growing raspberry canes, flowers and fruit are sensitive to frost. Frost in summer can stunt new cane growth and late summer frost can ruin the fruit crop or cause it to rapidly drop from the stems.
Red selections, the most common, are generally the most winter hardy. There are many old standard varieties that produce very well north of 60. Variety recommendations include Kiska, Fraser and Latham. Boyne dislikes highly variable temperatures, Sourris and Red mammoth have been noted as being too late ripening in some areas. Discovering the most suited variety for your location is important as high productivity is clearly related to variety suitability. A few yellow varieties can be grown, however they are not generally as hardy and flavours are usually lighter.
Raised beds will promote early quick growth, use them to increase production where possible if you grow a late maturing or tender variety and employ strategies that help snow collection to insulate the stems. If annual winter-kill is an issue consider a different variety. Full winter hardiness is achieved after leaf drop, so expect hardiness issues if the canes enter winter with leaves present, especially if they are still green. Plants can be expected to produce reliably the second summer after planting and a well tended bed will produce for 15-20 years as the plants slowly migrate among their allotted space and beyond.

Black raspberries need a very long warm season to grow and produce. A short season variety is required to have any success but be prepared to have winter-kill problems and late ripening fruit. 'Wyoming' has been successfully grown in the central Yukon.
They are only suitable for home production as crop failures can be expected after severe winters or cold summers. Planting them beside a retaining wall where snow is known to collect can help keep them protected and alive through the winter. Alternately promote low growth by bending and tying stems to wires or stakes periodically in early summer so that growth is more horizontal, this should promote strong flower bud production and the canes will be more readily covered by snow if grown in this fashion.
Blackberries and Tayberries are too tender for outdoor production and most likely to fail.

Fence cane beds for the most likely browsers at your site. Moose tend to browse the leaves before the stems in the fall so damage from them is not usually a big problem. Porcupines can be destructive through their rough manner of feeding as they break canes off while pulling them down to browse. Hares are even worse when their numbers are high they can clear all growth to the snow-line. Voles will eat the lower canes in winter but as canes are numerous, damage is usually not disastrous. In small plantings 6 to 10 inch sections of 1 inch i-d plastic pipe can be cut and slipped over the best canes in the fall to ground level to prevent damage. Scattered through a planting it can leave some of the necessary work of cane thinning to the rodents! Remove in early spring or wait till fall then cut away the old spent canes and replace tubes on new strong canes.

Blueberries
As cultivated blueberries have not been found to produce satisfactory crops when planted outdoors anywhere in the territory, the following information is intended to provide guidance that might promote some degree of improvement in this sad state.

Commercial varieties generally offered in stores and in mail order catalogues are selections and hybrids that are not well suited to our locale. Some early season, low growing selections will grow here, but they are prone to several issues that limit good productivity. The issues are likely the same as with other southern based plants, being that the plants tend to grow too long into the fall, discouraging bud formation and/or leaving flower buds and twigs prone to winter injury. Additionally the bushes bloom later than our native berries and late blooming leads to late ripening. This suggest that sites where mild fall weather lingers will be the most suitable.The half high varieties are mid range in hardiness, a better choice than the tall selections which are not cold hardy.

In order to grow any of the blueberries, soil conditions must be high in acidic organic matter and these kept moist to promote the fine root systems these bushes maintain, however the roots die if kept too wet in the summer. Plantings on peaty ground provide the stable, moist, acidic conditions preferred, however sandy soils have been successfully utilized so long as sufficient organic matter is incorporated prior and a ph level has been established in the 5.0-6.5 range. Applications of sulphur to acidify soil should be made a year prior to planting to ensure that the modifications have occurred evenly through the beds. Further minor adjustments to combat buffering from surrounding soil or irrigation water can be made during the growing seasons in subsequent years. An acidic mulch can help with this but it will need topdressing to maintain its effectiveness.

The fine roots are sensitive to over fertilization and susceptible to drowning if flooded in summer, spring inundation while dormant is not as serious.

Blueberries adapt well to and have been recommended for container culture. In pots, trays or rows, suitable soil conditions can be created and fertilizers added. Under some kind of shelter, an extended season can be provided to allow time for growth, fruiting and wood ripening in the fall. Recommended fertilizers in this application are for acid loving plants like azaleas and rhododendrons.

Our various wild blueberries, and bilberries are readily grown in native peat matts on which they grow naturally. These can be lifted from boggy areas in large sections in the fall by cutting manageable pieces at least the size of a plastic milk crate and planting these where high moisture levels can be maintained to keep the mosses and berry bushes alive. Keep grasses from becoming established or these will overwhelm the plantings. Simply pulling plants out of their native peats and planting them in any other type of soil will not succeed. Only the main long buried stems are likely to come out with very little fine root, so if they live, reestablishment will take several years.
For organic fertilization screened dried manures or compost that can work into the root medium, or older manure tea that has had much of the nitrogen leached out in the first or second filling of the soaking tub can be used.

A casual survey of blueberry growers in the territory reveals a picture of growers having success with plants but no fruit being produced. This would point to possibilities that:
no flower buds are being formed due to deficiencies in nutrition
or long summer/fall light durations over-promote shoot growth and inhibit formation of flower buds,
or flower bud death is prevalent due to cold winter temperatures, or insect predation is consuming the buds (unlikely)
and/or complete pollination failure is occurring in the spring.
A careful examination of plants in the spring could bring some clarity to whats going on here or focus the possibilities.

Sea buckthorn
Production guides from the prairies cover typical methods of production well and hint at the shortcomings that are encountered here with this crop. The following are ideas to overcome issues that are being encountered or anticipated.

