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Organic Orchard Techniques

By Michael Hutton, certified organic apple grower

Introduction

My basic philosophy of using the land, whether growing apples, plums, or a vegetable garden, is to leave the soil in a better position that I found it. Producing a greater degree of organic matter in the soil and encouraging diversity both of plants and animals is a major portion of this premise. Growing a monocrop like apples presents a great challenge to this basic ideal. However, there are simple, low-tech approaches that can be used to achieve this.

One part of the approach is whether to use pesticides, fungicides and fertilizers to reach your goals. I have always taken the approach that I would like to balance the nutrients in the soil and in the trees by non-intrusive means as much as possible, but if an input is needed, and if it is organically allowed, I will use it for the health of my orchard. Traditional plant breeding has produced scab-immune trees, but if one insists on growing heirloom varieties, then an organic scab control should be used (if you want to sell a large amount of otherwise cosmetically-challenged fruit for fresh eating). Technology has produced ways of confusing the insects that would otherwise infest our fruit and I feel we should use those techniques.

There are ways of avoiding fertilizers in the orchard, and I will be discussing these later. However, for new trees, using approved fertility agents may be unavoidable in order to give the trees a head start in the stressful situation of taking root and growing in a season that may be unfavourable. There are not many ways to avoid the use of lime to sweeten the soil; apple trees do have certain pH requirements.

Organic growers know that their apples are healthier than conventionally-grown apples; apples are the third most heavily sprayed conventional crop in the world. We can make the world a better place by using organic techniques. Stringent scientific testing has proved that certified organic apples are tastier and contain more nutrients than non-organic apples; what needs to be done is to get this word out to consumers. At that point, one could expect to see a lot of conversion to organic production occurring.

Starting Out

I had five acres of land which seemed suitable for growing apples. No matter that no-one in the area had more than a homestead orchard, or that the climate could be ferocious in the winter or that the soil is thin. Like many people with a goal, I didn't look at the potential difficulties. Now, twenty years later, I have evolved a technique that, if not assuring success for a tree or a whole orchard plot, at least raises the odds.

The first thing to be done is basic soil testing; find out what the soil has and what it lacks and set out to amend the deficiencies. If you can't wait the two or three years to do that, make a plan to amend the orchard as you go along. Bushes (particularly alders) and small trees should be cleared, but leave spaces for some biodiversity (I have little patches of raspberries, where birds often make nests) and put in windbreaks at intervals. Line them up perpendicular to the prevailing wind direction in the winter (there is nothing that kills young trees faster than harsh winds at –30 degrees C) and remember that these windbreak trees will grow and take up space. If necessary, leave an opening in the windbreak to get your machinery through!

The spacing of the trees depends on the type of trees planted; in my harsh climate, I can't use dwarf tree rootstock, so the spacing is about 4 metres in the row and 4 metres between rows. When hiring a backhoe to dig the holes, remember that this becomes quite inexact, depending on the estimation skill of the driver! If you have the time and inclination, putting in stakes where the holes should go would be ideal. The hole should be deep enough to have the graft at soil level, or slightly above, and large enough in diameter to spread the roots properly.

Treating the trees properly when planting is crucial. The start they get will determine speed of growth and, ultimately, how soon they will bear fruit. Bare-rooted trees need soaking in a seaweed meal or fish meal solution for at least a couple of hours prior to planting, and the roots should never dry out while waiting to be planted. Carry a tarp or some burlap along if you have a bunch of trees to plant at one time on a hot, sunny day. There are many differing recommendations for what to add to the hole with the tree, but I have always followed Bart Hall-Beyer's recipe from "Organic Fruit Production in the North" : one cup of sulpomag, one cup of lime, two cups of rock phosphate, one cup of bone meal and a good shovelful of composted manure, plus a full bucket of water. The tree should be staked and mulched immediately. If watering is possible (i.e. if you have just planted 200 trees, there may not be enough time in the day to do it! That's when mulch is very much needed), it is recommended.

What Trees to Plant

Varieties are very important in the success of your orchard; when I first started, all I knew was McIntosh and Cortland, and I purchased accordingly. This was a serious mistake, as these trees get high levels of scab even in a dry summer, and even when you are rigorous in your scab control, you will have a relatively low percentage of apples which you can market as fresh fruit. Purchase trees on rootstock which is appropriate for your climate; most of my trees are on Beautiful Arcade or Ottawa 7 rootstock, which produces a semidwarf (or semistandard, depending on the nursery) tree. Given that different varieties have different growth habits, this can mean a tree from 10 to 20 feet high.

