
I mproving Insect Pest & Disease Management Practices In Saskatoon Orchards

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Insect pest and disease damage can cause extensive crop losses in saskatoon orchards. For example, in most growing seasons there are numerous examples of serious yield losses due to *Entomosporium* leaf and berry spot where some growers have given up on their harvest entirely. To a large extent, crop losses caused by insect pest and disease damage can be controlled with timely pesticide applications and by following appropriate management practices. The following information is meant to help growers improve the effectiveness of their applications of insecticides and fungicides.

Pruning to Enhance Disease Control

Growers with saskatoon plants of differing sizes often observe that overgrown areas of their orchard are more seriously affected by disease problems than areas where the plants are not as dense. Other growers have commented that row ends show less disease than row centers and that very sheltered locations have greater disease problems. These examples illustrate the impact of poor airflow through the plant canopy on the initiation and development of disease in an orchard. Recent research

suggests that *Entomosporium* leaf and berry spot requires a minimum of 12 hours of continuous leaf wetness for spore germination to occur on saskatoon leaves. Increased airflow through an orchard reduces the risk of disease initiation by reducing the time leaves remain wet following a rain. Seasonal pruning is essential to maintain uniform yields and to keep disease problems in check. Pruning conducted while bushes are dormant will have an impact on air flow and disease development during the growing season. Reducing the number of stems by thinning out older wood (greater than 2.5 cm in diameter) will increase airflow through the orchard and reduce the severity of fungal diseases.

Monitoring for Insect Pest and Disease Problems

It is important for growers to know which insect pests and diseases are likely to be problems in their saskatoon orchards, and to be able to identify these pests and diseases accurately. Regular monitoring and accurate problem identification provide the information necessary to choose the most appropriate management strategy. Monitoring requires surveys for the presence

of insect pests and diseases, natural enemies of pest species, developmental stage and health of the crop, soil moisture and weather, at weekly or more frequent intervals throughout the growing season. Records of the results of these monitoring activities will help a grower forecast outbreaks of insect pests and diseases and schedule management practices. Monitoring techniques are beyond the scope of this factsheet because they are often specific to the species of insect pest or disease. However, it's important to note that growers may need to learn some specialized information and techniques to adequately monitor for some saskatoon insect pests and diseases. For further information on specific insect pests and diseases of saskatoons, refer to the Insect and Disease sections of **Growing Saskatoons - A Manual For Orchardists**.

Gathering Diagnostic Data

The key to diagnosing crop problems is careful observation. Diagnosis can be a complex task which requires experience, skill, knowledge and science.

The first step in diagnosis is the initial recognition of the problem because of certain symptoms. A symptom is any noticeable abnormal plant condition. Non-specific symptoms, such as yellow leaves, are common. It is very easy to misinterpret symptoms. Accurate diagnosis takes time and is best done in a structured manner so as to avoid hasty conclusions and misinterpretation.

1) Look for a pattern of damage on

individual plants, or on all plants in an area. Are the symptoms consistent, different, uniform, or scattered? It's important to try to determine the distribution of the problem with respect to water drainage, soil, shade, or exposure to wind.

2) What is the frequency or intensity of the problem? Do there appear to be different stages of development of the problem? How long have the symptoms been present in the orchard? What is the history of the site (previous crops, chemical application, standing water, and so on)?

3) Are there any signs of disease organisms, insect feeding damage, eggs, webbing, adult or larval insects, fungal organisms, or other causal factors (chemical residues, odors, and so on)?

4) Is there any evidence of recovery by the damaged plant?

5) Are root zones shared by the affected plants?

6) Inspect the interior, crown and roots of plants. Cut open stems, crowns, flowers, fruits and roots. Are there any hidden, internal symptoms (for example, rotten or discolored tissue)? Learn what a healthy root looks like by digging up healthy roots and carefully washing them.

7) What is the condition of the soil (wet, dry, compacted, odoriferous)?

8) Remember that many symptoms are non-specific and that a great variety of causes may be manifested by the same symptom(s).

Additional useful information includes the following: 1) cultivar/variety, age, propagation method, site preparation, dates and rates of fertilizer and pesticide applications, dates of transplanting and pruning, omissions or additions to usual/conventional management program; 2) water quality, frequency, rate and timing of irrigation; 3) soil pH, texture, drainage, homogeneity, aeration, temperature, salinity; planting depth; construction near site; 4) environmental conditions and recent history (temperatures, amount and distribution of rainfall, light intensity, air quality, wind); 5) rate of symptom development; coincidence with any treatment or environmental event; 6) recent unusual human, animal, insect or mite activity around or on the plant with symptoms.