Sea buckthorn is a very rugged plant with a long history of being grown where winter temperatures often reach -40 degrees. However it is a heat and moisture loving plant
which requires a minimum of 1450 growing degree days to mature a crop and harden its tissues. No general location in the territory has this kind of heat annually. So any attempt to grow this crop must be done in the warmest microclimates where adequate irrigation is available since its need for water during the growing season are beyond what summer rain averages are in most of the Yukon, with locations around Dawson and Watson lake being nearest to acceptable. As the bushes can be hardy to Yukon winters it is in the summer growing period that efforts be made to secure full hardiness. A terraced situation on a southerly facing slope sheltered from wind by trees, fences or buildings would likely be a great benefit. Planting sites should be in a location where snow accumulates to capture the benefits of this. If a site can be chosen that is shaded in the winter to minimize daily warming that would be beneficial.
Mature plants will take -43 or colder depending on variety, tissues being fully mature and winter conditions without sudden fluctuations. Highly variable winter temperatures can degrade full hardiness achieved in December if an extended warm spell occurs afterwards. A week long warm spell will make

plants much more prone to winter injury if extreme temperatures return. When this happens temperatures far warmer than -40 can be responsible for branch loss. However, since hard pruning is a recommended management practice, such damage can be tolerated if it does not happen too frequently. Hard pruning of older limbs can be undertaken after the first 6 years, then every 4-6 years after that, if other heavy limb loss does not occur. Pruning more often would remove or hamper the growth of numerous, short one year old lateral branches growing from the main frame where fruit is produced. With this in mind all pruning should take place in the spring when it is possible to determine levels of damage.
Sea Buckthorn is only wind pollinated, so where there is a prevailing wind in early summer plant male plants towards the windward end of rows or groups.

Fruit trees and bushes

Apples

For large fruit trees hardy apples are the best bet. Apples have a tremendously diverse genetic base, they grow in areas as varied as California, Australia and India, while others manage the cold of our Prairies and areas of Russia. In Yukon, they can be grown in sheltered warm locations where conditions permitting growth from late May till mid September prevail. Here, the most cold tolerant, early season selections that are adapted to our long summer days can be productive. Fruit can be expected in one to three years.
However, conventional orchards are not likely to succeed in the Yukon. Even though there are reliably hardy, early fruiting cultivars, the trees cannot be expected to produce high quality fruit annually over the long haul. Nevertheless, on sites, having the best soils, aspect and a warm micro-climate as found on a south facing slope, small scale orchards are possible.

Apples like many fruits, grow on trees that have been grafted or budded with the fruiting selection growing out of a rootstock that provides support, anchorage and nutrients via the roots.
For cold regions, most apple trees are grown with Siberian crab roots also known as bacatta, a very tough species that will withstand very cold conditions and tolerate poor, wet or dry soil. Ranetka is another Russian rootstock with very similar characteristics that is occasionally used. Ornamental trees in its own right these Siberian crabs will bloom prolifically after about 8 to ten years of age and produce red or yellow, pea sized fruit. They have papery leaves that may be green or reddish. If the grafted apple selection growing from the rootstock fails, these characteristics become evident as the rootstock grows up in place. Antonovka selections are hardy as a rootstock as far north as Dawson, but are less suited to the short season and will often die back above the snow-line.
Apples grafted on dwarf rootstock are not as hardy as the siberian crabs either. Ottawa 3 is likely the hardiest of the readily available and commonly used dwarfing stocks. They produce trees that are significantly smaller in size than those on Siberian stocks in more southerly locals but there is too little local research data to offer any comparative size projections here. Fruiting does occur at a younger age and so the trees may need to be well supported with stakes and wire as required. If growing in a shelter or using a containerized growing system, this stock can be considered. Budavosky 490 is also very hardy and dwarfing, but like Antonovka is not known to be suitable here. Trees originating from Yukon and Prairie provinces' nurseries are usually on cold hardy siberian roots. Trees from and in B.C. are grown on a wide variety of rootstocks, most of which are not winter hardy north of 60, so beware when considering your source for trees.

Different selections of crabs, apple-crabs and apples bloom and fruit at various ages. The most precocious can bloom at two or three years of age, while others can make you wait 5 years or more. Failure to bloom can be a result of young age, poor nutrition or death of the flower buds by serious cold. Flower buds are the most cold sensitive buds in a tree and if, when the tree leafs out in spring some buds and twigs fail to grow, suspect winter-kill. If blooms are weak, deformed or have black centres, again, cold damage is most likely.
Two varieties need to be grown nearby to cross pollenate to generate fruit. Apples with many seeds grow into larger fruit. Pollination is carried out mostly by flying insects like bumblebees, the most numerous pollinators in the spring. Bees do not fly in cold damp weather, so if the spring is a poor one expect pollination problems and fewer and smaller fruit.
The ultimate uses of a given fruit, whether its best to be eaten out of hand, dried or processed is variety specific, and not associated with a given size. Because of our particular growing conditions, Yukon grown fruit and trees tend to be smaller than more southerly grown ones.
Among the best apples to grow in the north are: PF12, Norland, Parkland, Prairie sun, Prairie sensation, 922 end, September Ruby, Golden Uralian and Norson. With the protection of a shelter, Norda, Norkent, Autumn delight and many others become possible.

People are generally familiar with crabapples (small and usually tart) and apples (large and sweet) but with apple-crabs, there is more confusion and diversity. Apple-crabs are smaller than apples but can be sweet like an apple or tart. They can have excellent hardiness characteristics and can fruit prolifically. Trailman, Shafer, Noret, Rescue, Ukalskoje nalivnoje, are a few selections worth trying.

