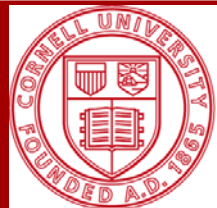




# FRUIT NOTES

## Lake Ontario Fruit Program



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### Using Disease Models for Controlling Fire Blight

D. Breth

So the season is catching up! We have already sent out a blossom blight alert for fire blight for Monday through Wednesday especially inland sites with first blossoms opening on Sunday in pears, Idareds, Gingergolds, 20 oz., SweeTango, NY-2, etc. And first bloom on Idared and Gingergold in sites closer to the Lake Ontario shore was noted for Monday. The cooler temperatures for Thursday through the weekend will mean only one streptomycin spray will be necessary this week in the varieties that started to bloom.

It is time to be ready for fire blight blossom blight sprays. I will be running fire blight models and will send out fire blight alerts as needed in Fruit FAX and as "text" messages if you let me know you want to receive the fire blight text alerts. *Get some streptomycin on hand for bloom and wait for the call.*

There are several ways to stay in the loop for blossom blight alerts:

NEWA will be listing the results for Cougar blight based blossom blight risk predictions. Go to this website: <http://newa.cornell.edu/index.php?page=apple-diseases>. Select fire blight in the Apple diseases box, then location, and then hit calculate. Be sure to set first bloom date if it is different from your bloom date. You can set the risk based on the proximity of fire blight to your sight which will adjust action thresholds to your site. The models are based on first bloom, not king bloom. So if in doubt, back it up a day.

MARYBLT 7 for Window is now available – free download. You can get it from: <http://www.caf.wvu.edu/KEARNEYSVILLE/Maryblyt/index.html>. This model assumes the abundance of inoculum. It will also predict the development of symptoms.

Cougarblight: Can be run as an excel spreadsheet; there is a new version which might identify more infections than the older version of CB. I have not identified differences in predictions comparing the Maryblyt and Cougarblight version 2000. If you need a copy of the old version of CB, please call Debbie. The advantage of having your own model is to allow you to adjust the temperatures up a couple degrees to accommodate warmer spots on your farm relative to the placement of the weather station published on NEWA.

Fire blight blossom blight models are not black and white decision-making tools. They are only as good as the weather data that is entered. Do the high temperatures of the weather station match the high temperatures in your orchards? All orchards have variable temperatures depending on sunshine and wind, perhaps with warmer spots because it is sheltered from the wind. Look at the locations in your orchards here you have a concentration of fire blight. Does it appear to be a warm spot out of the wind? A low spot where dew might settle? You should protect these areas earlier when we are just approaching a high risk situation. Or add a couple degrees each day for the high temperature.

There is always room for interpretation and that is usually where we make our mistakes. Here are the things I use to make my blossom blight risk decisions avoiding previous trials by fire. If you keep the threshold set as the defaults in the model, it will predict a high risk of infection if the degree hour threshold has been met. I do not pay any attention to the "temperature the day of the wetting event" in the Maryblyt model since we have had situations where we had plenty of heat building up to the wetting event, it

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Diversity and Inclusion are a part of Cornell University's heritage. We are a recognized employer and educator valuing AA/EEO, Protected Veterans, and Individuals with Disabilities.

Every effort has been made to provide correct, complete, and up-to-date pesticide recommendations. Nevertheless, changes in pesticide regulations occur constantly, and human errors are still possible. These recommendations are not a substitute for pesticide labeling. Please read the label before applying any pesticide.



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turned cold, but we still got infections. Were they blossom infections? If you have enough inoculum and a wetting event, we can get blossom infections as we do when researchers do artificial inoculation when the weather is cool. If we have met the degree hour threshold, and no wetting event is forecasted, I look carefully at other possible sources such as a leaf wetting event from dew during the night, or a fungicide application, and I will lean toward a streptomycin spray. Just a reminder that I reported a German study (E. Moltman) showed 52% of flowers were infected at 64-75F and 6% at 61F after spraying with 0.1 mm of water which cannot be effectively measured by a leaf wetness sensor.