Diagnosing Specific Problems With Saskatoons

Saskatoons are susceptible to a variety of problems. They are prone to a number of disorders caused by weather-related factors. They are also susceptible to many of the insect pests and diseases that are common to other related fruits in the Rose family. Diseases and certain insects appear to be the primary factors that limit total yield and fruit quality.

The following table indicates some of the more common problems growers may encounter in their saskatoon orchards.

Common Problems Of Saskatoons	
Problem	Symptoms
<i>Entomosporium</i> leaf & berry spot	Leaves with small, angular, brown spots; often followed by leaf yellowing & loss in mid-season
Saskatoon-Juniper rust	Hard, yellow patches on leaves or fruit; often with spiky, brown outgrowths
<i>Cytospora</i> Canker	Drying & shrivelling of buds & leaves in late-spring; sunken areas of cracked or broken bark
Woolly elm root aphid	Lack of vigour in young plants; early flagging (change of color) of leaves in late-July or early-August; white, woolly masses on plant's roots immediately under soil surface; partial leafing-out, followed by plant death early in season
Saskatoon bud moth	Flower buds with small holes; oozing droplets may be present; may contain a tiny caterpillar; young leaves & flowers tied together with white threads or webbing

Spider mites	Leaves with a stippled appearance; yellowing of leaves; presence of very fine webbing on the undersides of leaves
Winterkill	Loss of young plants on exposed sites; death of new wood, leaf buds and flower buds; delayed bud-break, reduced growth, small leaves, fewer leaves than normal, variable pattern of flowering within plants, or within the orchard; symptoms may not become noticeable until mid-June
2,4-D damage	Leaves with pronounced, feathery extensions; ends of leaves flattened; leaves may have a leathery appearance, with veins appearing prominent
Bird Feeding Damage	Large numbers of birds in the orchard; fruit with large, ragged holes; bird droppings containing many seeds

Flower Bud Development and the Timing of Management Practices

A knowledge of flower bud development in the saskatoon will help a grower to monitor for the incidence of insect pests and diseases, and to appropriately time the application of pesticides and other control procedures. The developmental stages of saskatoon buds are similar to those of the apple or pear. However, the structure of the inflorescence of the saskatoon is different from that of the apple and pear, and the period of bud development in the saskatoon is much shorter.

Additionally, there may be substantial variability in bud development both within a plant and within an orchard, depending on plant material, growing season, and microclimate surrounding any one plant. This variability alone makes it difficult to easily characterize the larger number of stages used for the apple and pear. The developmental stages chosen for the saskatoon reflect easily-defined stages that growers can recognize. Eight different stages of development are defined in the following table.

Stage	Description
Dormant	- buds are tightly enclosed by brown bud scales
Silver Tip	- stage immediately following dormancy where the brown bud scales have split open, and are falling off; the bud beneath appears silver because of the presence of many hairs
Green Bud or Green Tip	- the flower bud cluster is visible; the flower buds are very small and tightly packed together; the entire cluster appears green in color

Stage	Description
White Tip	- the flower bud cluster has expanded so that the individual buds are no longer tightly pressed against each other; the white petals of the individual flowers are visible as a small cone
Tube	- the petals of the individual clusters have elongated to form a tube or cylinder
Balloon	- a very brief stage immediately prior to full-bloom when the tube of petals has loosened and the petals are beginning to separate
Full-bloom	- the petals have fully expanded and the anthers (pollen-bearing structures) and pistil (pollen-receptive structure) are visible; the flower is receptive to pollination and fertilization at this stage
Post-bloom	- the petals fall off of the flower and the ovary begins to swell, indicating fruit set

Safe Pesticide Use

The word pesticide is a broad term that includes herbicides, insecticides, fungicides, repellants, wood preservatives, and bactericides. Pesticides are important pest management tools and are often required to maintain an economically viable commercial orchard. Pesticides vary dramatically in toxicity, spectrum of pests controlled, hazard to health and environment, and mode of action. Pesticides include synthetically produced chemicals (carbaryl, benomyl, glyphosate), naturally occurring substances derived from plant or animal sources (rotenone, pheromones), naturally occurring rock sources (sulfur, copper sulfate), and microbial agents (*Bacillus thuringiensis*). Substances derived from plant and animal sources (organic pesticides) tend to break down more rapidly than synthetic substances (less persistent), however these may be difficult to use

effectively. Some pesticides are very toxic. A pesticide that is appropriate for managing a specific pest problem must be chosen. The label must be carefully read. Careless pesticide applications endanger human and environmental health, and are less likely to control the target pest properly.

