With time comes change. If you have leftover pesticides from previous years, the labelled requirements may be different now since the time that label was put on the product container.

Health Canada’s Pest Management Regulatory Agency reviews older pesticides that have been on the market for years to ensure the labelled uses still meet today’s health and environmental protection standards. Through this review process, certain uses or formulations may be eliminated or phased out; the product may no longer be acceptable for registration; there may be no change; or, there may be changes to the label, such as longer re-entry intervals (REI) and preharvest intervals (PHI). So, the take-home message is “pesticide labels can change”.

For example, the following label changes were made to the REIs and PHIs for the pesticide Imidan® 50-WP Instapak:

<table>
<thead>
<tr>
<th>Crop</th>
<th>REI for “Pick Your Own” operations</th>
<th>REI</th>
<th>PHI</th>
<th>REI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alfalfa</td>
<td></td>
<td>5</td>
<td>7</td>
<td>-</td>
</tr>
<tr>
<td>Apple</td>
<td></td>
<td>7</td>
<td>14</td>
<td>14</td>
</tr>
<tr>
<td>Blueberry (highbush &amp; lowbush)</td>
<td></td>
<td>3</td>
<td>15</td>
<td>15</td>
</tr>
<tr>
<td>Carrot</td>
<td></td>
<td>5</td>
<td>40</td>
<td>-</td>
</tr>
<tr>
<td>Celery</td>
<td></td>
<td>5</td>
<td>40</td>
<td>-</td>
</tr>
<tr>
<td>Cherry (sour)</td>
<td></td>
<td>3</td>
<td>7</td>
<td>-</td>
</tr>
<tr>
<td>Cranberry</td>
<td></td>
<td>3</td>
<td>30</td>
<td>-</td>
</tr>
<tr>
<td>Grape</td>
<td></td>
<td>14</td>
<td>14</td>
<td>-</td>
</tr>
<tr>
<td>Peach</td>
<td></td>
<td>7</td>
<td>14</td>
<td>14</td>
</tr>
<tr>
<td>Pear</td>
<td></td>
<td>7</td>
<td>14</td>
<td>14</td>
</tr>
<tr>
<td>Plum</td>
<td></td>
<td>7</td>
<td>14</td>
<td>14</td>
</tr>
<tr>
<td>Potato</td>
<td></td>
<td>5</td>
<td>7</td>
<td>-</td>
</tr>
<tr>
<td>Floriculture crops</td>
<td></td>
<td>3</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

There are some helpful Internet resources available to obtain current pesticide label information. The latest-approved labels for all registered pesticides are under Label Search on the PMRA website at [www.pmra-arla.gc.ca](http://www.pmra-arla.gc.ca). Also, agriculture chemical companies update their on-line labels accordingly.

You can learn more about the PMRA’s re-evaluation decisions at the web site: [www.hc-sc.gc.ca/cps-spc/pubs/pest/_decisions/index-eng.php](http://www.hc-sc.gc.ca/cps-spc/pubs/pest/_decisions/index-eng.php).
Minor use label expansion granted for Tattoo C Fungicide for control of downy mildew on field cucurbits

The Pest Management Regulatory Agency (PMRA) recently announced the approval of a minor use label expansion for TATTOO C FUNGICIDE for control of downy mildew (*Pseudoperonospora cubensis*) on field cucurbits, crop group 9 (which includes cucumbers, melons, squash, pumpkins and all other field cucurbits) in Canada. TATTOO C FUNGICIDE (propamocarb HCl + chlorothalonil) was already labeled for management of late blight on potatoes in Canada. This is the 1st minor use registration of TATTOO C on a crop grown in Canada.

This will provide field cucurbit growers with a much needed disease management tool to manage one of their most challenging disease problems. Downy mildew on field cucurbits has been the subject of several emergency uses in eastern Canada and has highlighted a significant example of the technology gap that exists between Canada and the USA where this disease is also a serious problem.