**Fire blight text alerts:** if you know how to text with your phone, you can text Debbie at 585-747-6039 to get on the FB alert list. ***If you are enrolled in the LOF program*** with your partner county CCE office, we will send you a short blossom blight alert based on the risk predictions of the models. We need to know your cell phone number and phone carrier to send a text message to you.

**Fruit FAX** will be sent more often during apple bloom to report the risk of blossom blight infections.

## Confusing Internal Lep Pests

Greg Krawczyk and Larry Hull, Penn State Univ., Biglerville;  
Editorials- Art Agnello, D. Breth

[Ed. Note: We are reprinting some excerpted advice on mating disruption of internal-feeding Lepidoptera contributed a couple of years ago by our Pennsylvania colleagues, with a few updates, to help in your preparations for managing these pests, which are already beginning to show up.]

For growers planning to use mating disruption as part of their annual codling moth (CM) management program, you should have already purchased (if not already placed) your products for this year. There are a number of products on the market that affect both codling moth and the oriental fruit moth (OFM) simultaneously, in addition to a number of products that affect just a single species. Briefly, if your target is both CM and OFM, there are a number of products that affect both pests – CheckMate CM/OFM Duel, CheckMate CM/OFM Puffer, and Isomate CM/OFM TT. Please follow the label for each product for dispenser density and placement within the tree (i.e., for CM, place the dispensers in the top 20 percent of the tree canopy). Even though OFM has already started to fly, the above products should be in place before CM biofix (not yet reported in Western NY).

For those growers who have used a mating disruption product for CM in previous years, it is likely that you will still need some supplemental insecticides, especially for the first generation (see below for a listing of product choices). In addition, it is very important that you place pheromone traps in

trees to monitor the success of your mating disruption program. We have conducted a number of studies with a newer lure from Trécé Inc. to monitor CM in mating disruption blocks, called a CM-DA Combo. It contains both the sex pheromone – which is released by the females to attract the males – and a kairomone (i.e., a plant-derived chemical volatile [i.e., pear ester]) that attracts both male and female moths and should be hung in the top third of the tree canopy attached to a pole. We recommend at least one trap per 5 acres with no less than one trap per 10 acres to determine the success of your mating disruption program.

Note from D. Breth: If this is your first season to deploy mating disruption pheromones, experience with the area-wide project showed that you will still need to augment the pheromones with at least 2 insecticide sprays per generation if you have been getting a lot of damage to fruit in previous seasons. You should be able to avoid the September insecticide and reduce the stung fruit at harvest.

If your plan is to use just conventional insecticides for CM control this year, your choice of products is quite varied, depending on the stage of CM you wish to target. Products that possess ovicidal activity (i.e., affecting the eggs) should be applied as follows: Intrepid – apply within 150–175 DD after biofix and repeat 14 days later. Rimón is labeled in NYS as a Special Local Need Registration for only 1 application per crop per season in apples only. Using Rimón at

50-100 DD after codling moth biofix (around petal fall) will also help control leafrollers (D. Breth). Insecticides that target the hatching larvae (i.e., 230–250 DD after biofix) are as follows: diamides (e.g., Altacor, Belt, Voliam Flexi), organophosphate (Imidan), various neonicotinoids (e.g., Assail, Calypso), Avaunt, and Delegate. Proclaim will also be effective at controlling the first generation codling moth, but not as effective for the second generation (D. Breth). Please refer to the Tree Fruit Guidelines for rates on these products. It is important to implement good resistance management practices for all of the above products; that is, use only one of the above active ingredients within the same generation of CM; do not use the same active ingredients across two consecutive generations).

Another option that growers can consider for CM control is a codling moth granulosis virus (CpGV) (e.g., Carpovirusine, Cyd-X). We have used these products very successfully over the past few years in combination with mating disruption to reduce the severity of this pest. CpGV products must be ingested by the hatching larvae. The larvae will

continue to feed for a couple of days before the virus kills them. CpGV products are fairly short residual (i.e., 5–7 days); thus, they need to be reapplied more often than conventional insecticides. Growers will likely need 4–5 applications per generation depending on the length of the egg hatch period, the severity of the populations, and weather conditions. [Note: Madex HP, the new Certis product containing a CpGV that is active on both CM and OFM, is not yet labeled in NYS.]