It is important for grower's to recognize that the supply of healthy fruit is associated with pesticide use, residues and food safety. Pesticides must be registered with Agriculture Canada in order to be legally used on a commercial fruit crop. The process of registration is associated with the determination of efficacy and safety. Knowledge of the application rate and timing of use (preharvest interval) are important to keeping residues at safe limits. If a fruit crop is tested, and pesticide residues higher than the legal limit are found, the fruit crop may be confiscated and destroyed, and the grower given a fine or jail

term. The illegal use of pesticides is not worth the risk to individual growers, nor the industry in general.

Some Guidelines To Using Pesticides In Saskatoon Orchards

- 1) The problem must be identified correctly and it must be determined that a pesticide is the most appropriate solution to the problem.
- 2) The pesticide label must be referred to for the proper rate and timing of application.
- 3) In general, pesticides stored for more than 2 years should not be used.
- 4) Pesticides must not be mixed unless the compatibility of the chemicals is known.
- 5) Pesticides must be applied only when weather conditions are appropriate. Rain may wash pesticides off the plants; hot, dry weather can cause a pesticide to become toxic to the plant; wind causes substantial drift of pesticides.
- 6) Complete and accurate records of pesticide use should be kept.
- 7) Application equipment must be appropriate for the job and must be cleaned properly.
- 8) A sufficient spray volume to thoroughly cover the target area is essential for proper control of the problem.
- 9) The pH of the grower's water supply may be important when mixing pesticides; some

insecticides degrade in alkaline (high pH) water.

10) Additives recommended by the pesticide label (pH adjusters, surfactants) must be mixed with the pesticide and water to maintain the effectiveness of the chemical.

11) Appropriate application equipment should be used. Small droplets provide better spray coverage than large droplets and reduce the volume of the spray required.

12) Growers should be familiar with the toxicity of the chemical they are using and protect themselves properly during both mixing and application.

Pesticide Application Equipment

Growers who experience poor control of insect or disease problems should examine their pesticide application equipment. Uniform leaf coverage is essential to reliably protect a saskatoon crop, particularly from fungal diseases. Growers who use modified ground application equipment, with flat-fan nozzles, and pressures less than 60 PSI, likely will experience incomplete coverage and poor pest control. The nozzles and pressure used in conventional field equipment do not produce enough dispersion of the spray droplets to provide uniform coverage of an orchard crop's canopy. The use of commercial airblast spray equipment is recommended for spraying insecticides and fungicides in saskatoon orchards. Orchard and vineyard sprayers operate at relatively high pressure, generally between 100 and 300 PSI. These sprayers generate a spray

mist that is carried into the plant canopy via a fan. The forced airstream provided by the fan also results in more complete coverage of top and bottom leaf surfaces.

Effects of Water Quality and pH on Pesticide Activity

It is important to consider water quality prior to mixing pesticides. If water is obtained from an open source such as a dugout, suspended organic material in the water may interfere with active ingredients in the pesticide or cause a malfunction of the pesticide application equipment. If possible, filter the water before mixing with pesticide concentrates. The pH of the water supply should be tested prior to mixing with any pesticide. This can be done at a local soil or water testing lab, or on site with a pH meter or pH-testing paper (Litmus paper). The impact of water pH on pesticide activity varies with the product used. The deactivating effects associated with inappropriate pH levels are greater the longer a mixed pesticide product is allowed to sit, so it is important to use mixed pesticides immediately. In the case of some pesticides, the effectiveness of a mixed product may be cut in half in less than one hour if the pH of the water is too high or too low. As a general rule, most pesticides are stable in the pH range of 6 to 7. There are no known problems associated with the pesticide products currently registered for use on saskatoons, however, if the pH of the water source is above 8.5, the likelihood of having a problem is significantly increased. In this case the grower should consider using a buffering agent in the water to neutralize the water and stabilize its pH.

Applying Insecticides and Fungicides

Adequate monitoring for insect pest and disease problems, along with proper application rates and timing of chemical sprays, are important factors in efficient and effective control. At present, one insecticide (Decis 5.0 EC) and four fungicides (Topas 250 E, Kumulus DF, Funginex 190 EC and Nova 40W) are registered for aboveground use in commercial saskatoon orchards. Note that more than one fungicide may be used each season. The use of several fungicides reduces the risk of incomplete control that can occur when the scheduled application timing does not coincide with actual disease development or due to the development of chemical resistance in the fungal pathogen. There are no registered tank mixes for any combination of insecticide and fungicides available to saskatoon growers and this practice is not recommended. For further information regarding the registered uses of these pesticides, refer to the Insect and Disease sections of **Growing Saskatoons - A Manual For Orchardists**.

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