Most of the ornamental flowering crabs are not hardy enough to grow in the territory, but some selections will grow in the southern Yukon where fewer nights of serious cold torment them. Dolgo, Makamik and Selkirk are very hardy selections but fruit may not ripen in our short summers.

Site Selection
In the broad scene, a south facing slope that can be readily travelled and worked, that has good soil coverage and water nearby is the dream site. On such locations cold air drains off so that summer frost and winter temperatures colder than -40 are minimized. While ridge tops can be very suitable if tree cover or higher ground provide some protection, hilltops are generally too cool and windy. While more expensive to prepare, slopes sufficiently steep to require terracing can provide particularly warm planting sites and be easier to irrigate efficiently. The suitability of any site requires adequate moisture or ready access to water for irrigation on the site. Orchards near Fairbanks, Alaska have annually produced thousands of pounds of fruit on such a site. Good road access to the site is advisable if larger quantities of fruit are anticipated.
During the growing season, direct sunlight for a minimum of 6 hours and bright light beyond that is necessary for fruiting trees. Other large trees need be at least 25 feet / 8 meters away to minimize root competition and shade. If possible, situate your fruit trees in a location that will be shaded by trees or buildings through the cold months. This will lessen snow loss should a warm spell occur and prevent damage due to strong sunlight while temperatures are still well below freezing.

Apples need good soil fertility to grow and fruit. In the back yard soils can be amended or brought in to meet these needs where they do not exist naturally. A loamy soil with a ph of 5.5-6.5 with abundant organic matter is desirable. This soil should be well drained and at least 18 inches deep before hard or

rocky substrate is encountered. This is much more shallow than southern recommendations, but deeper soils will not necessarily be utilized since lower strata is often colder than the roots will tolerate especially where drainage is less than perfect.
Where trees are grown on bottom lands be sure drainage is maintained to minimize pooling or standing water beyond early spring thaw. Recent Russian work described by Ilya Kotovich reports some interesting observations comparing trees grown on level wet ground with ones on 1/2 meter high raised beds and one meter high mounds. Those trees on wet land were short lived lasting only a few years, while those apples on a 1/2 meter high bed grew significantly better and longer and those on meter high mounds were still growing after 25 years. Just how the fruit was picked was not discussed!

Nutrition
As soils in the Territory are typically poor to marginal in fertility, learning when and how much to fertilize apple trees without over stimulating them is a feat unto itself. Too little or too late applications result in thin, unproductive growth. Too much and growth is likely to continue into the fall, jeopardizing winter hardiness. It is impossible to give clear advice on applying amendments when each site has its own soils and so many fertilizers are available. As a general guide, spring growth should be strong and growing leaves large and heavy in appearance with little reduction in size as the season progresses. If leaf sizes diminishes obviously over the growing season it indicates a shortage of nutrients. Main shoots should ideally be as thick as a pencil or heavier, short shoots need to be robust and heavy to support fruit buds that will often be larger and more rounded than leaf buds. Soil analysis can identify major shortcomings, best identified prior to planting. A few annual plants like marigolds or small vegetables like a scattering of carrots or bush beans can be planted below the drip line of newly planted trees. If these rapid growing plants look poorly and do not grow vigorously, take this as a cue that the nutrition levels are not up to scratch and apply additional fertilizer. Early in the season, May through June, granular fertilizer can be applied that will feed the plants for weeks. Early in July if growth is looking weak or main leading shoots are winding up growth as noted by enlarging leaves with no new ones emerging, and deficiencies are suspected use a liquid fertilizer that will act immediately for a short term. This can give a quick shot to keep growth going for a few weeks and aid in the formation of flower buds that form in mid-summer on strong shoots and spurs.

Planting
Containerized trees are the most likely ones to be found for sale and these can be planted any time the ground is thawed enough to dig. Bare root trees available via mail order can be tricky to get growing in our short season. These require lots of water and a warm site to get going. Planting bare root stock in a large container in a greenhouse or kept on a warm site where very regular watering can be kept up can be a good way to promote strong growth, particularly if the roots on the tree appear to have been severely pruned or have broken in storage.
The standard recommendation is for a planting hole to be twice as large as the rootball. Up north this applies only on sites where the soil is exceptionally good. Otherwise preparing as large a hole or trench as you can and amending this large area prior to planting is good practice. On sandy, dry soil this might be a 2 meter, 6 foot wide hole as deep as your knee. Previous gardening experience is a good guide here.
Bonemeal should be applied on the generous side. Dig out the soil over the intended planting area, distribute enough bone meal on the bottom of the hole sufficient to cover all the ground in a thin layer, mix this in with several inches of soil and plant over this. Manures and fertilizer suited for vegetables or fruit trees, should be incorporated in the planting hole more judiciously to avoid promotion of late season growth which is more prone to winter cold injury. If planting later in the growing season, (July

onward) less should be applied to avoid promotion of late season growth. Late fall planting carries no risk of overstimulation and amendments will have plenty of time to spread out into the soil. Compost can be added anytime as its stimulating effect is not usually powerful enough to be a problem. Mix amendments in well with the planting soil till uniform colour and texture of soil is achieved.
Plant trees in sandy soils or in dry ares slightly lower than the soil on the rootball, or stain line on bare root stock so that a moisture catchment area can be maintained around the trees when young. On heavy clay or lowland damp soils, plant the trees up on a mound to help ensure the trunk and immediate roots remain above pooling moisture.
Space standard trees a minimum of 10 feet apart which, while close spaced, reflects the smaller size trees are expected to grow here. Higher density plantings are only for dwarf trees which are not recommended due to the climate and risks involved.