Even if you are just using insecticides or CpGV for CM control this year, don't forget to use pheromone traps to monitor adult populations in your orchards. Monitoring traps in insecticide-only treated orchards require the use of a 1X or Standard lure. The traps are very important for setting biofix, determining the seasonality of adult flight, and they can estimate the relative adult population density in the immediate area. We don't yet have any reliable moth capture thresholds for determining whether to spray or not spray in insecticide-only treated orchards. [Note: However, we have recognized the utility in relying on the provisional "ballpark" values of 5 CM/trap and 10 OFM/trap - AMA.]

## **Pollinators and Pesticide Sprays during Bloom in Fruit Plantings**

*A Fruit Times article from Penn State, to help shed some light on the current concerns of pesticide spray impacts on pollinators.*

D. Biddinger (djb134@psu.edu), E. Rajotte, N. Joshi, Dept. of Entomology; K. Demchak (efz@psu.edu), Dept. of Plant Science; and T. Baugher, Penn State Extension

Recently, there has been a lot of press related to pollinator health, and some troubling information indicates that certain fungicides, when used during bloom, can negatively affect the health of honey bees. This is a complicated problem with the solutions relying on understanding the detailed relationships among chemicals, pollinators and pest management needs. It is not prudent to treat this topic with a broad brush with statements such as "All neonicotinoid insecticides are bad for all pollinator species," or "No fungicides should be sprayed during bloom." Research is on-going, and we do not know all of the details yet.

We do know that there are another 4,000 species of bees in the US in addition to the honey bee and they also play an important role in pollinating many crops. In Pennsylvania fruit plantings, many growers large and small, have forgone the use of honey bees

completely and rely solely on about 50 species of solitary bees, bumble bees and feral honey bees. It has been shown that the susceptibility of the honey bee, the most tested type of bee, is not a very accurate predictor of the responses of wild bees like the mason bees (*Osmia*), leafcutter bees or bumble bees to pesticides and that susceptibility varies by bee species and pesticide. For example, one of our recent trials showed that our Japanese orchard bee was 26 times less susceptible to contact by Provado than the honey bee, but 12 times more susceptible to Assail. Both products are neonicotinoid insecticides and in the same pesticide class.

The purpose of fungicide sprays applied during bloom has been to protect plants from diseases that can infect future fruit tissue through the blossom; thus, fungicide sprays during bloom can decrease or negate the need for fungicides closer to or during

harvest. The period from just prior to bloom to just after petal fall are critical times during the disease cycles of pathogens such as apple scab, botrytis, powdery mildew, cherry leafspot, brown rot and cedar apple rust. These are major disease problems, which if left untreated during this time, will devastate the quality of a tree fruit or strawberry (for botrytis and powdery mildew) crop. Some can cause the decline and eventual death of trees. In the case of apple scab, controlling the early season form called primary scab, which attacks foliage mostly until just after bloom, prevents the buildup of secondary scab, which attacks the fruit during the summer. The need to control secondary scab would require 3 to 4 times more fungicide sprays (and cost) than if the disease was stopped as primary scab. Now it turns out that practices long utilized to minimize fungicide residues on the fruit are being questioned. So, what is a grower (or field researcher, for that matter) to do?

It might help to understand why this shift in thinking came about, especially since fungicides had previously been thought to be quite safe for bees. For decades, we've known not to apply most insecticides during bloom – except for a very few with unique modes of action – and fungicides alone still appear to be safe, but now it's feared that the combination of some fungicides in special cases with other materials may synergize their toxicity. The first of the situations are with the neonicotinoid insecticides such as Assail, Calypso, Actara and Belay [Ed. note: Belay is not labeled in NYS] that can be used pre-bloom in some crops. Because they are to varying degrees systemic and move through the plant tissues, we have found them in apple pollen and nectar at low levels where they can be ingested along with fungicides, even though these insecticides were not sprayed during bloom. This systemic movement can also be found in some fungicides to varying degrees, which helps their efficacy against pathogens. We have had many other systemic insecticides in the past (e.g., Orthene, Mitac, Swat, Lannate, Vydate, etc.) that were not neonics, but they were usually used much later in the season and not a problem to pollinators. Spraying at night may help with many pesticides as they are less toxic when dried, but not with systemic pesticides that are ingested in the nectar and pollen. So much for the "do not spray when bees are actively foraging" clause of many pesticide labels.

