THE TENDER FRUIT GRAPE VINE

A Newsletter for Commercial Fruit Growers

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Effects of SmartFresh (1-MCP) on tender fruit quality in Ontario

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The use of SmartFresh™ (1-MCP) technology to improve the quality of 'Shiro' yellow plums, 'Fantasia' nectarines, and 'Redhaven' peaches during storage was investigated. All fruit were harvested from commercial orchards in 2005. Plums, nectarines and peaches were treated with or without 1-MCP (1000 ppb) for 24 hours at 0°C on the day of harvest and stored for 2 or 4 weeks at 0°C.

'Shiro' Plums

- 1-MCP treated plums from the first harvest and held in storage at 0°C had less CO_2 production, ethylene, and hydrophobic volatiles (aroma, flavor) than those not treated with 1-MCP. These effects were not observed in plums from the second harvest.
- Plums treated with 1-MCP were firmer than non-treated plums, and this effect was more pronounced in plums from the second harvest and held for 2 weeks at 0°C.
- 1-MCP-treated plums retained green color longer and turned yellow-gold more slowly than control fruit.

'Redhaven' Peaches

- 1-MCP had no significant effect on CO_2 (respiration), ethylene, and volatile production, fruit firmness, soluble solids (% Brix), or color of peaches. This needs to be confirmed in 2006.

'Fantasia' Nectarines

- 1-MCP-treated nectarines were firmer than those not treated and this effect was more pronounced in nectarines from the second harvest and held for 2 weeks at 0°C.
- No effect of 1-MCP on CO_2 production, ethylene, and hydrophobic volatiles, soluble solids concentration and color was observed. This is in contrast to the previous season (2004).

For more details or a copy of the project report, please contact Jennifer DeEll.

Interaction of SmartFresh (1-MCP) and ReTain (AVG) on pears

Dr. Jennifer DeEll, Fresh Market Quality Program Lead, OMAFRA, Simcoe;
and Dr. Dennis Murr, University of Guelph

The use of SmartFresh™ (1-MCP) technology to improve the quality of 'Bartlett' and 'Bosc' pears during storage was investigated. As well, the interaction of ReTain with SmartFresh on storage quality of 'Bartlett' pears was evaluated. Fruit were harvested from a commercial grower in 2005. After harvest, pears were held at 0°C for 3 days and then treated with or without 1-MCP (300 ppb) for 24 hours at 0°C. Following 1-MCP treatment, fruit were held at 0°C for 0, 2.5, or 4.5 months. After each cold storage period, 25 pears from each treatment combination were "preconditioned" at 10°C for 0, 5, or 10 days. Firmness, color, rots,

disorders, and ethylene, respiration and volatiles were then followed at 22°C.

'Bartlett' Pears

- 1-MCP significantly delayed or prevented CO_2, ethylene, and hydrophobic volatile production in 'Bartlett' pears.
- ReTain had no significant effect on CO_2 or ethylene production in 'Bartlett' pears, but those treated with ReTain had less hydrophobic volatile production than pears without ReTain.
- 'Bartlett' pears treated with 1-MCP and/or ReTain and held in storage at 0°C were firmer and changed color (green to yellow) more slowly than control fruit. In some cases, the effects of 1-MCP and ReTain appeared additive.
- 1-MCP had little effect on soluble solids, whereas ReTain-treated pears tended to have higher soluble solids content.
- "Preconditioning" at 10°C had no significant main effects on quality of 'Bartlett' pears.
- After 4.5 months of storage at 0°C, most pears not treated with 1-MCP had deteriorated with severe senescent scald and/or storage rot, whereas pears treated with 1-MCP were still of acceptable quality.
- After 4.5 months at 0°C, 'Bartlett' pears treated with 1-MCP and ReTain, and no preconditioning at 10°C were the firmest after 5 and 10 days at 22°C. Pears with no ReTain that were preconditioned for 5 days at 10°C had the highest incidence of senescent scald and internal breakdown.

'Bosc' Pears

- 1-MCP significantly delayed CO_2, ethylene, and hydrophobic volatile production in 'Bosc' pears, but after 4.5 months of cold storage at 0°C the effect of 1-MCP on ethylene and hydrophobic volatiles was reduced.
- 'Bosc' pears treated with 1-MCP were firmer than non-treated fruit, but this effect was reduced with increased storage time.
- Pears treated with 1-MCP also changed color (green to yellow) more slowly than non-treated fruit.
- There was no significant effect of 1-MCP on soluble solids content.
- "Preconditioning" at 10°C had no significant effect on quality of 'Bosc' pears.