The following spring work more manure or granular fertilizers in all over the planting area. Whenever you plant, water in well. What that means is running a hose on a low flow for 10-15 minutes per tree. If you are hauling water, try leaving a bucket with a crack or small hole in it beside the tree and filling this several times, moving it around the tree twice a week for the first two months, then once a week after that. In all cases create a soil berm or dike ankle high, around the tree far enough away that at least 20 litres / 5 gallons of water can be held within is helpful.

Fruiting

It is desirable to have bloom and fruit set on the trees in late May or very early in June. Most of the blossoms will fall off a few days after petal drop, that is fine. If they all drop then either there was no pollination or frost killed the embryos. Developing apples will continue to drop off for some weeks as the trees sort out which will grow. For larger fruit, thin young fruits when the size of a cherry to be spaced singly, a hands width apart. Small fruiting selection like the apple-crabs do fine in groups and as some folks are unwilling to remove the excess early fruit, these match up well. Experience teaches us how we are doing here. Too many fruits will result in small apples and trees that are less prepared to face winter.
The earliest fruiting selections will provide ripe fruit the third week of August. Better fruit takes time and ones that ripen in September are usually even better. Ripening fruit will withstand cold nights to -5C so do not panic and pick when nights are getting cooler, this improves the flavour.

Form considerations

Growing fruit trees in a bush form rather than as a single stem tree is often a good idea under northern conditions. It affords a larger portion of the tree greater protection through snow coverage in the winter which can increase stem and more fruit bud survival. Smaller multiple stems are less prone to sun scald warming in the spring, minimizing this type of damage. However it can make more of the trees vulnerable to browsing by rodents /deer so beware of this.
Similarly, trials have been undertaken in Russia where trees were trained to grow very low to the ground to ensure snow cover and the insulating effect to promote cropping. While this type of ultra low growing will work, it is very labour intensive and completely reliant on ensuring that the trees are covered in a rodent deterrent like ‘Skoot’, or a heavy application of poison baits to kill rodents near the trees while under the snow. Where so many of our agricultural holdings are in close proximity to forested wild areas, the impacts of such a program on other wildlife needs consideration.

Pruning should ideally take place in the spring, just before leaves break out. This allows the maximum time for hormones in the buds to stimulate the roots and promote growth. For trees prone to diseases that enter open wounds like plums it also lessens the time before new wood begins to grow, covering small wounds quickly. However any time after the ground has begun to freeze in the fall is fine and more practical if larger numbers are grown.

Over-wintering.

On the warmest sites, where severe cold drains away, overwintering is as simple as providing a fence to keep browsers away, some kind of rodent deterrent to protect the lower trunk, like a collar of aluminum,* plastic, or the liquid 'Skoot' applied and whitewash (thinned latex paint) on the south and west facing trunk to prevent sun scald and the job is done. With several inches of snow on the ground its good to go.

Sun scald or south-west injury can become a serious problem on exposed trees. It is caused by surface warming of the bark on sunny afternoons when the air is still quite cold. If the cambium layer is killed over a large area serious disfigurement and steady decline can set in and ruin the trees. Young trees are particularly sensitive, but it is easily remediated by applying a light coloured wash to those areas broadly facing the late winter afternoon sun.

Overwintering trees in the valley bottomlands is not so easy because the coldest air resides there. The added challenge is to prevent the trees from experiencing long exposures to temperatures below -40, which is a critical temperature threshold for many plants. A tipi shaped shelter over the trees, that captures and supports snow to cover the trees is most helpful in preventing damage or death. Cover a pole frame with white or other light coloured tarp tight to the ground.The basic requirement is that it must be closed up well so that moisture which comes up from the soil, condenses as frost on the inside of the plastic and this insulates in the absence of snow. The cover material should not be clear or black, either can encourage the air inside to warm up readily under strong sunlight. (Translucent material is usable where winter temps remain well below freezing or where the trees are shaded in the winter.) See more under 'Shelters'.

Everyday aluminum foil is not heavy enough, but one-use baking pan aluminum will work.

Note: After a single afternoon of temperatures above freezing, evidence of cell death caused by too much cold or sun scald can be detected on those portions of woody plants above the snow. Simply nicking a twig to remove a small portion of 'bark' will reveal either a healthy green, tan or reddish cambium below, or if dead or seriously damaged, rather watery brown tissues. The extent of damage can be determined by nicking the wood progressively lower toward the trunk till healthy looking wood is discovered. Become familiar with this technique because such twigs or branches should be removed at the earliest possible time before many days of above freezing temperatures occur. Turns out, the brown fluids of burst cells are toxic to live cells and damage will spread further if these fluids are left in the tree. For this reason, cut away visibly damaged tissues. Even if all the dead wood is not removed, the fluids will drain readily out of the cut and cause less harm.

Other Tree Fruits

Pears are to be treated like apples, but only as fully sheltered trees and even then they are difficult to grow being intolerant of our very cold winters, short summers and poor soil. Get a hang of apple husbandry before attempting these. Pears prefer a heavier soil with more clay in it than apples do. The rootstock generally used is a Chinese pear Pyrus Ussuriensis, that is tough enough to grow as a ragged shrub outdoors as far north as Mayo and Dawson. However the fruit is tiny, inedible and woody if produced. When joined to a good fruiting selection like Ure or Early Gold this rootstock produces a rapidly growing, upright tree that is difficult to train in a small space. Very regular specific pruning is required to maintain smaller size. However pears can be grown on Saskatoon berry and cotoneaster roots, which will dwarf the tree considerably, but these are not available in the nursery trade. Two different selections are required for pollination. Tioma, John and David are some other prairie hardy selections that are encounteredTrees may grow for 5 or more years before first bloom. Fruit should be picked before fully ripe which is fortunate, and allowed to mature indoors. Eating good home-grown pears in the Yukon is a mark of clear dedication and success.

