

Nova Scotia Haskap Berry Best Management Practices

Version 1.2

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Produced by the

Haskap Growers Association of Nova Scotia

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Introduction

This manual is designed for all growers of Haskap berries in Nova Scotia. The purpose of this document is to put in place methods for a farming operation to follow so that there is consistency throughout the industry.

All growers are encouraged to register as farm in Nova Scotia through Nova Scotia Department of Agriculture (NSDA): <https://novascotia.ca/sns/paal/agric/paal005.asp> . All growers are also encouraged to become members of the Nova Scotia Federation of Agriculture (NSFA): <http://nsfa-fane.ca/>.

In Nova Scotia there is also a Haskap association that all growers are encouraged to be become members. The association is called the Haskap Growers Association of Nova Scotia (HGANS): <https://haskapnovascotia.wordpress.com/>

This document should be reviewed annually to ensure that the content is correct and current.

1.0 Whole Farm Management

1.1 Occupational Health and Safety (Regulations)

Haskap berry farms must comply with the Government of Nova Scotia OH&S regulations, regarding farm Health and Safety.

Link to ThinkFarm which has a summary with links to the various necessary publications:

<https://novascotia.ca/thinkfarm/documents/fsheets/12-farm-safety.pdf>

1.2 On farm Food Safety

Haskap berry commercial producers are encouraged to become certified in an On-Farm Food Safety Recognition Program, or to adapt a record keeping system on their farm that is similar to what is required for a FSRP.

The Food Safety Recognition Program (FSRP) includes the On-Farm Food Safety Recognition Program and the Post-Farm Food Safety Recognition Program, which provides government recognition of on-farm and post-farm food safety systems developed and implemented by national industry organizations in order to:

- enhance food safety;
- maintain the confidence of Canadian consumers; and
- facilitate market access.

The FSRP is led by the Canadian Food Inspection Agency (CFIA) with the participation of the provincial and territorial governments.

Recognition acknowledges that a food safety program has been developed in line with a systematic and preventive approach to food safety based on international accepted standards ([Hazard Analysis Critical Control Points](#) principles); that the program conforms to federal, provincial and territorial legislation, policy and protocols; and that a [Food Safety Management System](#) has been implemented in an effective and consistent manner.

By providing a recognition framework that supports national, auditable, industry-led, HACCP-based food safety programs, the CFIA can support its goal of safeguarding Canada's food supply along the whole food continuum.

For an On-Farm Food Safety Recognition Program being certified by Canada GAP meets these requirements. More information can be found here: <http://www.canadagap.ca/>

1.3 Transportation Guidelines

Haskap berry commercial producers must follow provincial transportation guidelines for farmers. The Nova Scotia Federation of Agriculture has put together a booklet that outlines all of these guidelines. Link to booklet that was updated in May of 2015: http://nsfa-fane.ca/wp-content/uploads/2011/06/Transportation-Guidelines-NS-Farmers-REV_MAY6_2015.pdf

1.4 Environmental Farm Plan

The EFP program helps farmers identify and assess environmental risk on their property, so that they may incorporate environmental considerations into their day-to-day, or business planning activities. Following the EFP guidelines will ensure that your operation meets the various environment regulations as set down by various government departments. An Environmental Regulations Handbook for Nova Scotia Agriculture can be found here: https://novascotia.ca/thinkfarm/documents/env_handbk.pdf

Why enroll in the EFP program:

- Compliance with environmental laws, regulations, guidelines and currently accepted practices for NS agriculture.
- Required to access provincial and federal funding.
- Required by some financial agencies.
- Also educational, confidential, practical for all farms and available at no cost!

EFP program unique to each farm and addresses following areas of environmental concern:

1. Water sources.
2. Watercourses and ditches.
3. Nutrient management.
4. Manure storage and handling.
5. Fertilizer storage and use.
6. Pesticide storage and handling.

7. Waste handling and disposal.
8. Fuel storage and handling.
9. Soil management.
10. Commodity specific issues i.e. crop production
11. Wildlife habitat and biodiversity.

Process:

1. Requires registration with the EFP program.
2. An EFP coordinator will be assigned to you and will arrange a visit to your farm.
3. Visit gathers information on farm practices, and includes a walk around with the farmer.
4. A report generated where risk ratings are assigned, and an action plan recommended to minimize risks.
5. The EFP team is available to implement the action plan.
6. Follow up visit in 5 years to reassess and update plan.

1. Water sources, use, and management.

Wells require minimum separation distance for application of manure (30m on clay/loam soils, 60m on sandy/gravelly soils), and application fertilizers and pesticides (10m).

-The Drop on Water Well Decommissioning, Factsheet.

-Before you construct a Well: Facts a Homeowner should know.