For more details or a copy of the project report, please contact Jennifer DeEll.

Composting Grape Pomace in the Finger Lakes

Jamie Hawk, Community Educator - Sustainable Viticulture, Finger Lakes Grape Program

The Finger Lakes Grape Program, in cooperation with Matt Doyle (Vineyard Manager for Centerra Wine), hosted a Coffee Pot Meeting on 20 July 2006 detailing the practice of composting, specifically as it relates to viticulture. Participants met at Centerra's pomace compost piles on Middle Road between the towns of Hammondsport and Pulteney. Jean Bonhotal, Cornell Waste Management Institute, presented an overview of the composting process with insights for the grape growing community. Highlights of the presentation included:

- Start small and experiment with the process before trying it out on a large scale.
- Higher quality compost is produced when there are a variety of feedstocks in your compost pile (i.e. instead of composting only pomace, mix in animal manures or other feedstocks to diversify the piles).
- It is much easier to mix in other feedstocks when piles are first laid down rather than trying to mix them in at a later date.
- Applying a layer of bulking material (e.g. wood chips) under the piles promotes aeration and a more rapid and complete composting process.
- With proper management, pomace-based compost can be finished in 4-6 months.
- Compost should be thought of as a soil health enhancer, not necessarily as a direct fertilizer. Its effect is seen most in improved water retention, cation exchange capacity (CEC = the

soil's ability to supply nutrients), soil structure and organic matter content.

- A potential problem with pomace-only compost is its high K+ content which interferes with Mg2+ availability. Vines have not been symptomatic of Mg2+ deficiency, but petiole tests have shown low levels where pomace-only compost has been applied.
- The Cornell Waste Management Institute has published a series of fact sheets on composting. For these and other compostrelated materials, visit their web site at: http://cwmi.css.cornell.edu/Composting.html
- Specific questions can be directed to Jean at jb29@cornell.edu

In addition to Jean Bonhotal's discussion, Matt Doyle and Jamie Hawk (Sustainable Viticulture Community Educator) described their respective fertilization/compost field experiments. Centerra Wine is experimenting with nitrogen fertilization in their Elvira vineyards just north of Heron Hill Winery. They have created the following treatments in separate blocks with clay and gravel soils: no additions; compost at 10 tons/acre; inorganic N (ammonium nitrate) at 50 lbs actual/acre; and a combined 6 tons compost and 25 lbs actual N/acre. Matt noted that they are in the early stages of a planned three year trial, so no conclusions can yet be drawn.

Within the Centerra blocks, Jamie Hawk has setup 4 rows of replicates of 6 treatments in both the clay soil and gravel soil sites. The 6 treatments are: no additions; compost at 6 tons/acre; compost at 12 tons/acre; inorganic N (ammonium nitrate) at 25 lbs actual/acre; inorganic N at 50 lbs actual/ acre; and a combined 6 tons compost and 25 lbs actual N/acre. All applications were banded under the rows, and sampling began in mid-May and has been done every 1-2 weeks since. The dual purpose of the work is to 1) describe the soil nitrogen dynamics in the various treatments and sites, and 2) evaluate the Cardy Nitrate Meter for use by growers to obtain a rapid and accurate estimate of available nitrate in vineyard soils. Preliminary results have shown no surprises. Spikes in available nitrate coincided with inorganic additions, soil nitrate levels fell faster in the high leaching potential gravel soils, nitrate levels began to rise prior to N additions as soils warmed and microbial activity increased accordingly, and though the compost additions showed no immediate effect on nitrate levels, anecdotal evidence saw better water retention and soil structure beneath the compost additions.

Notes on Composting Grape Pomace In Virginia

Fritz Westover, Viticulture Research-Extension Associate westover@vt.edu

Wine producers in the state of Virginia have shown increasing interest in producing compost from wine grape pomace, which can then be applied to vineyard soils as a nutrient rich soil conditioner. The notes below have been compiled to provide a quick reference guide for farm wineries initiating small or large scale composting operations.