Plums and cherry plums are less winter hardy than apples, they ought to be attempted only as a home garden project. They prefer warm sandy loam soils and are very prone to early blooming and crop loss due to late frost. Fertilizing this group of fruits should be done carefully and only early in the growing season and water restricted by whatever means after the third week of August to promote hardening off. Many of these plants are likely to grow on much later than desirable, reducing hardiness. The modern Prairie bred cherry/plum hybrids are the ones to look for (hardy selections may be difficult to locate) and try on warm sites. As they cross breed readily, seedlings from friends in other cold climate areas may grow acceptable fruit. One can also collect dormant twigs from known hardy plants and graft these onto a rootstock you have, perhaps one that grows in the yard from an earlier trial that never produces fruit. Most selections are bushy in form, so winter damage while inevitable, is likely not the end of a seasons crop, but a reduction as lower limbs survive with snow covering. Generally speaking they need only light thinning to remove broken, diseased or crowding limbs.

Plums bear fruit on older limbs that have small spurs and from bud clusters on last years shoots. Pollination can be an issue. Plant a few sand cherries and two or more selections to have a good chance for pollen compatibility. Fruit thinning is generally not required. Getting the bushes to survive the first 3 years is likely the trickiest part as juvenile plants are very vigorous and readily killed by over cold temperatures. Older fruit producing plants grow fewer lush shoots and more short twigs that harden in the late summer. However a severe winter that knocks an established bush near to the ground will result in a storm of new juvenile shoots that are again prone to winter injury, so it can be a nasty cycle. Most disease issues these trees have are not prevalent in our northern areas. However gumnosis is likely to occur at wound sites and this can be controlled. Try Sapalta, Opata, Brookgold, perhaps Heaver, Prolific, Mistawasis.

Plumcot hybrids between plums and apricots require more heat than available in Yukon so these will be more problematic.

Bush Cherries

These include a wide variety of species and selections from Mongolian cherries, Sand cherries, Nanking and the new romance series including Juliette and Valentine, developed at the university of Saskatchewan. This last group of hybrid cherries have excellent fruit qualities but like the others mentioned are not reliably winter hardy anywhere in the territory. SK Carmine Jewel is another very hardy cherry and would be a good choice for trial. Severe cold may reduce growth to the snow line some years but favourable bush development and fruiting below the snow line will take place.

As noted elsewhere, microclimates exist or can be created that should permit limited production of these fruits. Where deep annual snow cover is reliable, better winter protection is assured. However the summer season still must be long enough to mature the new season's wood and ripen fruit.

The bushes need lots of sun, heat, moisture and loamy, rich soil to perform well. Blooms are frost sensitive, insect pollinated and should not require cross pollination. Leave fruit on the bushes till they get quite dark, as sweetness and flavour steadily improve as the fruits hang.The low growth of the bushes makes them good candidates for sheltered culture.

Pruning can be restricted to removing winter damaged, broken limbs and those becoming heavily shaded as the plants grow out. You should be able to see light through the bushes in full leaf. All of this to be carried out in the spring before buds are swelling. Fertilizing should also be done in the spring to early summer. Late growth will be very vulnerable to winter-kill. Hand weed around cherries as they are very sensitive to herbicides.

Pin cherries are nearly as hardy as Maydays and will grow on sunny well drained sites. The small, bright red fruit of these shrubby trees is useful for jelly.

Tree form cherries whether sweet or sour fruited are not hardy enough for outdoor planting period and poorly suited to sheltered conditions as they grow so large.

Small fruited bird cherries like Maydays and Schubert cherries (which have purple leaves), are the hardiest fruiting trees readily adapted to central and southern Yukon. These primarily ornamental trees are useful as indicators of soil quality high enough to grow other types of fruiting trees. Where these cherries can be grown vigorously the likelihood that other fruits can likely be grown is higher. No special care is required to grow these very hardy ornamental trees. The astringent fruit has some use in jellies or juice. Note that late in winter chokecherries that have been repeatedly frozen and thawed have been reported in Alaska as being toxic to moose.

Disease issues

The cherries, plums and related trees and shrubs are host to 'black knot' a fungal disfiguring disease that damage the trees. It is not in the background vegetation in the territory and so it is likely to show up only on newly imported stock from the Prairies where it is widespread. It is imperative that anyone familiar with or growing these trees keeps an eye out for knobby, green or black swellings on branches of these trees. They need to be removed where ever they are growing on the trees and burned as soon as they are removed.

Winter Shelters

A simple winter shelter characterized by a few poles lashed together tipi style with a tarp secured to it in such a way as to be closed off to the sky and tight to the ground in order to moderate severe cold temperatures is a quick, effective way to protect plants.