Our work at the Penn State Fruit Research and Extension Center has measured the movement of most registered neonicotinoid insecticides into the pollen and nectar of apple from pink sprays (i.e., closed blossom) and has shown that Assail and Calypso, which are also much less toxic to bees than the other compounds of the same class, are also much less systemic with little movement into the nectar and pollen. We did find, however, higher levels of the fungicide Nova/Rally in the nectar and pollen from the same pink application. When we say "higher," it is relative. A typical application of a neonicotinoid insecticide would be applied at 100–150 parts per million in the spray tank. Pollen and nectar samples taken 5 days later at about 25% bloom, however, were at the 1–5 parts per billion level. This is up to 100,000 times less than what was in the spray tank. While in most cases, we know that these levels are below what is toxic to the honey bee when exposed to this pesticide alone, it is not well understood how combinations of pesticides affect the long term health of bees, especially the 4,000 other species of bees in the US besides the honey bee. So why use neonicotinoids pre-bloom? With apples, the intent is to control the Rosy Apple Aphid, which has resistance to organophosphate and pyrethroid sprays and can only be controlled by these pesticides at this critical time. Sprays after bloom are "revenge" sprays that may kill the aphids, but don't prevent the stunting of the fruit that happens from feeding during bloom.

The second special situation where spraying fungicides during bloom can cause problems is where the honey bee keepers are using the insecticide/miticide amitraz for control of varroa mites in the hive. Most tree fruit growers will remember amitraz as Mitac, which was used heavily for pear psylla control in the past. This product was routinely used for synergizing organophosphate and pyrethroid insecticides in crops like cotton, where key pests had developed resistance, because it shut down the enzymes insects used to detoxify pesticides. This raises concerns about amitraz being used to treat mites in honey bee hives. While it may be effective in controlling varroa mites now that they have quickly developed resistance to the organophosphate coumaphos and the pyrethroid fluvalinate, adding this synergist to a hive basically shuts off a bee's immune system to pretty much any pesticide with which it later comes into contact. In

addition, work presented by Dr. Jeff Pettis, from USDA-ARS in Beltsville, MD indicates that amitraz interferes with mating in honey bees. Finding a replacement for amitraz in controlling varroa mites should be another research priority.

A key point is that most fungicides are still considered pretty safe to bees, even in combination with other pesticides. We refuted a previous lab study with technical product dissolved in acetone that implied synergism of over 1,000-fold when a sterol inhibitor fungicide such as Rally or Indar was mixed with a neonicotinoid insecticide. When we tested formulated product of Assail and Provado with field rates of the sterol inhibitor fungicide Indar in water, we found synergism to be barely significant at a 5-fold level with Assail and non-significant for Provado. We now consider almost all fungicides with the exceptions of captan (Captan, Captec, Captevate), chlorothalonil (Bravo) and mancozeb (Penncozeb, Dithane, etc.) to be safe, even in combinations, until we see further data showing otherwise.

What about Captan, Bravo and Penncozeb? All are old products that are still the mainstays of disease control and resistance management in many crops because they have multiple modes of action. They are also not systemic, so the chances of the bees coming in contact with them from pre-bloom sprays are nil and spraying at night to give the residues time to dry also helps reduce short-term toxic effects. All of these products are suspected to be synergists for other pesticides, and both captan and mancozeb are somewhat insecticidal by themselves at the highest rates (this is typically 6 lb/acre, depending on the formulation). This toxicity is thought to be from chronic long term ingestion exposure of bees of all types feeding on contaminated pollen during their

development. The best solution until we know more about the effects of these compounds on bees is to restrict their use to the half rate that is used in combination with other fungicides, rather than the full rates or the extensive use of the combination of both Captan and Penncozeb, commonly referred to by growers as "Captozeb."