Tattoo C Fungicide can be applied as a foliar spray on a 7 to 14 day schedule beginning when conditions for disease development are favourable at a rate of 1.8 to 2.7 L per hectare in 300 to 600 L water per ha. Use the higher rate and shorter interval under heavy disease pressure and when conditions of rapid disease development exist. Tattoo C Fungicide can be applied up to 5 times per season, however when applying Tattoo C using intervals longer than 7 days, alternate with at least one application of fungicide having a different mode of action for control of downy mildew. The preharvest interval is 2 days.

Tattoo C fungicide should be used in an integrated pest management program and in rotation with other management strategies. Follow all other precautions and directions for use on the Tattoo C fungicide label.

This minor use label expansion was sponsored by the provincial minor use office of the Ontario Ministry of Agriculture, Food and Rural Affairs in response to emergency use and minor use priorities established by field cucurbit producers, processors, extension personnel and researchers in several provinces.

Furthermore, we also wish to thank the personnel of Bayer CropScience Inc. for their support of this registration and the personnel of the Pest Management Regulatory Agency for evaluating and approving this important pest management tool.

For copies of the new minor use label contact Jim Chaput, OMAFRA, Guelph (519) 826-3539, Elaine Roddy, OMAFRA, Ridgetown (519) 674-1616 or visit www.bayercropscience.ca

Minor use label expansion granted for Assail 70 WP insecticide for management of pests of stone fruits

The Pest Management Regulatory Agency (PMRA) recently announced the approval of a minor use label expansion for ASSAIL 70 WP Insecticide for control of Oriental fruit moth (OFM) and plum curculio (PC) and suppression of cherry fruit fly (CFF) on stone fruits, crop group 12 (which includes apricots, cherries, nectarines, peaches, plums and plumcots) in Canada. ASSAIL 70 WP (acetamiprid) was already labeled for management of a variety of insect pests on a range of crops in Canada.

This will provide stone fruit growers with a much needed pest management tool to manage some of their most difficult insect problems. This project was initiated in late 2003 as a prioritized project with the Agriculture and Agri-Food Canada, Pest Management Centre (AAFC-PMC) as a result of minor use priorities put forward by producers, researchers and extension personnel.

The following is provided as a general outline only. Users should consult the complete label before using Assail insecticide.

Assail insecticide can be applied as a foliar spray at 120 to 240 grams per hectare for control of OFM and at 240 grams per hectare for control of PC and suppression of CFF. Apply in a minimum finished spray volume of 1000 L/ha. Do not apply during bloom. The first application and follow-up applications, if required, should be applied when treatment thresholds have been reached as indicated by field monitoring. Do not make more than 4 applications of Assail insecticide per season.
Ginseng Gnawing 101 - Cut Stems
and the Creatures that Cause Them

Melanie Filotas, Specialty Crops IPM Specialist and
Sean Westerveld, Ginseng and Medicinal Herbs Specialist

It’s that time of year again - when ginseng growers and garden walkers start seeing evidence of seedlings that have been cut as they emerge through the straw. With cut stems we often think of cutworms, but there are actually a variety of creatures that can cause similar symptoms in ginseng. Here’s a quick review of each and how to distinguish between them.

Cutworms are perhaps most commonly associated with cut stems. Cutworms are the immature stages of a family of night-flying moths called noctuids. Cutworms are variable in appearance but are usually dull grey to brown with darker markings, and are often hairless and greasy looking. They tend to curl into a “C” when disturbed. Cutworms spend their days in soil, emerging in the evening to feed on stems (and sometimes leaves) of ginseng crops. Cutworm damage can be distinguished by their habit of severing plant stems like a knife (Figure 1). The upper portion of the stem falls over and is often distinguishable by the severed leaves lying upside-down on the straw.

Slugs are soft-bodied, slimy animals (essentially snails without a shell) which are more closely related to clams than insects. They move relatively slowly and as they move they secrete a layer of mucus, called a “slime trail”. They prefer cool, wet areas (such as under straw mulch) and are most active at night. In older gardens, slugs will chew holes in leaves, berries and taproots. Cut stems are typically seen in seedling gardens. Unlike cutworms, which chew directly through the stem, slugs chew vertical holes in the side of the stem (Figure 2). Seedlings will not be completely severed, but rather bent over. Additionally, you may see evidence of a slime trail near feeding sites.