Where summers are mild and plant growth is good but winters are just too severe and serious or regular damage is observed, then the winter shelter is all that is necessary to keep the plants in good health and fruiting. In this case a frame of lumber or poles are collected and tied or wired in a suitable fashion to

cover the stiff portions of the tree frame. Flexible branches can be brought in under the covering when the is is applied, or if widespread and rangy then they can be carefully tied with cord into a smaller configuration by wrapping around or through the tree from opposite branches. The material should be heavy enough to support expected snow accumulations and be light in colour so as to not attract much heat when exposed to the spring, March, sun. This can be stapled, nailed or tied to the frame in any way that makes a relatively tight cover that extends to the ground. If a 4-6 inch strip of hardware cloth or similar wire mesh is situated in a ring just inside the plastic covering one can rest more easily that voles or mice will not freely chew through the covering and waltz up to the trunk and strip the bark off and doom the tree in the dark of winter. While the rodents will climb up a tree or shrub contained in the snow and eat along the way, they strongly tend to travel through the snow at ground level, so obstructions there are most effective in redirecting them away. Simply packing early snow around the bottom of the covering with ones boot will usually be sufficient to discourage traffic unless it blocks a well travelled route. Once covered in this way, snow will provide insulation on the outside and frost will accumulate on the inside, preferentially on the coldest places and this will help insulate the space. In this way temperatures 10 to 20 C degrees warmer can be achieved inside these unheated spaces. This will not have such a dramatic effect where regular thaw cycles occur that melt the snow and frost. In the central Yukon this technique has been utilized for over 25 years, successfully sheltering dozens of apples, pears, cherries and plums from temperatures below-50.
The shelters can be opened up in March whenever the likelihood of serious cold has passed and removed and packed up whenever thawing conditions permit but certainly prior to leaf out.

Summer shelters

Plant tubes are the smallest form of summer shelter and these are used across the board in establishing new commercial orchards. They fit tight to the ground and keep a warm column of air around young trees to promote more rapid growth. At a larger scale, a series of poles set in the ground with a three to five foot high wall of poly wrapped and fastened around the frame will create a hot zone for a plant improving growth. The top not need be enclosed, but the lower edge must fit snug to the ground so as to not create a chimney effect. Such a strategy will bring a fruiting bush or tree into production much more rapidly and by promoting quick growth improve winter hardiness.

Year round shelters

While people are familiar with the benefits of growing vegetables in greenhouse style structures, with a bit more dedication and tending over the shoulder months, fruit trees can be grown in these same or similar spaces. Fruit trees can be planted in the ground in a dedicated fruit house or with vegetables or flowers in conjunction. Growing practices are similar for trees grown outside, but pruning and water management are more important under cover. Growing fruit under poly can result in softer fruit and less colour at ripening. This seems to be more of a problem with the earliest ripening apple selections. On cold sites though, shelters can make the difference between slightly pale coloured fruit and failure. Extra effort involved in fruit production under cover is encountered when cold weather arrives. The structure is sealed up then to ensure that heat is trapped and moisture is deposited as frost on vertical walls as insulation, accumulating snow on the roof will help keep the air and trees warm once in place. If snow loads become excessive and it needs clearing, its best to do it just before snow falls again rather than before a cold snap. Placing vertical poles inside, ground to ridge for additional support is always a prudent move.

The other job to do before the snow flies is to fix tarps or similar to shade the walls facing the spring sun in whatever way is practicable, so that temperatures cannot climb well above freezing in the days and fall into hard freeze (-20) after the sun sets.This is a typical scenario in March in the central Yukon. Alternately as early as mid March temperatures lower than -40 are unlikely so vents or doors can be opened to keep heat build-up from occurring on mild sunny days. On windy sites though, this may cause problems. The particular exposure of a given site will dictate what needs to be done to moderate early warming. Greenhouses or cold frames that are built off the ground will not capture heat from the ground to provide winter protection.

Trees and shrubs grown in containers can be heeled in the ground in a year round shelter, well watered and mulched with leaves or snow early in the winter along with any fruit trees living permanently in the shelter. Any containerized plants placed in a shelter or cellar must be kept moist. In an unheated greenhouse, cold frame or cellar this simply means watering the container to the saturation point prior to it freezing, placing a piece of plastic over the soil surface will minimize desiccation.
Keep the shelter closed except for occasional inspection. As the weather warms in the spring, prop open doors or vents to prevent early heating. Watch for meltwater dripping onto frozen trunks as the ice buildup can damage surface tissues which can result in longitudinal dead zones and limb loss similar to sun scald.

Unless you are prepared and equipped to provide supplemental heat in April and May, the trees should not be encouraged to leaf out much earlier than native trees outside. If you are heating the structure then providing night time heat to limit frost any time after mid April will give a long season to produce fruit. Keep in mind that flying insects that pollinate blooms of fruit trees are not numerous or very active before the snow is gone.

With spring arrives two approaches can be taken. First, one can choose a time in April when the weather begins to mellow, to close the doors and start the show. Doing so when nights are still going to be colder than -8c means occasional heat will be required once the buds start to break out. How soon this happens depends on how warm the days are and whether the night-time temperatures are allowed to go below freezing regularly. If the days are warm and nights are mostly above 5 C. degrees the trees will leaf out and bloom quickly. Cherries and plums are very quick to react to frost free conditions, pears are next and then apples. Once flower bud pink is visible the tolerance to cold steeply falls off and only a few degrees of frost is tolerated before damage occurs so be prepared to keep the place warm. If one is growing other flowers and vegetables in the site then this is required anyhow.
The other approach is to keep the shelter open to the air and cool till May when frost is still expected but not so often or hard. Closing it up then and removing any shade cloth will still add several weeks to the season start and minimize cold damage if the option to heat the premises on cold nights is unavailable.
Either way daytime venting will be required as it is for all greenhouse production. Heat scorched leaves can be a problem on calm, suddenly hot days especially when humidity climbs. If serious wilting is observed, spray affected plants immediately with cool water for several minutes while lowering temperatures. Scorched leaves will brown and dry quickly, and 15 minutes of too hot temperatures can ruin the appearance and slow development of a tree for the rest of the year. Plants are more sensitive to excess heat in the spring generally and in the mornings particularly. At temperatures above ~36 degrees C. growth and many important functions begin to stop, and damage begins at temperatures