Also, since captan, chlorothalonil and mancozeb seem to be the fungicides most implicated, at least for the time being, their use should be avoided when bees are actively flying. Instead, they should only be used when contact with pollinators is avoidable. Other fungicides that might be used during bloom appear to be relatively safe, though any of this information could change as we learn more. Thus, if possible, fungicides other than captan, chlorothalonil, and mancozeb should be utilized in bloom sprays, remembering to alternate among modes of action. One additional restriction relating to fungicides is the use of sulfur and lime sulfur around or during bloom, as the odor is repellent to bees for up to 48 hours, depending on the rate and formulation. Most growers would not use lime sulfur during bloom anyway, as it is caustic to the flowers.

Fortunately, we now have a new table that was put together for tree fruit growers that lists toxicities of primarily insecticides and miticides to bees, and also provides useful guidelines to follow to protect all pollinators in general. All growers should follow these guidelines, and avoid the materials that are toxic to bees during bloom or when blooming weeds that bees visit are present in the field. The table can be found here:

<http://extension.psu.edu/plants/tree-fruit/insects-mites/honeybees>.

## Precision Chemical Thinning in 2014 for Gala and Honeycrisp

Terence Robinson, Steve Hoying, and Mario Miranda Sazo

(Mario's note: Please give me a call or email me (315-719-1318, [mrm67@cornell.edu](mailto:mrm67@cornell.edu)) if you would like to train one or two of your farm employees to conduct fruit measurements this year. Do not forget to send your target fruit number and flower cluster counts to Terence Robinson ([tlr1@cornell.edu](mailto:tlr1@cornell.edu)) by full bloom). Precision chemical thinning is the second leg of managing apple crop loads more precisely (the first is

precision pruning). It utilizes sequential chemical thinning sprays guided by the use of the carbohydrate model and the fruit growth rate model. In the last 4 years we have developed the precision chemical thinning method to **more consistently achieve a target crop load**. It uses the carbon balance model as a predictive tool for predicting thinning response prior to application of thinners and the fruit growth rate

model for early assessment of thinning response, immediately following application in time to re-apply another spray if needed.

The method begins with first calculating the final fruit number (target fruit number) per tree and secondly assessing the number of flower clusters on the trees (after pruning) by counting 5 representative trees. The initial flower number can be estimated by multiplying the number of flower buds by 5 flowers/cluster. Once the initial number of flowers/tree is determined, sequential chemical thinning sprays are applied followed by rapid assessment of the results in time to apply a subsequent thinning spray and then an early re-assessment, followed by another spray if needed until the final target fruit number for each variety is achieved.

In practice precision thinning begins with: (1) One or two bloom thinning sprays at 60 and 80% full bloom, (2) the first spray is followed by a petal fall spray applied 2-4 days after petal fall (about 1 week after the bloom spray) when fruits are 5-6mm in diameter. Before the petal fall spray the results of the carbohydrate model are used to guide the rate of chemical and the exact timing of the petal fall spray, (3) the first two sprays are followed by an assessment of the efficacy of those 2 sprays using the fruit growth rate model which indicates the percentage of thinning achieved with the first 2 sprays, (4) then, if needed, a

third spray is applied at 10-13mm fruit diameter (about 1 week after the petal fall spray). Before the petal fall spray the results of the carbohydrate model are used to guide the rate of chemical and the exact timing of the third spray, (5) the third spray is followed by an assessment of the effectiveness of all previous sprays using the fruit growth rate model, which indicates the percentage of thinning achieved with all 3 previous sprays, and (6) lastly, if still more thinning is needed, a fourth spray is applied at 16-20mm (about 1 week after the third spray) to achieve the target fruit number.