Mice will also chew on stems and exposed roots of ginseng. With mice, you often see elongated areas of chewing along the length of the stem (Figure 3), and like cutworms they can sever the stem. If you suspect mice, look for tunnelling beneath the straw, which is characteristic of mice as they move along the length of the beds.

Assail insecticide should be used in an integrated pest management program and in rotation with other management strategies. Follow all other precautions and directions for use on the Assail insecticide label.

We wish to thank AAFC-PMC for sponsoring this minor use submission in response to grower identified needs in 2003. We also wish to thank the personnel of Nippon Soda Co. Ltd. and DuPont Canada Inc. for their support of this registration and the personnel of the Pest Management Regulatory Agency for evaluating and approving this important pest management tool.

For copies of the new supplemental label contact Hannah Fraser, OMAFRA, Vineland (905) 562-1674, Jim Chaput, OMAFRA, Guelph (519) 826-3539 or visit the DuPont Canada website at www2.dupont.com/Crop_Protection/en_CA/Assail™ is a trademark of Nippon Soda Co. Ltd., Tokyo, Japan. Assail™ 70 WP insecticide is marketed by DuPont Canada Inc.
Millipedes are only sporadic pests in ginseng, however on occasion they will attack seeds and emerging seedlings. Millipedes have elongated, hard bodies and range in colour from white to grey-black. They tend to coil up when disturbed, and can be distinguished from the other insects described here by their many legs, which run down the length of their body (typically there are two pairs for each body segment). As seedlings begin to extend above the straw, millipedes will chew them off where they break through the soil. Millipedes will chew anything that emerges, and not just the stem, so you will see a wider range of damage than with the other pests described (Figure 4).

No discussion of feeding on ginseng stems would be complete without mentioning grubs! Grubs do not technically cut stems, however they do feed on young ginseng roots in seedling gardens. Grubs in ginseng are usually the immature stage of the European chafer, a common beetle pest of turf and other crops in Ontario. Grubs have six legs with a C-shaped white body, dark head and darkened tail end. As they feed, the young plant is drawn down into the straw, so in contrast to cutworms the upper part of the plant is not left above the straw (Figure 5). Damage is most commonly seen in 2 year old gardens as circular empty spaces in beds, however at this point the grubs are typically not present in the garden.

Ginseng growers are most commonly focused on disease, however seedlings are also susceptible to damage by a variety of animal pests. When you see evidence of damage, it is important to properly identify the culprit, because control measures will vary with each one. For information on control options, refer to OMAFRA Publication 610, Production Recommendations for Ginseng.

Figure 3 – Mouse damage to ginseng stem. Note the severed stems with long, elongated areas of chewing.

Figure 4 – Millipede damage to ginseng seedlings.

Figure 5 – This seedling has been pulled into the straw by grubs.
Now that the Victoria Day weekend is over and sunshine and warm temperatures are upon us, pests seem to be abundant in the garlic patch. One of the critters I’m seeing in different garlic gardens is the garden springtail.

Globular springtails are tiny (1 mm/1/16th inch), primitive wingless insects (Fig. 1). Females lay their eggs in moist soil, with a preference for areas of high organic matter (Fig. 2 – life cycle). The young often only differ from the adults in colour. Both lifestages spring away when disturbed using a structure called a furcula, located on the underside of their abdomen (hence the name springtails). As an aside - these little critters can propel themselves a distance of up to 20 times their body length!

Most springtails are considered beneficial soil scavengers, feeding on decaying matter, fungi, moulds and other soil microbes; however, there are a couple of species, including the garden springtail (Fig. 3) which feed on plants. Young garden springtails are orange in colour, while adults are reddish-black.