I have over 50 varieties in my orchard, but have large numbers of four varieties:
NovaMac – great taste, a little sweeter than Macs, great for fresh eating and keeps for a long time without getting soft;
• Redfree – a hard, crisp late summer apple (ripening here in early September most years). These are great for fresh eating, and surprisingly good for pies, as the slices keep their shape. They keep about a month;
• Liberty – a late apple, ripening in mid-October, resembling a Red Delicious, but with much more taste. The fruit are variable in size and will be damaged by a hard frost. They keep about two months;
• Macfree – a smallish tree, giving genuine Mac apples in taste and appearance. They are a little later than the NovaMacs but keep almost as well. The tree is prone to limb breakage, so pruning is important.
All of these apples are scab immune (although there are reports from Europe that this immunity is breaking down there with time. They must have developed a "Superscab"!). If you must have other varieties for other purposes, some others are listed below.
• Wealthy – good for sauce and pies. I use them as part of my blend for cider. A tall tree.
• Ribston Pippin – cider apple, slightly russetted, also good for eating.
• Cortland – THE pie apple, in spite of the scab. Some Maritimers will use ONLY these for pies.
• IdaRed – a very late apple, which stores until the next summer even under poor storage conditions. I use them for apple butter.
• Yellow Transparent – the earliest summer apple, sometimes the end of July. They don't keep, bruise when you look at them the wrong way, but they make great white apple sauce. They are also incurably biennial, so you need several for the alternating seasons.
• New Brunswicker – these were developed about 50 years age near Woodstock. The apples are large, early and moderately tart. The trees produce heavily.

All of these apples get scab to a degree (except the Ribston), but they have their uses and fan clubs, so they should be considered, depending on your marketing plan and the products you plan on making. I have small numbers of about 40 other varieties, many of which I haven't figured out what to do with yet!

Growing Techniques

Pruning:

When I started buying trees, it was recommended that you remove the top third of the "whip" and continue with that technique for the next two or three years – and I followed that. Then I read, in a report out of Cornell, that tests showed that this early pruning made no difference in the level of growth or in the time to bear fruit. So I stopped pruning of the first year trees, aside from removing any small branches that are below three feet off the ground. I continue this practice for several years, until the tree gives up and works on branches at a sufficient height.

The tree should have six (or so) branches spread out around the trunk at a reasonable distance from each other. You don't want lateral branches that compete with each other for light, so pruning is necessary to

remove some of those. A major part of pruning is intuition and “feel”, as every tree grows differently, and so pruning is a very individual process, both for you and the tree. There are several possible shapes for mature apple trees, all of which can be used for successful production. I chose to try to have an arching shape, for two main reasons: this seems to be a way to get light to all the tree, and good air circulation; and this also helps to keep the height of the tree at a convenient level. Having said that, trees that grow naturally tall like Wealthy will need constant encouragement to keep to your required height.

I prune at two main times: midwinter and in the heat of the summer. Try to pick a reasonably warm day in the winter, and prune for the ideal shape. Remove any broken branches and crossovers. Start with the oldest trees and work your way towards the youngest trees. Aside from pruning very young trees in the summer, the only reason to prune in midsummer is to remove branches or areas of bark affected by the disease “European canker” (more about this later).

Feeding:

The only way to know what your trees need is to do regular soil and leaf testing. Soil testing can be done at any time of the growing season, but you should recognize that any changes which you need to make in terms of nutrients may not have any effect until next year if you wait too late. You should consult reference texts for information on how and when to apply the deficient nutrients. Leaf testing can only be done in July, and requires 100 leaves from 10 trees of the same variety in the same block of your orchard. Obviously, you may want to test more than one variety, or more than one block of the orchard.

I apply composted manure to every tree each year. It is recommended that you apply it early enough that it does not encourage late growth, which would mean that the tree (or certain branches, at any rate) will not harden off for winter. My orchard is quite acid (orchard pH should be close to 6.0) so I have applied lime most years, and will continue to do so until the pH is optimum. Be aware, however, that dolomitic lime and calcitic lime have different properties which may affect other nutrients and flip them over into an excess situation. I also apply a foliar liquid seaweed spray for micronutrients every two weeks during the growing season.

As a final example, I discovered that both my soil and leaves were seriously deficient in boron, a micronutrient which affects fruit set, particularly in dry weather. After reading how much to add (a teaspoon per tree in a foliar spray and less that an ounce per tree if spread on the soil) and when to apply (late summer on the soil or after harvest, but before leaf drop as a foliar spray), I took the appropriate measures to correct the situation. But I would not have known this had I not done the testing.