- pomace is high in N>K>Ca [N-P-K-Ca = 2.0-0.5-2.0-2.0]
- pomace is about 8% seeds, 10% stems, 25% skins, 57% pulp
- in general 1 ton of harvested grapes produces 100lbs of stems and 160 to 240 lbs of pomace (more simply, 3 tons grapes is about equal to 1 ton of total pomace) returns ½ to 1/3 of nutrients and OM removed from crop
- 1:1 ratio, pomace:manure bedding (straw + manure) provides 2/3 to 100% annual nutrient needs of vineyard
- pomace alone composts' slowly – low pH (3.5 to 3.8)
- compost microbes prefer a pH of 6.2 to become active (pH >6 desired)
- lime or other feedstocks must be added to the pomace in order to increase pH
- pomace has C:N ratio appropriate for composting (1:17 to 1:30)
- feedstock added to pomace should also have C:N ratio appropriate for composting (1:20 to 1:30)
- high lignin in seeds (17to 35%) limits decomposition in unturned piles
- wet piles (>60% moisture) may continue to ferment, produce acetic acid = poor quality (check for off odors in pile or other clues of anaerobic activity)
- 1-5 tons per acre annually is considered maintenance application

- frequent turning of pile (2x's or more/week) reduces N & OM
- turning pile only once every 2 weeks retains more N & OM
- pile temperature of 130-140oF for 1 to 2 weeks is necessary to kill weed seeds and pathogens
- pile temperature of 110-140oF is typical after the initial 1 to 2 weeks
- minimum of 3 turns of a pile is also required to kill seeds and pathogens
- keep pile temperature under 160 oF to reduce risk of combustion and loss of beneficial organisms
- composting is a 6 to 10 month process, dependent upon turning frequency, moisture, and temperature of piles or windrows

Brown Rot Resistance to Indar

Neil Carter, Tender Fruit and Grape IPM Specialist, OMAFRA, Vineland

Earlier this year, researchers in New York State reported their first cases of brown rot resistance to Indar (fenbuconazole). There have not been any reports of Indar failures in Ontario yet, but the New York experience is important – we could end up having the same problems if proper resistance management is not followed.

Indar is registered in Ontario for brown rot on stone fruit as well as black knot on sour cherries and plums. Indar is one of several fungicides in the same chemical group (triazoles) registered for brown rot. The members of this fungicide group are often referred to by their mode of action – usually as "SI" (sterol inhibitor) or alternatively as "DMI" (demethylation inhibitor). Other members of this group used against brown rot include Nova (myclobutanil) and Topas or Mission (both are propiconazole). Resistance to one member of a group usually means resistance to all members of the group and this was indeed the case in the Indar resistant strains of brown rot in New York.

In one New York case of resistance to Indar, it is theorized that repeated use of Indar exclusively for years against blossom blight and brown rot in one nectarine orchard led to the selection of a resistant strain of brown rot. Of course, not everyone sprays in that fashion and other cases may have arisen from many uses of Indar over the last decade or so, even if Indar was not used exclusively.

Repetitive use of one product should be an easy mistake to avoid. It is repeated *ad naseum* in articles, talks, and on some product labels to not use the same product repeatedly. For stone fruit, there is a fairly wide range of materials registered for brown rot in Ontario (including a new one this year – Pristine), so using one product continuously is definitely not necessary. Everyone has heard the refrain of rotating product chemistries to avoid resistance, as well as using adequate water volumes to obtain good coverage, and all the other means to get the most out of your pesticide use. So why would there be any confusion about repeated use of a single product?

One possible reason is that we always mention rotating between chemical *families* or *groups*, not just between products. In the past, it might have been difficult to keep track of which family a particular product belonged to as well as the families of previously used products. There are now charts at the end of each commodity calendar clearly showing the family for all products listed in *OMAFRA Publication 360 –Fruit Production Recommendations 2006-2007*. Referring to those charts when planning your fungicide strategy will help avoid overuse of any particular chemical group.

A second reason that confusion may arise about the reasonable number of times a product can be used in a row or in a season comes from product labels themselves. Many product labels carry conflicting statements about the acceptable number of uses. For instance, some labels suggest weekly applications are necessary for most of the season at one point on the label while stating that no more than two (or even one) applications should be applied in a row! This confusing information persists even though most new labels carry valuable advice in a resistance management section.

To lessen the chance of developing resistance to any pesticides, use the information on chemical families in *Publication 360* when choosing

appropriate products and critically evaluate any information that appears to imply that repeated use of one product or products with the same mode of action is acceptable. All products have a "group" number on the front of the label; always rotate products with different group numbers. There are very few insects or diseases that are unlikely to develop resistance if exposed exclusively and repeatedly to one control product. There are a few exceptions to this rule, but assuming resistance is a potential problem is the best way to be aware of it and avoid strategies that may promote it. For the most part, the best strategy is to follow known resistance management strategies to keep as many products and families of chemicals efficacious and in our marketplace for as long as possible.