**Protocol for precision thinning group effort of willing participants in 2014:** (1) Select a mature orchard of either Gala or Honeycrisp, (2) Count flowering clusters on 5 representative trees at pink, (3) Calculate target fruit number for a high yield, (4) Tag 15 spurs per tree on each of 5 representative trees (75 total spurs) at pink, (5) Apply one of two spray protocols of thinning sprays as shown below, (6) Use the carbohydrate model to adjust rates up or down based on model recommendations, (7) Measure fruit diameters on 75 spurs 6 times (3 and 8 days after petal fall spray, 3 and 8 days after 12mm spray and 3 and 8 days after 18 mm spray), (8) Send the data within 24 hours after each 8 day measurement to Terence Robinson, (9) Get back an assessment within 24 hours of thinning progress before next spray.

#### Two Options in 2014 for Precision Thinning of Gala:

Option 1	Option 2
<b>Apply a Bloom Spray</b> NAA (8oz/acre)	
<b>Apply a Petal Fall Spray (6mm)</b> NAA (6oz/acre) + Sevin (2pt/acre)	<b>Apply a Petal Fall Spray (6mm)</b> NAA (6oz/acre) + Sevin (2pt/acre)
<b>Apply a 12 mm Spray</b> Maxcel (96oz/acre) + Sevin (2pt/acre)	<b>Apply a 12 mm Spray</b> Maxcel (96oz/acre) + Sevin (2pt/acre)
<b>Apply an 18 mm spray (if needed)</b> Maxcel (96oz/acre) + Sevin (2pt/acre + Oil (1pt/100gal) (directed to the upper part of the tree)	<b>Apply an 18 mm spray (if needed)</b> Maxcel (96oz/acre) + Sevin (2pt/acre + Oil (1pt/100gal) (directed to the upper part of the tree)

#### Two Options in 2014 for Precision Thinning of Honeycrisp:

Option 1	Option 2
<b>Apply a Bloom Spray</b> NAA (8oz/acre)	
<b>Apply a Petal Fall Spray (6mm)</b> NAA (8oz/acre) + Sevin (2pt/acre)	<b>Apply a Petal Fall Spray (6mm)</b> NAA (8oz/acre) + Sevin (2pt/acre)
<b>Apply a 12 mm Spray</b> NAA (6oz/acre) + Sevin (2pt/acre)	<b>Apply a 12 mm Spray</b> NAA (6oz/acre) + Sevin (2pt/acre)
<b>Apply an 18 mm spray (if needed)</b> Sevin (2pt/acre + Oil (1pt/100gal) (directed to the upper part of the tree)	<b>Apply an 18 mm spray (if needed)</b> Sevin (2pt/acre + Oil (1pt/100gal) (directed to the upper part of the tree)

## Improving the Soil Health in Your Future Orchard

Carol MacNeil, CCE, Cornell Vegetable Program

Poor soil health in the orchard can result in slow water percolation and ponding after heavy rain, in spite of the presence of tile. Poor soil health can restrict root growth, limiting the depth and volume of soil that tree roots can “mine” for water and nutrients. Take steps 2 – 3 years in advance to improve the soil health in your future orchard. A Cornell Soil Health Test (CSHT), done in the spring before tillage, will result in a report on the status of your soil’s physical, biological and chemical/ (nutrient) health, and provides recommendations for improving soil health over the next few years. (New! Soil & Water Conservation District (SWCD) offices have info on financial support for the full CSHT.)

Directions on sampling, handling, shipping:

<http://soilhealth.cals.cornell.edu/extension/test.htm#packages>

In the meantime, do your own evaluation of your prospective orchard. Is the field properly tiled for tree fruit, and for your soil type and topography? Is the tile functioning well, or are there wet spots in the field? Are tile drain outlets at least a foot above the bottom of the ditches, and are ditches and outlets well cleared? Spring is a good time to check. (Note: Compaction can cause ponding on the soil surface, even if there’s adequate tile!).

If a prospective field has been tilled for row crops, manure has been spread, or produce has been harvested in wet weather, there likely will be compaction 9-12+ in. deep. Measure the extent and depth of compaction in ten spots in the field with a penetrometer, when tiles have stopped running. Record what you find. Plant roots can’t penetrate compaction of 300 lbs. /sq. in. (psi). Borrow a penetrometer from Cooperative Extension or SWCD. Directions:

[http://soilhealth.cals.cornell.edu/extension/test/penetrometer\\_instructions.pdf](http://soilhealth.cals.cornell.edu/extension/test/penetrometer_instructions.pdf)

Also dig a few 18+ in. holes. Is there grayish sub-soil, an indicator of poor drainage? How deep are most plant roots? Are there earthworms or channels? Is the soil loose and crumbly, or dense and blocky?