In general, springtails thrive in moist soil environments where there is an ample supple of decaying plant material (e.g. leaf litter, decaying wood, high levels of organic matter, soils amended with compost). Species that spend most of their time in the soil are very susceptible to desiccation. Based on what I’ve observed, this may not be true for the garden springtail. In garlic, both immature and adult springtails were happily feeding in the heat of the day under a clear blue sky with temperatures reaching 28°C. With that said, they could leave the plant at any time and take refuge under ground cover.

Damage caused by the garden springtail is shown in figures 4 and 5. In most cases, damage is only observed on the oldest leaves. Feeding sites are pale yellow in colour, and appear as though the springtails have ‘sucked’ out the chlorophyll. Lesions may be mistaken for botrytis leaf blight. Botrytis is often found throughout the field and affects young and old tissues alike. Also, botrytis lesions are often larger than those caused by the springtails. And finally, springtail feeding removes the chlorophyll but doesn’t appear to change the leaf texture. Botrytis lesions cause death of tissue and have a different texture than healthy leaf tissue. In addition to the feeding damage, I also observed a lot of leaf yellowing of the oldest leaves. When these plants were pulled, we found that springtails weren’t the only critter munching away - bulb and stem nematode was also present. The question now is – which came first? Are the springtails more attracted to the garlic due to activities of the nematode, or vice versa? Are the decaying garlic bulbs, attacked by the nematodes releasing chemicals that are attractive to the springtails? Are plants fed on by springtails more susceptible/attractive to the bulb and stem nematodes? Many questions!
The bulb and stem nematode is a microscopic worm-like organism that is causing extensive damage to garlic across the province. It’s a parasitic nematode, which becomes active in the spring. Once active, it enters plants through the roots or wounds on the bulb/clove; however, research has shown that they can also enter stems or leaves close to the soil surface during periods high moisture. Once in/on a suitable host (e.g. garlic), the nematode injects a toxin into the plant as it feeds, causing lesions and resulting in distorted growth.

Under warm soil conditions (15-18°C), it takes between 19-23 days from egg to adult. Adults live from 45-74 days with the female capable of laying between 200 – 500 eggs during her lifetime. The fourth juvenile stage (J4) is able to enter a survival stage/stage to survive adverse conditions. Research has shown that under field conditions, J4s can survive in this state anywhere from 3-5 years. In museums, previously dried J4 specimens as old as 23 years could be ‘awakened’ and became viable nematodes.

Above ground symptoms include yellow leaves, which dry prematurely and stunted plants. In many cases, diseased bulbs/cloves are then invaded by other fungi and bacteria resulting in secondary diseases and rots. Infested garlic bulbs tend to be soft, shriveled, discoloured and lighter in weight. The basal plate and roots of severely infested bulbs may also appear to have a dry rot and can be easily separated from the bulbs, mimicking symptoms of Fusarium basal plate rot.
Bulb and stem nematode can spread within the field and to other fields via a variety of vehicles (Fig. 2):

- infected seed stock
- contaminated soil (in field, on equipment, on people)
- irrigation/rain water
- volunteer plants

**So, what can you do?** There are two key points, prevent the introduction into your fields, and, where present, keep populations below economic thresholds. In Ontario, we use a threshold of 100 nematodes per kg of soil. In Russia, the threshold is 10 nematodes per 500 cubic cm.

Ways to reduce damage:

1. test your soil before planting a host crop; if high, don’t plant
2. use clean seed - obtain and plant seed from a reputable seed supplier
3. use a hot water treatment on seed stock before planting  
   (Research has shown that when cloves are submerged in hot water (between 44 - 50˚C) for an hour, there is a reduction in the number of nematodes present; but remember, bulbs/cloves are living things and there is always a risk that the cloves may experience some damage during this process) and;
4. rotate and implement a 3-year crop rotation with non-host crops.

If you have an issue with nematodes, you may also want to consider growing a Brassica green manure (e.g. Indian mustard) which releases allyl isothiocyanates, a natural fumigant, when broken down and worked into the soil.