Fighting Fire with a Twist

A.M. Svircev, P.L. Sholberg and A.J. Castle, Agriculture & Agri-Food Canada, Vineland

Researchers at Agriculture and Agri-Food Canada (AAFC, A.M. Svircev and P.L. Sholberg) and Brock University (A.J. Castle) have taken a novel approach towards the control of fire blight in the orchard. The biological control project is funded by AAFC under the Improving Farming Systems and Practices Initiative, funded by AAFC's Pest Management Centre. The novel system relies on the 'double punch' approach of controlling *Erwinia amylovora*, the fire blight pathogen with *Pantoea agglomerans* and bacteriophages.

Biological control strategies have attracted more and more interest as regulatory bodies question the agricultural use of antibiotics. Two commercially available biocontrol products, the bacterial antagonists BlightBan® C9-1 and A506 provide control of the fire blight pathogen, *Erwinia amylovora*, through competition for nutrients and/or the production of microbial antibiotics.(see article in Biocontrol Files Issue #6 for details). During the blossom time under ideal weather conditions, the pathogen can destroy (Fig. 1) an entire orchard within one growing season.

Fig. 1 Severe shoot blight in apples due to blossom infections in the spring. *Photo by Ed Barszcz*.

Our research has focused on developing a biological control strategy for fire blight that improves upon the efficacy and reliability of bacterial antagonists alone. We use *P. agglomerans* together with bacteriophages of *E. amylovora* to prevent growth of the pathogen in the pear and apple floral cup. Bacteriophages (or simply "phages") are bacterial viruses that infect specific host bacteria, replicate inside it, and then kill the host cell to release the new phages. *P. agglomerans* has a dual role in this system, acting as a biological control agent and as a carrier for the phages. The carrier permits the continuous production of fresh, infective phages on the flower surface, while competing with the pathogen for the ecological niche provided by the blossom.

Phages in our project were collected from the orchard ecosystem in which disease symptoms were visible in the form of cankers, blossoms and/or shoot blight. Phages belong to the order *Caudovirales*, specifically the tailed families *Myoviridae* (Fig. 2) *and Podoviridae* (Fig. 3). They form 6 distinct molecular groups based on the RFLP patterns and vary from 40-250 nm in size. Phage host ranges have been established on13 *E. amylovora* isolates. Some phage isolates may have very promiscuous host range while others are much more restricted, particularly when considering their relative behaviour on pathogen isolates from

Ontario vs. British Columbia (Applied and Environmental Microbiology, Vol. 69: 2133-2138).

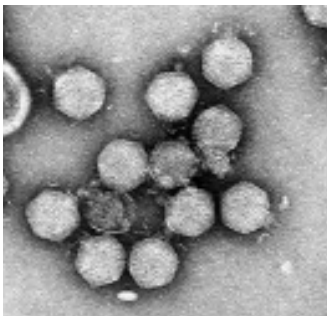

Fig. 2 Short tailed *Erwinia* sp. phages.
Photo by Ron Smith

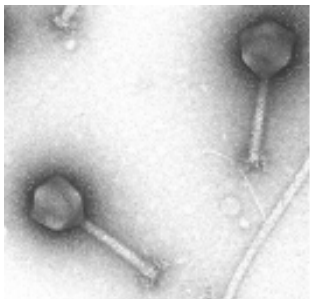

Fig. 3 Long tailed *Erwinia* sp. phages.
Photo by Ron Smith

Quantitative PCR technology was applied by Dr. Won-Sik Kim (NSERC Visiting Fellow) to investigate the microbial populations present in the blossom. This technology, which we refer to as direct real-time PCR (DRT-PCR), allows rapid and sensitive quantification of organisms directly from plant tissue. Using blossoms from field based experiments, we can simultaneously detect and quantify populations of *P. agglomerans, E. amylovora*, and some phages. Field trials carried out by the group and Brock University graduate student Susan Lehman, indicates that a correlation exists between populations of the biocontrol agents and the pathogen and the ability of each treatment to control disease. In treatments in which disease control was successful, phages multiplied on the *P. agglomerans* carrier and once the pathogen was applied the phages grew preferentially on the pathogen in the floral cup. Early field trials in pear and apple orchards have demonstrated that the phage-carrier system can reduce the incidence of diseased blossom clusters by 50%. Research conducted with a laboratory-based pear blossom assay in Ontario and British Columbia continues to screen new isolates and to assess potential modes of application for incorporation into future field trials. Phage mixtures will be eventually used to prevent the pathogen from sequentially accumulating resistance to individual phages. How easily does the host develop resistance to the phages? Brock University, graduate student Dwayne Roach is studying this problem. He will determine the incidence and nature of phage-resistance among pathogen populations.