between 38 and 40 degrees. Mature leaves will withstand higher temperatures for short periods but growth is suspended.
Water needs will climb steeply too, especially if the fruiting plants/trees are containerized. Regular drip irrigation is advised for trees grown in large pots or wooden boxes.
If growing in box or crate type containers, construct these with heavy wire fencing for the bottom so that roots can grow into the ground or a well amended substrate for the summer. The extra root mass is cut away in the fall to allow the tree to be moved into a shelter if placed outside for the summer. Annual pruning keeps the tree to a manageable size and balances the loss of roots. This method of containerized culture allows fruit trees to start the spring under shelter like a greenhouse where they gain several weeks of early season but then free up the space, by being moved outside when the weather is warmer.Trees can be kept in this way for many years.
The trees should be encouraged to harden off and drop their leaves by the end of September, so do not keep them too warm that month, remembering that the fruit can take some frost!

A few insects can be more problematic in a sheltered situation given the extra heat and more even climate. Watch for aphids in the spring on rapidly growing shoots. In a shelter their numbers can rise alarmingly but they become conspicuous and are easily removed. Scale insects can also become an issue. They are usually first noticed as brown lumps the size of a pepper seed, either shiny and soft when growing or papery when dry adults. They are only damaging in large numbers but this can happen in the spring quickly if a group of adults were left on the trees from the previous year. Learn to keep a sharp eye out for the dry 'scaly' hats clinging to the sides or under two year twigs. Each dry scale shelters dozens of eggs, visible as a fine powdery dust when the dry scales are flipped off. Do just that and smear any white powder you see to remove and kill the eggs. This will do much to control numbers on a few trees. If the problem looks like it is getting out of control, crush or spray off with fine jet spray of water Sulphur/mineral oil spray should be applied the following spring before leaf out if scales persist.

Overwintering strategies

When growing anything that is not native to the region the hardiness rating must be given some consideration. This consideration must be weighed against your site characteristics and its micro climate. When researching a new selection it is not enough to learn that a plant can withstand the lowest temperatures likely encountered in your location and that it might ripen fruit on a date before a hard freeze. While these criteria are important and sufficient for some crops they are not the whole story. If trying to grow something no one else is succeeding with it is likely that another factor such as growing degree days or a growing season with sufficient warmth for a required length of time is necessary. The long daylight hours in summer, encountered north of 60, can be an issue also. Plants from much further south can be sensitive or adapted to shorter days to such an extent that growth patterns are unsuited to northern growing. This can be observed when active growth continues well into the fall when all other native plants are loosing leaves and becoming dormant. A shrub or tree or vine will not achieve its full hardiness and withstand the severest cold possible if the newly created wood throughout the plant has not matured or ripened. In many plants this process of hardening continues for some weeks after the leaves have been shed.

Having the ability to control moisture levels in the ground in the fall particularly can be critical to success with a marginal crop. Drought stress, late in the season inspires many plants to terminate growth and harden off. If moisture can be reduced to induce this condition, it is possible to shorten the season

required to grow sensitive plants. This might be achieved by planting in very well drained soil and irrigating well when required and holding back after the crop is ripe and picked. Plants can be grown under a roof or shelter and irrigated as needed then allowed to dry for a time in the fall to force dormancy. Remember though that a good watering will be required as the leaves drop off in order to protect the plant from desiccating and ensure it is hydrated for winter. If water stress is encountered or induced too early in the season, it will result in poor growth and can be damaging. Where soil nutrient levels are very good plants may set large numbers of fruit buds when water stressed, but should moisture levels rise late in the summer, a second flush of growth is likely that makes the plants very susceptible to cold related damage.
These manipulations will not work with all plants. Those that are of very southerly origins may be too adapted to shorter day length to respond adequately, peaches and many plums are examples of this. These will display signs of drought with stunted growth, but will continue to grow tenaciously, while the days grow shorter and ultimately cold, trapping the plants out of sync with their environment and doomed to fail.

Situating trees on the lower side of a low profile shed where the tree can grow limbs just above the roof, where in summer reflected heat will promote growth and winter snow cover will protect the buried limbs on the roof would likely give good results. Rodents are unlikely to find the sheltered limbs and fruit would be easy to pick!
If you are planting near a building think about whether snow is likely to slide off and damage the trees, or if the soil will be too dry which is often a problem near buildings with significant overhangs.

If your land seems just too cold or windy there is always the option of building a greenhouse or cold frame shelter to grow trees in. The aim in doing this is to achieve several goals. The primary obvious objective is to keep the plants warm enough long enough to grow and become fruitful. Then they need to be kept sheltered enough to avoid freeze damage, (warmer than -30 in most cases is fine) and wild sudden fluctuations of temperature need to be avoided. Particularly sudden drops. In a sealed shelter, a buildup of frost on the inner plastic surface is very helpful to minimize temperature fluctuations. This will be discussed further in another section.

Other complimentary strategies

Old car tires
Long used as country planters, if you can stand the sight of them, they can be used singly or stacked to create planting beds that get very warm in the summer. The main drawback is always that they dry out rapidly and remain dry out in the ring area covered by the sidewalls unless watering is done especially well and regularly. If irrigation is well provided they create excellent planting sites for fruiting shrubs and small trees. For best results cut drainage holes through the sidewalls of each corresponding layer to ensure water movement through the enclosed regions. To cut through sidewalls place a block of wood tight between each side and cut triangles out with an old axe, they need not be pretty. Keep stacks short or roots will be exposed to serious cold in the winter. Be sure of what you want to grow in them as a successful tree will be difficult to remove in the future.