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**Weed control in strawberries (late May)**

**In established plantings**, where bloom or fruit is present, the window for weed control in strawberries is CLOSED. Herbicides such as Poast, Venture and RoundUp (spot-treatments) have a 30 days to harvest interval and should not be used after bloom.

An exception is the herbicide AIM EC. This product can be used up to one day before harvest, but only with a hooded sprayer to weeds in between the strawberry rows. Avoid all contact with the strawberry plant… this is a “burn-off” product.

**In new plantings:** The window for post-emergent weed control is OPEN for 2-6 weeks after planting. Use 2,4-D Amine before the strawberry plant produces runners. 2,4-D provides post-emergence weed control, but apply when weeds are small. To reduce risk of strawberry plant injury avoid application in warm humid weather. These conditions enhance uptake and will lead to more twisting and set back of strawberry plants. Use the amine formulation of this product and avoid drift to sensitive crops (ie tomatoes).

Grass herbicides can also be applied 2-6 weeks after planting, where grasses are a problem. These herbicides are very safe to strawberry plants, be sure to apply at the appropriate timing for grasses, generally the 2-5 leaf stage for grains and grasses, and the 3 leaf stage for quackgrass. Check the label.

Avoid the use of grass herbicides for several days application of 2,4-D and vice versa. Never tank mix these predicts on strawberries.

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Fig. 2. Nematode dispersal. A) on/in infected bulbs; B) in free water; and C) within leaf tissue. Source: [http://plpnemweb.ucdavis.edu/nemaplex/images/G042S14.jpg](http://plpnemweb.ucdavis.edu/nemaplex/images/G042S14.jpg)
2009 Downy Mildew Control Strategy for Cucurbits
Elaine Roddy, OMAFRA, Vegetable Crops Specialist

Downy mildew is a serious disease of cucurbit crops grown in Ontario. Cucumbers are particularly susceptible to this disease. Once established in a region, downy mildew can spread rapidly causing significant loss of fruit quality and yield.

Downy mildew must be managed preventatively. Do not wait for symptoms to appear before initiating a fungicide program. Use only recommended downy mildew fungicides. These products have performed consistently in research trials across North America.

Follow the following fungicide spray intervals:

**Under High Risk Conditions:**
- Maintain a 5-7 day spray interval.
- Use only targeted downy mildew fungicides.
- Start applications as soon as the risk conditions indicate a need.
- Consider a banded application on small plants.

**Under Low Risk Conditions:**
- Maintain a 7-day preventative spray schedule.
- Start applications no later than vine development.
- Rotate between broad spectrum and targeted downy mildew fungicides.

Refer to Table 1, Recommended Fungicides for Cucurbit Downy Mildew Control, on page 2 for a list of recommended fungicides.

**Cucurbit Transplants, Row Covers and Tunnels**
- Ensure all transplants are free from disease.
- Produce vegetable transplants in greenhouses used solely for vegetable transplant production.
- Where row covers are used, apply either Ranman 400SC or Tattoo C immediately after field-setting, just prior to covering plants with row covers or tunnels.
- Immediately after the row covers or tunnels are removed, apply either Ranman 400SC or Tattoo C. **Do not make sequential applications of either of these products.**
- After the row covers are removed follow a standard preventative program using targeted downy mildew products on a 7-day spray interval.

**Any of the Following Conditions Indicate a High Risk of Cucurbit Downy Mildew:**
- Downy mildew has been identified in the Great Lakes Region.
- Strong weather fronts originating in the Gulf of Mexico are predicted.
- Prolonged periods of cool, wet weather.
- Cooler night-time temperatures and heavy dew fall followed by warm, windy days.
- Extended periods of leaf wetness due to overhead irrigation.
- At a temperature of 20°C infection will occur with only 2 hours of leaf wetness.

Downy mildew conditions will be communicated to Ontario growers via the weekly OMAFRA Vegetable Crop Update. For a copy of this update, contact OMAFRA at 519-674-1616.