The major goals of this project are to establish an extensive collection of phages from Ontario and British Columbia that individually have a wide host range, handle well during scale up production, show potential for fire blight control under field conditions and develop formulations and application procedures that result in high levels of control in the field. Research is continuing to identify isolates with high field efficacy, determine the mechanisms of development of phage resistance in host bacterium, develop large scale processing of phage/carrier and to follow the environmental fate of the phages in the orchard ecosystem. The ultimate goal is to develop a biocontrol system that will have efficacy for disease control in the orchard comparable to streptomycin, the industry standard.

Get the Most From Your Fumigant!

Anne Verhallen, Soil Management Specialist (Hort.), OMAFRA, Ridgetown

As a Soil Management Specialist, fumigation is not my first choice as a soil management tool. However it is often necessary for the successful establishment of crops, particularly perennial crops. Fumigation is expensive and disrupts the soil ecology of a field so it is important to get the most out of the process when it is used.

Moist but not wet soil is critical for optimum fumigation activity. Dry soils have little water surrounding soil particles, really just thin films of tightly held water. More of the fumigant material will be adsorbed to the soil particles while in moist soils this adsorption is reduced. Wet soils have more pores filled with water which will block and slow the movement of the fumigant through the soil pore matrix. This can particularly interfere with fumigant penetration to depth as soils usually get wetter with depth. Check the soil moisture at the depth of application before applying. Optimum soil moisture for fumigant movement is usually described as -0.6 to -15 bars of water potential or half of field capacity. Another way to describe it would be the moisture level at which the soil would be fit to plant.

Soil structure plays a critical part in determining how well the fumigant moves and disperses in the soil and stays in the soil. Fumigants are applied to the soil and the materials generally vaporize and move through a process called diffusion from an area of greater concentration – the application zone, outward through soil pores. The general movement of the fumigant is up. Gravity does not play a significant role in pulling the material down into the soil profile. So the process relies upon connected pores that are not filled with water. Recently tilled soil is usually recommended for fumigant application to ensure consistency and to create a larger number of large pores. Compaction and other types of structural degradation have a direct effect on fumigation because of the impact on the number and size of soil pores. As soils compact or a compacted layer forms, pores are squished or reduced in size. Smaller pores are more likely to hold water. The squished pores may lose the connectedness; basically the route through the soil pores becomes more difficult, even for a vapour like fumigant. This has a direct impact on consistent pest control through soil profile.

Each fumigant material has a slightly different response to the soil conditions. It is important to read fully the product label before application to ensure that rates, timing, application and post application field management is correct.

Whether you use in-row or broadcast fumigation, after all the work and expense of fumigation, take steps to slow the re-infestation of the field. Wash tillage and planting equipment before field entry to remove any soil or crop residues that could be carrying soil pests.

Looking for more information on soil preparation for fumigation? Check out the OMAFRA Factsheet Land Preparation: a Key to Successful Soil Fumigation on the OMAFRA website at http://www.omafra.gov.on.ca/english/crops/facts/89-177.htm.

Some Tips for Cover Crop Planting, Establishment and Management

Anne Verhallen, Soil Management Specialist (Hort.), Leslie Huffman, Weed Management – Horticulture Crops program Lead, Michael Celetti, Plant Pathologist – Horticulture Crops Program Lead, and Pam Fisher, Berry Crop Specialist.

Interest continues in new cover crops for nematode suppression, improving organic matter, and reducing replant problems in horticultural crops. Did you try growing some different cover crops this season? We did. Here are some tips and tricks we have learned from growers and from test plots.

The goal with all the cover crops is to establish actively growing, pure stands of these cover crops. Planting and establishment must be focused on getting a dense stand and achieving the most top growth possible. Nematode suppression from cover

crops is dependent upon a consistent, dense, weed free, actively growing cover crop.