Other amendments commonly used are sulpomag (or K-Mag) and rock phosphate. Be careful that the rock phosphate is not accompanied by heavy metals.

Managing the Orchard Floor

Every one of my trees gets a layer of mulch about every second year. I am careful to ensure that the mulch is not touching the trunk, but instead is a few inches away (having it touch the trunk is an invitation to mice to girdle the trunk from the safety of cover!). With my cold climate, I need to be sure of root protection in case of a winter of inadequate snow cover. The mulch is composted straw, which then will fully decompose over two years and provide nutrients for the tree. I also use a “weed eater” to cut the grass under the remainder of the drip line, but I do wait until after flowering is finished before I do this. Apparently, the tarnished plant bug prefers the low weeds and grass, but will migrate upwards to the apple blossoms if disturbed at that time.

I mow the orchard regularly during the growing season, but not to a fault! I like to encourage the presence of beneficial insects, and a level of biodiversity in the orchard means the greater likelihood that the beneficials will keep the insect pests in check. I also leave areas of raspberry plants, Queen Anne’s lace and caraway for their healthy populations (and also it’s nice to be able to have another fresh fruit for the table and a condiment for cooking from my own land!).

For many years, I have planted cover crops between the rows of trees. These add nitrogen and organic matter to the soil, and there are ways of calculating how much, depending on the crop. Among the ones I have used are buckwheat (a legume, cut it down before it sets seed) white and red clovers (also legumes, and perennial), field peas (lots of nitrogen here) and birdsfoot trefoil. Till up the areas to be seeded as early as possible in the spring. Soil tests have shown that my organic matter and nitrogen levels are very good.

Tree Losses

It is inevitable that you will lose trees in spite of your best efforts. It is important to understand why and take measures to prevent this cause from happening again. There are almost as many causes as dead trees:

winter kill, crown rot, European canker, deer, mice, inadequate roots, drought, wind. If the climate causes loss, reevaluate the tree selection and change to a hardier or more drought or wetness resistant tree. About 10 years ago, we had the coldest and windiest winter in 100 years in northwestern New Brunswick. I lost 40 trees outright, and another 30 over the next two years in a delayed kill. Most of these trees were from a nursery in Michigan and were not acclimatized to our climate – a real lesson, and a bitter one to learn.

Many trees that die send up suckers from the rootstock, and these can be used for grafting more appropriate scion wood. Learning grafting techniques is a real asset to an orchardist, but even so, a success rate with grafting of greater than 50% qualifies you as a real "pro". Growing out seeds for rootstock or buying rootstock (or rootstock seed) is the way to go, along with cutting your own pieces of scion wood from successful trees in November. Once you have taken the samples of scion wood, put them immediately into plastic bags with damp earth or peat and store the closed bags in a cold location over the winter (the back of a refrigerator shelf is good).

Disease Control

Scab

Scab is not an issue if all your trees are scab immune. If you have trees which are susceptible to scab, you must deal with it if you wish to sell fresh apples. Scab is a fungus disease which is spread by spores during wet weather. It overwinters in the leaf debris on the orchard floor. There are methods of preventing the disease and methods of counteracting it.

Counting "degree-days" to find out when the scab spores start to spread is an absolute must. You need a max-min thermometer and the ability to use this formula: Degree-days (DD) = (max + min)/2

When this formula has accumulated 175 degree-days, you must spray all susceptible trees with a wettable sulfur spray before each rainfall. This will continue until 430 degree-days have elapsed, when the spreading of spores from the first inoculation period stops. Although the method will not achieve 100% control (and much less, if unexpected rainfalls occur), you will greatly improve the situation. Interestingly enough, scab spores do not spread at night, and temperature and length of wetness time are also key factors. See my references at the end for a full discussion of this.

A method of preventing scab from overwintering involves the use of lime. Once the leaves have dropped in the fall, apply your lime over as much of the leaf litter as you can. Then mow and/or "weed eat" the area and the lime should take care of much of the latent scab problem for the following year.

European Canker

This fungus disease also goes by the name of sooty fungus. It causes black, sunken lesions in the crotches between branch and trunk or where a branch has been pruned poorly. The fungus kills the sap-bearing cells and eventually girdles the branch (or, horror-of-horrors, the trunk). This fungus will not enter a tree if there is no break in the bark. One way to keep healthy, unsplit stems and trunks is to prevent winter splitting caused by rapid increase and decrease of temperatures during thaw/freeze conditions. This is accomplished by spraying a dilute mixture of white latex paint and water on the trunks and lower stems of trees before winter. This reflects the solar energy and stops the trunk from heating up during a thaw.