Always rotate between fungicides from different chemical families. **Use a minimum spray volume of 30-60 gallons per acre (337-674 L/ha).** Apply a preventative fungicide before a rainfall event or prior to overhead irrigation. Do not rely upon “kick back” or curative fungicide activity. Downy mildew must be managed consistently and preventatively.

Foliar fungicides in the strobilurin or QoI family (group # 11) pose a high risk of developing resistance and have not performed consistently in research trials. Due to the highly infectious nature of this disease, group 11 fungicides are **not** recommended for downy mildew control in Ontario.
**Broad Spectrum Fungicides**
These products have multiple modes of action and are applied preventatively to protect the crop against a wide variety of leaf diseases. Thorough spray coverage is essential to the performance of these fungicides.

**Targeted Fungicides**
These products are used to prevent the germination of downy mildew spores on the leaf surface. They must also be used preventatively. Targeted fungicides have a single mode of action. The risk of developing resistance to these products is quite high if they are not rotated properly, or if they are overused. Thorough spray coverage is also essential to the performance of these fungicides.

### Table 1. Recommended Fungicides for Cucurbit Downy Mildew Control

<table>
<thead>
<tr>
<th>Fungicide</th>
<th>Chemical Family</th>
<th>Rate</th>
<th>PHI</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Targeted Downy Mildew Fungicides</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>cyazofamid</td>
<td>21</td>
<td>150-200 mL/ha (40-80 mL/acre)</td>
<td>1</td>
<td>12 hour re-entry interval. Maximum 6 applications per year. Use the high rate on a dense canopy or under high risk conditions. Use 150 mL/ha (62 mL/ac) of Sylgard 309 as a surfactant.</td>
</tr>
<tr>
<td>Ranman 400SC</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>propamocarb/chlorothalonil</td>
<td>28/M5</td>
<td>1.2-2.7 L/ha (0.72-1.1 L/acre)</td>
<td>2</td>
<td>Use the high rate on a dense canopy or under high risk conditions. Maximum 5 Applications per year.</td>
</tr>
<tr>
<td>Tattoo C</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Broad Spectrum Downy Mildew Fungicides</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>mancozeb</td>
<td>M2</td>
<td>1.1-3.25 kg/ha (0.44-1.3 kg/acre)</td>
<td>14</td>
<td>Ensure thorough spray coverage.</td>
</tr>
<tr>
<td>Dithane DG or Manzate DF or Penncozeb 80 WP</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>chlorothalonil</td>
<td>M5</td>
<td>4.8 kg/ha (1.9 L/acre)</td>
<td>1</td>
<td>Ensure thorough spray coverage. Maximum 7 applications per year.</td>
</tr>
<tr>
<td>Bravo 500</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Warm, windy days have arrived: cottages are open, barbecues are hot and pesticide is drifting in the air. Anything seem out of place in that description? So what are you doing to keep those expensive products on-target and out of the summer breeze?

Drift is the airborne movement of agricultural chemicals onto a non-target area with the risk of injury or damage to humans, plants, animals, environment or property. Every farm should develop spray drift management strategies relevant to their particular circumstances and spray applicators (in-house or commercial applicators) should follow them.

**Develop Spray Drift Awareness Zones**

Much can be done to mitigate spray drift when planning a new farm by identifying where pesticide use may conflict with adjacent land use. Incorporate adequate separation between cropped areas and so-called “sensitive areas”. For established plantings, create a map of the crop and surround it with a 1 km spray drift awareness zone. Survey the zone and identify any sensitive areas that could be affected by spraying: e.g. neighbouring sensitive crops, native flora and fauna, waterways and wetlands, bees and sites of human habitation or activity (see Figure 1). An operational plan should be prepared for all routine spraying that includes site-specific instructions for each sensitive area falling in the awareness zone. Note that droplets can be carried well beyond 1 kilometre, depending on the conditions, even long after the application.