Alternatively if stacked several feet high and filled with sand, soil or rock they become great heat sinks. They can still be planted with annual flowers or vegetables, while creating very mild, microclimates for nearby plants. A fence or broken wall of these with fruits planted in between creates a very sheltered environment for growing heat loving plants. Planting on the sunny side of any slightly reclined retaining wall can be useful in the same way. if this is terraced all the better so that snow is more generally distributed.

Weeding

With trees, keep grass and any weeds away from the trunk base with a 3 foot or 1 meter diameter clearance. This ensures warmer soil, minimal competition and less rodent damage and can result in trees reaching productivity in half the time as grass encompassed trees. It also ensures that various weed whacking tools do not strip the bark off which is fatal!

For bush fruits or shrubs, keep the area under the plants as weed free as possible for the first two years, thereafter try to keep taller perennial weeds like fireweed and tall grasses from becoming established. Low growing grass will inevitably get established but will be kept in check by the shade and growth of the fruiting shrubs.

Insects and mowing

Honeybees are excellent pollinators on outdoor crops in good weather, but they are not indigenous and are only to be found where they are being housed nearby. Bumblebees are excellent pollinators that will not get disoriented under poly and work at lower temperatures. Less common but still helpful are the small solitary bee species that are native to the Territory. Wasps will visit flowers in the spring but are not noted pollinators, however they are predatory and they play a roll in harvesting other insects including mosquitos .The presence of all bees can be reinforced by having wild flower areas, margins or gardens nearby to keep the bees fed and nearby through the summer and fall when native food sources of pollen dry up.

Keep this in mind when mowing or cutting background vegetation. Simply keeping an area uncut, in a damp area or where spill-over irrigation occurs can give a much longer period of flowering to Yarrow, clovers… and other late and long flowering plants.

Late in the fall, isles and areas surrounding / adjacent to fruit crops, particularly near strawberries be mown short or turned over. This discourages rodents from establishing nests, eliminates much of the cover and feed for voles under the snowpack.

Our isolation and cold weather mean that most of the insects that plague southern orchards do not thrive or live here. The steady vigilance to monitor for bugs, set traps, spray, set other traps and spray something else with all the inherent expense and stink, is not required here. Then our usual cool, dry summers do not provide good conditions for many of the fungal, scab and other diseases that ruin crops, so take comfort, we have our advantages too!

Hedge tunnels

Where growing uniformly low hedge fruits such as bush cherries, overwintering success can be improved by covering the row with plastic or fabric in such a way that the plants are somewhat directionally oriented and pinned down to minimize breakage from snow load. This can be achieved by placing a tarp over the row, with one end of the tarp extending several feet beyond the row end, weighing it down slightly using wood, stone, bricks etc. then pulling the tarp along the row several feet to orient the branches along the length of the row. This will make the plants more resistant to breakage

under snow cover. Secure the tarp further so wind will not lift it. Do this late in the fall on a mild afternoon after the leaves have fallen and the ground has begun to freeze. Voles or mice may browse the plants more under these darkened conditions so employ baits/traps/deterrents as you choose or leave openings where a cat might enter.

Snow removal
Broadcasting sand or wood ash over the snow late in March or April can do much to melt snow weeks ahead of un-sanded snow. A thin dusting is all that is required to capture sunlight and create melting conditions. Broadcast over rows of shrubs the added effect can help eliminate limb breakage and fungal outbreaks in the damp snow.
Sanded snow along ditches will help open these areas up to promote early flowing of melt water before it pools and saturates low ground.

Grapes
There are presently more than a few varieties that can be grown in short season areas. Some of the best varieties to try are Valiant, Marquette, Minnesota 78 or Kay Gray. All grapes require the extra heat and season extension provided by a greenhouse or cold-frame in summers and protection in winter. Vines can be container grown using 5 gallon pails with much of the bottoms removed for drainage and extra root development through the summer. Provide irrigation, sandy well drained soil with bonemeal and grow in full sun where air movement is best. Decrease water supplies in the fall when fruit is ripe. Learn how to prune the vines and do so each spring and during fruit development as this makes a big improvement on crops and plant health. In the fall cut vines free of their supports, tie stems loosely together and store the vines in a cold cellar or heel the pots on their sides in the ground inside a greenhouse and mulch the stems if temperatures below -25 C are to occur. Vines can be grown in the ground if winter temperatures are held within the vines cold tolerance. Provide shade to any shelter that might warm up in the winter to prevent repeated, rapid freeze and thaw cycles.
More research is underway in this field and new selections are likely to come out that will improve fruiting options.

Pine nuts
For the truly patient, those planning to pass property on to younger generations, pine nuts offer a long term specialty crop. Pinus cembra the swiss stone pine and its Siberian equivalent P.c. siberica and the dwarf P. pumila will grow in central and southern areas. They will grow on most soils, making the heaviest growth where moisture is abundant while not saturated. The trees are great feature specimens and are valued for timber. Pinus pumila is the lowest growing form and by far the easiest to pick cones from but also most accessible to browsing by hares, moose and deer. Cone crops cannot be expected before the trees reach 15 years of age. The trees require no special care, pruning or maintenance and can live 400 to 800 years.

Hawthorns are another very tough flowering and fruiting tree. The fruit or haws as they are known can be made into preserves or dried and eaten raw. While seedy, they contain compounds with health attributes for the heart. Finding selections that will grow in the Yukon can be challenging. Most commercial offerings are for Toba and Snowbird neither of which will survive cold winters here. if the right selections are planted, the small trees or hedges that result when grown in a row can provide a good alternate berry crop for birds that might otherwise eat more desirable fruits these trees can also form thickets that are not readily traversed by animals. finding the right selections is difficult.