If your trees do get the disease, it must be exorcised during the time when it is dormant: during the winter or when the summer temperature is at its peak. With a sharp knife, remove the affected bark and underlying tissue and go back into the healthy tissue (which will not have a brownish-red colour). Seal it with tree wound dressing. After each use of the knife, wash it in a Javex solution. I usually spend a few hours beforehand scouting the trees to find the disease.

Crown Rot

When I first started, I had some problems with this. The base of the tree, at the ground level, showed rot, and the bark peeled off. Obviously, you lose whole trees this way. It can easily be prevented if you take care to remove ground cover around the base of the tree, and prevent that base from being more-or-less permanently wet.

Insects

Codling Moth

This is the insect which lays its eggs under the skin of the apple; the larva then burrows into the core. Codling moth attack most apples varieties uniformly, but their dispersion in the orchard is haphazard and

inconsistent. They may destroy most apples on one tree, while the one next to it is virtually untouched. My climate is cold enough to have only one generation of codling moth, but other warmer climates with long seasons may have two or three generations.

The key to controlling the codling moth is to stop mating (abstinence is 100% effective as birth control!). Male moths are attracted to the female by sexual attractant pheromones. A product called Isomate-C takes this into account; the pheromone is impregnated into twist ties which are placed on the upper branches of trees, two or three to a tree. The pheromone saturates the orchard and the males cannot locate the females – no mating, no larvae. This should only be done in orchards of more than one acre, and is not 100% effective (some males will blunder into some females). Your normal fruit thinning in June can include inspection for codling moth, and can remove the affected apples.

When to put the twist ties out includes another DD calculation, and different reference sources give different threshold dates. I used a Canadian source. The formula is: DD = (max + min)/2 - 10 . Nothing happens when the daily average temperature is below 10oC. The overwintering moths emerge after 110 DD , overwintering eggs hatch after 190 DD (this would be a rare occurrence in my climate) and the first hatch of newly laid eggs after about 240 DD. You want to get your twist ties on the trees before 110 DD have occurred to prevent mating. They last for a full season in my case.

How do you prevent overwintering of the mature moths? Actually they overwinter in the pupated state. They like to pupate in the ridged bark of mature trees or in the leaf litter on the ground. Remove the litter if you can and compost it to reach a high temperature (if you don't reach a high temperature, all you've done is to concentrate the moths in one place!). Otherwise, buy a roll of corrugated cardboard (corrugated on one side only) and tightly tape a 15-cm wide band around the trunk of producing trees. The moths may be fooled into pupating in the ridges of the cardboard. You would want to do this soon after 240 DD have occurred. The eggs hatch quickly and the larvae often leave the apple within a few days. Remove the cardboard later in the season and burn it (with the pupae). Also, pick up all drops during this time, as they may contain a larva. With these techniques, you can bring the moth population down to a low, manageable level.

Incidentally, it has been found that codling moth mate only at dusk, and only at temperatures above 17 degrees C. Fussy little individuals, aren't they?

Apple Maggot

These little guys, also called railroad worms, tunnel through fruit and make the familiar brown paths through the flesh. Their occurrence can be predicted, as with scab and the codling moth, by the use of degree-days also. The formula for this calculation is:
DD = (max + min)/2 - 5 . No activity occurs below 5 degrees C. When 300 DD have elapsed, the adult flies emerge and eggs are laid 10 days later. This timeframe appears to be fairly exact and can be used to plan control measures.

I have found that my Redfree apples rarely suffer apple maggot damage; the only reason that makes them different from other varieties is their thick, hard skin. Maybe the flies cannot penetrate the skin to lay eggs. Just an hypothesis, but maybe it's worth investigating with other hard-skinned varieties as well.

As with the codling moth, picking up drops is key to future prevention. The larvae will move out of the apple into the soil quickly, already preparing for next year. To prevent them this year, the most effective method seems to be to hang wooden "apples" (or spheres) , painted red throughout the orchard at the time of adult emergence. Coat these apples in Tanglefoot . The female flies are attracted to the biggest, reddest apples in the orchard and get stuck permanently. One sphere every three or four trees seems to be enough. If you have a secret method for removing Tanglefoot at the end of the season, I'd like to hear about it. At present, I cover the sphere with a tight layer of plastic wrap and put the Tanglefoot on that. Just removing the wrap at the end of the season is much easier.