**Observe Buffer Zones and Establish Vegetative Barriers**

Pesticide labels specify downwind buffer zones to protect sensitive areas. The distance will depend on the toxicity of the product, the potential exposure to non-target organisms, the weather and the application method. At the time of this article, a new approach to determining buffer zone width is being developed by the Pest Management Regulatory Agency (PMRA). It uses a series of multipliers that increase or decrease the zone based on the type of sprayer, wind speed, and the nature of sensitive area, such as the depth of any permanent aquatic area. Until this new method is introduced, follow the label and consider planting vegetative barriers (aka wind breaks or buffer strips) along the downwind side of the crop. It can be a tree or shrub line surrounded by tall grass and should be more than one row of vegetation. Studies have shown that a density of about 50% with a minimum height of 1.5 times the release height of the spray can potentially reduce drift by 45 to 90% (See Figure 2). For more information see the Best Management Practices publication entitled “Buffer Strips”.

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**Establishing a 1.0 kilometre Awareness Zone**

**Plant Downwind Vegetative Barriers**
Watch the Weather and Employ Drift Mitigating Technology

Operators should spray only when temperatures are low and relative humidity is relatively high. This reduces the chance of drift due to temperature inversions or evaporation and it increases target deposition and coverage. In general, only spray when relative humidity is between 40 and 80% and air temperature is less than 25°C.

Wind speed affects the distance that a droplet will travel before deposition. Only spray when wind direction is consistent and between 2-15 km/h, or as indicated on the product label. Table 1 matches the visible signs of wind to the potential for drift and advises whether or not to spray. Cut out the scale shown in Figure 3 and tape it up in the spray cab for quick and easy reference. Applicators can operate in the higher end of this range by using:

- drift-mitigating nozzles,
- larger droplets,
- slower forward speeds,
- by reducing the distance-to-target, and
- by using shrouds or deflectors

<table>
<thead>
<tr>
<th>Wind Condition</th>
<th>Description</th>
<th>Wind Speed / Beaufort</th>
<th>Visible Signs</th>
<th>Spraying</th>
</tr>
</thead>
<tbody>
<tr>
<td>Still</td>
<td>May lead to vapour drift where finer droplets remain suspended in the air, prone to evaporation and drift long after spraying is completed</td>
<td>0-2 km/h / Force 0</td>
<td>Smoke rises vertically</td>
<td>Do not spray</td>
</tr>
<tr>
<td>Gusty</td>
<td>These conditions make wind direction unpredictable and may indicate an inversion</td>
<td>Not applicable</td>
<td>Direction keeps changing</td>
<td>Do not spray</td>
</tr>
<tr>
<td>Light air</td>
<td>Suitable Conditions</td>
<td>2-3.2 km/h / Force 1</td>
<td>Direction shown by smoke</td>
<td>Spray</td>
</tr>
<tr>
<td>Light to Gentle Breeze</td>
<td>Ideal conditions</td>
<td>3.2-9.6 km/h / Force 2-3</td>
<td>Leaves rustle, wind felt on face, twigs in motion</td>
<td>Spray</td>
</tr>
<tr>
<td>High</td>
<td>Higher wind speeds pose the most obvious risk of drift through, around or over target</td>
<td>9.6-14.5 km/h / Force 4</td>
<td>Small branches move, raises dust</td>
<td>Spray with Caution or Do not spray</td>
</tr>
</tbody>
</table>

Communication

Last, but not least, communicate with your neighbours. Many drift incidents can be avoided or greatly reduced if neighbours and contractors are advised and consulted prior to application. This can be verbal communication or written depending on the situation. Come to a mutually agreeable solution, perhaps sharing the responsibility for buffer zones or wind breaks.

Mitigating drift is the responsibility of all applicators. I hope you catch my drift so no one catches yours.
Wireworms are on the rise in Canadian crops such as potato, sugar beet, carrot, cole crops forages and cereal grains. Wireworms are the larvae of slender beetles known as click beetles. There are approximately 30 pest species of wireworm in Canada – with many found in potato fields. Before pesticides, potato growing was abandoned in some areas of Canada due to wireworm damage. There are indications that wireworm numbers are increasing, and damage is growing in many crops. If you aren’t familiar with wireworms, it’s time to learn more about these damaging pests, and determine if they are a threat in your area.