- Mustard cover crops provide nematode suppression when the fresh green crop residues are incorporated and break down in the soil. The more plant tissue, the greater the nematicidal action.
- Pearl millet and marigolds, as well as some hybrids of sorghum-sudangrass provide control mostly because they are non-hosts for nematodes. With these crops, it is very important to control weeds, because many weeds are good hosts for nematodes.

Establishing cover crops*:* Pearl millet, sorghum-sudan, mustard and marigold are all small seed and careful planting is important. Soil should be worked to give a fine, level seedbed in good condition. All of these seeds will have problems getting through a crust.

Seeding rates are :

- Pearl millet - 12 kg/ha (10 lbs/A)
- Sorghum-sudan – 12-40 kg/ha (10-36 lbs/A)
- Mustard – 6-7kg/ha (5-6 lbs/A)
- Marigold – 1.3 kg/ha (1.1 lbs/A

Drilling is the best option for seeding, both depth and distribution are more controlled with a drill, and this is critical under dry soil conditions.

If a drill is not available, broadcast the seed either with a spinner spreader (cyclone) or a seed fiddle – the key is an even distribution of the seed. Use a slightly higher seeding rate when broadcasting. To improve distribution you may want to halve the rate but spread twice. If the seeding rate adjustment is coarse, add some inert material like rice will help the flow and distribution of seed.

Consider seeding mustard twice. Plant mustard as soon as possible in the spring and then work it into the soil as soon as it starts to bolt. Re-seed a few weeks later. The second seeding could be tricky because soils are usually dry in July or early August. For the second seeding ensure that the site and all equipment is ready and be prepared to seed when rain is imminent or soil moisture conditions allow.

Marigold is particularly difficult to seed – the feathery tails get a static charge and stick together and to everything. In previous projects with marigolds, rice helped the seed flow considerably.

Incorporate and firm the seedbed – The key to good establishment is to have good seed to soil contact without burying the seed too deeply. Millet and sorghum-sudan can take being ½ inch deep or a bit more as long as the soil does not crust. Mustard should be in the top ½ inch. In test plots we have run over the area with an ATV. Another alternative is to lightly harrow (we usually flip the drag harrows we have upside down) and follow with a light packer.

Fertility –For nematode suppressing cover crops, nitrogen is needed to ensure optimum growth. Apply at least 50 kg/ha of actual nitrogen. If manure or some other organic source of nitrogen has been applied to the site this year, adjust the nitrogen rate accordingly.

Mowing –Both pearl millet and sorghum-sudan grow very tall, and mature crop residues become difficult to incorporate and breakdown. Pearl millet and sorghum-sudan should be mowed periodically as they reach 3 ft (1 m). Do not mow closer than 6 inches (15cm) or they will not consistently re-grow. Mustard generally does not take traffic or mowing well – work it into the soil when it starts to bolt and flower.

Weed management – Controlling weeds is very important to achieve maximum nematode suppression. If weeds like ragweed, pigweed and lambs-quarters are allowed to grow, they will support and possibly increase nematode populations. Using the stale seedbed technique will greatly reduce weed pressure. This means that the sites should be worked several weeks before seeding, and weeds allowed to germinate over several weeks. Just before planting, weeds can be killed down by Roundup, Ignite or Gramoxone. Seed can be direct drilled or spread on top. Harrowing may be necessary to get seed-soil contact, but this tillage will bring new weeds to the surface. Where drilling is used, and if weeds emerge before the crop, Gramoxone or Ignite could

be used to kill off existing weeds (Note: using a plate of glass on the soil surface will give you a couple of days notice on when the cover crop will emerge.)

Herbicides – For sorghum-sudangrass and pearl millet, postemergent herbicides could be used. See Publication 75, Guide to Weed Control under Forage crops. Pardner @ 1 L/ha or 2,4-D @ 0.5 to 1 L/ha can be applied after the crop reached 4 leaves. Pardner is stronger on lady's-thumb and ragweed. Basagran or Peakplus can be used at an earlier stage of growth. There may be some recropping issues with Peakplus – it has a 22 month interval for alfalfa. There is nothing registered for mustard or marigold cover crops, however, research is in progress.

For more information on cover crops, establishment and nematode control see:

- OMAFRA website for cover crop information at: http://www.omafra.gov.on.ca/english/crops/facts/cover_crops01/covercrops.htm
- OMAFRA publication 811, Agonomy Guide : http://www.omafra.gov.on.ca/english/crops/pub811/5ann.htm#warm
- OMAFRA publication #360: Fruit Production Recommendations, Chapter 4