Tarnished Plant Bug

It took me a long time to find out why my apple flowers were being eaten, but it was these insects. Some years they can be a real problem. They don't actually prefer apple flowers, but instead like flowers on the orchard floor. If you mow early and disturb them, they will move up into the trees. So wait to mow, even if you are getting looks from neighbours about your sorry state of maintenance of the orchard! If they are still a problem, you can spray with the restricted substances like sabadilla or ryania, but these also kill bees and other beneficials, so be very careful. Neither substance is longlasting.

Degree-days for the tarnished plant bug are calculated with the same formula as the apple maggot, but they emerge after only 27 DD. Unless you are planning to spray, however, this calculation isn't necessary.

Scale

I'm not sure what category of life scale falls into, but they can devastate a tree if they get a hold. I just had my first case this year, and two neighbours (a few kilometres away) have had them also. This creature is the main purpose for a lime-sulfur spray in the spring before white tip, although other less bothersome pests can be knocked down with it. I have never seen any other non-spray solution to scale in the literature.

Aphids

I used to worry about aphids on my trees in the early days; they appeared to severely damage the tips of young trees. I used an insecticidal soap spray (Safer's was the only one available in those days) and attacked the aphids (and their master ants) every few days until the infestation subsided.

I have not had to resort to that tactic recently, and have not had major problems with aphids. The only reason that I can attribute to this is that I have a large population of their natural predator, the ladybug (and their larvae). Rarely does the aphid population get ahead of the ladybugs. I never eliminate the ladybugs when they decide to overwinter in clusters in my home.

Leaf Rollers, Borers, Tent Caterpillars

Others have had problems with these pests, but I have not. Once in a while, tent caterpillar masses appear, but they can be manually removed and "stomped on". You can also walk around in the fall, looking for masses of silver coloured eggs on the underside of branches. Scrape them off and permanently dispose of them. Vigilance is the key here. Leaf rollers never cause a serious problem, although they are always present in small numbers. Borers apparently can't survive in my climate (or they can't make their way this far back in the woods!). I would have to research what to do with them if they appeared.

Larger Pests

Deer

Whole treatises have been written on keeping deer away from fruit trees and vegetable gardens (as well as tulips). The techniques I mention here have worked for me, but friends with market gardens have not enjoyed similar success. A study at Cornell several years ago reported that deer do not like the smell of deodorant soaps – the smellier, the better! In every tree I hang a plastic bag filled with a chunk of Irish Spring soap and some dog hair collected by the garbage bag from a local dog groomer. This smell will last at least a year, sometimes more (ah, the smells of the earth and the green plants, occasionally overcome by Irish Spring!). I put these out in the spring. One winter skiing in the orchard I noticed coyote prints systematically going from tree to tree with destroyed plastic bags under each one. He took offense to the smell of the dog hair!

If you feel like more work, spray the tree tips with a solution of hot pepper flakes and soap to make it stick. This needs to be replaced after rain, and the solution will mould if you have leftovers. This kept the deer off my small patch of echinacea.

Or failing this, you could fence in your orchard (remembering that deer can jump), preferably with electric fence, or to invite all friends with deer licenses to your place during hunting season.

I really don't know how to deal with moose; they can eat the tops of the trees, above the smell and the hot-tasting leaves. Luckily, I rarely see them here, although they are around.

Mice

Mice will girdle a tree trunk in moments if you give them an opportunity for winter food. In my climate, they make tunnels at ground level under the snow, and they would be very happy making detours to tasty bark and tissue underneath. Plastic tree guards work well on smaller trees; just make sure they are firmly at ground level or into the ground if your ground doesn't freeze. The length of these depends on your average snow depth. For older trees, a wire mesh guard, made of fine mesh chicken wire does the job. After a few years (about 10 on average for me), the trunk is thick and ridged enough to be able to ward off mice. In spite of this, I will usually lose one or two small trees a year to girdling – the wind pulls the guard up before snow cover keeps it in place.

References:

Here are three books that I have found useful (and for some things, invaluable):

Organic Tree Fruit Management (1998)
Linda Edwards
Publisher: Certified Organic Associations of British Columbia
ISBN: 0-7726-3615-X

The Apple Grower (1998)
Michael Phillips
Publisher: Chelsea Green Publishing Company
ISBN: 1-890132-04-7

Ecological Fruit Production in the North (1983)
Bart Hall-Beyer & Jean Richard
ISBN: 0-9691414-0-8