**Tuber damage**

Wireworms do their damage when they feed on potato seed pieces and daughter tubers, burrowing shallow holes and opening the way for secondary diseases including *Rhizoctonia* and blackleg. The greatest damage occurs when they tunnel into daughter tubers destined for the processing and table markets, leaving them unmarketable. While wireworms are doing their damage under the surface, you will not generally see any above ground symptoms unless damage to the seed pieces is severe. Plants will then become discolored and may wilt.

**Wireworm lifecycle**

Wireworms have an interesting, and troubling, lifecycle. The larvae, the most damaging lifestage, are able to live in soil for several years (3-5) depending on the species. Here is a breakdown of their lifecycle:

- Click beetles (adult wireworms) enter fields, preferably those with pasture, cereals and certain weeds, between April and June to lay eggs (about 200 per female)
- Eggs hatch into wireworm larvae in about three weeks and live and feed on plant roots and germinating seeds in the soil for 3-5 years depending on the species
- Wireworms burrow deeper into the soil (up to a meter) when it is hot and dry (mid summer), or when it is cold (winter), or when there is nothing to eat
- In potato fields in the spring, wireworms move towards the soil surface, following carbon dioxide (C02) trails produced by potato seed pieces after planting
- In late August, wireworms return to the surface to feed on daughter tubers and damage from wireworms can double every three weeks until the crop is harvested
- After 3-5 years, wireworm larvae metamorphose into click beetles (adult wireworms), which overwinter in the soil and emerge in spring to lay eggs and continue the cycle
Finding and baiting wireworms in your field

Wireworms are attracted to CO$_2$, whatever the source. Bait balls are a simple, effective way to check for wireworms in potato fields because they give off CO$_2$. Burying 1 cup of wheat flour or oatmeal in narrow 4-6 inch deep holes in fields will attract them. Mark the spot with a flag and check back in about 4-5 days (no later). About 20 evenly spaced baits per acre should suffice. This technique will indicate wireworm ‘presence’ but is NOT an indication of population threshold. Any wireworms you find should be put in a small container such as a camera film canister with soil to be identified (see “Tracking the pest” below), because some wireworm species may not be adequately controlled with certain insecticides.

Important information on control

Wireworm populations are high in fields that have had a recent history of pasture and rotations with forages and cereal grains. If growing potatoes in high risk fields, the effectiveness of insecticides will be reduced if green manure is present in soil at planting. This is because green manures produce CO$_2$ which will attract and hold wireworms away from the treated areas. Later in the season, wireworms will then attack daughter tubers. Ideally, a well fallowed field prepared well in advance of potato planting would ensure that wireworms would visit the seed furrows and come in contact with the insecticides applied.

Tracking the pest - You can help!

Dr. Bob Vernon, entomologist with Agriculture and Agri-Food Canada (AAFC) is behind a nation-wide wireworm tracking survey. Since some insecticides do not control or suppress all wireworm species, it is important to know which type of wireworms are present in the major growing areas of Canada so that the right control option(s) are chosen to get the job done.

You can help! By using the baiting approach described above, or if you notice wireworm damage in your crops, collect the wireworms you find, along with some of the field soil, and put them in a hard plastic container. There may be more than one species present, so collect as many as you can.

Please mail the sample(s) to Dr. Vernon at:
Agriculture and Agri-Food Canada
6947 #7 Hwy, P.O. Box 1000
Agassiz, B.C. V0M 1A0

It is important to include a brief description of where the sample was collected (nearest town or address), what crop the wireworms were found in, your name and phone number. Once identified, you will be contacted with the results.

If you have any questions about this wireworm tracking initiative, please contact Dr. Bob Vernon at 1 604-796-1708 (bob.vernon@agr.gc.ca), Bayer CropScience at 1 888-283-6847, or the Pest Management Regulatory Agency at 1-800-267-