Ripping 2 in. deeper than the compacted layer is an important, though temporary, step in eliminating compaction. Straight, narrow shanks with small points at the bottom, ~30 in. apart, are

recommended. Be sure soil is dry enough as deep as you plan to rip. Tilling the soil when it’s wet causes compaction at the plow/implement bottom and on the sidewalls of the plow cut or chisel/ripper shank. Soil smearing occurs, which dries to a hard layer, impenetrable by roots, air or water. The soil ball test is a method for determining if the soil is dry enough to work. Take a handful of soil from as deep as you intend to till. Roll it between your hands into a ball. (If it’s too sticky to make a ball it’s too wet to till.) Press your thumb into the soil ball. If an imprint of your thumb remains in the intact ball it’s too wet. If the ball breaks and crumbles then it’s dry enough to till. 80-90% of the field should pass the test.

Deep rips will only remain open until the first hard rain; unless you have plant roots and a high percentage of water-stable soil aggregates to stabilize them. Soil aggregates provide the pore space for root growth, water storage, and air and water movement in the soil. Excess tillage and compaction destroy soil aggregates. Regular additions of fresh organic matter (OM) are necessary for their maintenance. The decomposition of fresh OM by soil microbes produces sticky polysaccharides, waxy glomulins, and stringy fungal hyphae, essential for holding soil aggregates together. In contrast, very well decomposed OM, which is measured in common soil nutrient analyses, provides much of the soil’s cation exchange capacity and water-holding capacity. It changes very slowly even with high additions of fresh OM.

For 2 – 3 years before planting the new orchard keep the soil covered as much as possible with **soil-building crops** like small grains, sudangrass (for summer; produces lots of OM but needs management), buckwheat (short-season summer crop; improves aggregation), and late season/winter cover crops.

The grasses scavenge leftover nitrogen (N) and produce OM. Ryegrass is especially good for soil aggregation since it produces a thick sod. Oats generally winter kill. Oats and ryegrass need to be planted by late-Sept. Cereal rye can be seeded through Oct. **(continued on back cover)**

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## **Improving the Soil Health in Your Future Orchard (continued)**

Carol MacNeil, CCE, Cornell Vegetable Program

The clovers (medium red clover is most common in crop production) and hairy vetch can produce 100+ lbs N/acre if they're allowed to grow through May. Seed by mid-Sept. Forage radish is a newer cover crop which can break through moderate to deep soil compaction with its fleshy root and very deep taproot, producing channels for tree roots and drainage. Good varieties are Groundhog, Cedar Meadow Forage Radish, and Tillage Radish. It needs to be seeded by mid-Aug. Most forage radishes winter kill. Seeding grasses at reduced rates with legumes results in higher OM and higher N production than from either alone. Adding a lower rate of forage radishes to the mix provides the radishes with extra N, resulting in larger, deeper radishes to break through compaction.

Regarding tillage, rototillers are among the worst offenders for destroying soil aggregates and burning up organic matter. Heavy discs and rollers are excellent compaction tools, used by road crews! Excess tillage of any kind reduces soil health, especially if the soil is wet. Limit tillage to what's absolutely necessary. You do not need a fine seedbed for planting trees. If you have a good drill for seeding cover crops or permanent grasses, especially one with double disc openers, you also don't need a fine seed bed.

For more information contact the Lake Ontario Fruit Team or Carol MacNeil at [crm6@cornell.edu](mailto:crm6@cornell.edu) or 585-394-3977 x406. Cornell Soil Health Assessment Manual: <http://soilhealth.cals.cornell.edu/extension/manual.htm>.

Building Soils for Better Crops, 3<sup>rd</sup> edition, F. Magdoff, U VT, and Harold van Es, Cornell:  
<http://www.sare.org/Learning-Center/Books/Building-Soils-for-Better-Crops-3rd-Edition>.