<http://www.novascotia.ca/nse/water/wellcontractors.asp>

2. Watercourses and ditches.

Rivers, ponds, ditches/culverts and wetlands (marshes, swamps, fens, and bogs).

Importance of riparian zones, grass buffer strips and ditches; separation distances.

Wetland Alteration Approval from Nova Scotia Environment.

3. Nutrient management.

Balancing nutrients in soil; input from manure, fertilizers vs. output from crop grown.

Nutrient management plan based on soil fertility tests once every 2-3 years.

Field Cropping Record Book

4. Manure storage and handling.

Manure/compost location storage to minimize runoff, not stockpiled over subsurface drains, permeable soils, and flood risk areas. Store 100m from water source, and 50m from property line or provincial highway.

Maintain minimum separation distance from wells during application; 30m (100ft) on clay and/or loam soils; 60m (200ft) on sandy and/or gravelly soils.

Check nutrient value based on changes in generating, storing, turning etc.

Application rate by tractor with calibrated manure spreader

Not permitted to apply to frozen soil or snow covered fields (Dec 1 –Apr 1).

5. Fertilizer storage and use.

Attention to safe storage and risk water contamination from loading and application.

Calibrate spreaders for proper application rates.
Maintain separation distance from wells of 10m (33ft) for application.
Maintain a log for each field.

6. Pesticide management.

Safe and secure storage such that any spills can be contained and cleaned up.
Safe handling; mixing, using calibrated sprayer, weather conditions e.g. wind speed, clean up; log book.
Maintain application distance 10m (33ft) from wells.
Posted warning signs with emergency contact list and telephone numbers.
Pesticide Application Course required.

7. Waste handling and disposal.

Oil, tires, batteries, and empty pesticide containers. Ensure appropriate disposal.

8. Fuel storage and handling.

Fuel storage tanks ULC or CSA approved on concrete pad. Padlock secured
Fuel storage shed.
Repair leaks, materials to absorb spills, post emergency numbers
Fuel Storage and Handling factsheet.

9. Soil management

Manage Soil health and productivity with practices (conventional or organic) to reduce erosion (and risk of water contamination), maintaining soil structure with organic matter, nutrient and nitrogen balance, cover crops, mulch.

10. Commodity (crop) specifics.

Address those activities with potential to contaminate water; manure, stagnant water breeding ground for flies; any processing; any irrigation.
Energy use Efficiency Nova Scotia (www.energycyns.ca); Ericka Wicks (902) 470-3603
Nuisance issues: flies, bees swarms, noise, pesticide drift, odors.

11. Wildlife and biodiversity.

Farm practices that promote sustainability, directly improve wildlife habitat and diversity.
Land management practices to promote both include:

- Planting of shelterbelts and hedgerows
- Managing of riparian areas
- Conservation of wetland and wetland buffer zones
- Conservation of natural areas inside and around farmland

Resources:

Reg Newell, Stewardship Coordinator, Nova Scotia Dept. of Natural Resources: Agricultural Biodiversity Conservation Plans for individual farms at no cost or obligation to implement recommendations. Tel (902) 679-6145

Farms should have a completed environmental farm plan that is reviewed every three years. This program is administered by the Nova Scotia Federation of Agriculture and is free of charge. Having an EFP is required in order to access funding from any programs by the NSDA. Link to information concerning an EFP is here: <http://www.nsfa-fane.ca/efp/>

1.5 Record Keeping

Record keeping is essential part of a commercial operation. If you are adapting to Canada GAP processes, or you are certified organic, than accurate record keeping for areas of your operation are already in place. Additional recording keeping should also be kept. Areas involving record keeping should include the following:

- Equipment logs – detailing maintenance, overhauls, daily checks, calibrations, etc., of all equipment
- Fertilizer storage – inspections
- Fuel storage – inspections
- Manure – storage, composting records
- Pesticide – storage, inspections
- All facilities – inspections/cleaning as per Canada GAP

Every part of your operation should be included in your record keeping. All record keeping should be readily available for any inspections at any time.

2.0 Pest Management

Integrated Pest Management (IPM)

Many farmers participate in Integrated Pest Management (IPM) programs to monitor and control pests. The presence of pests is monitored through a provincial or regional program, a local pest management specialist, private scout, or the farmer him or herself. Using traps, observing the condition of the crop, and gathering information from weather recorders, the experts can determine what the issue is and where it is occurring. This results in choosing the correct method of pest management, and the ability to target specific locations for treatment. With chemical applications in the field, this can reduce the amount of pesticide application that is used overall because a farmer can spray only where it is needed. The idea behind IPM is to “integrate” or combine multiple strategies to reduce pest pressure with either organic or conventional pesticides.

2.1 Applicator/Vendor License

All Haskap berry producers who purchase and/or apply their own pesticides must have a Nova Scotia Department of Environment pesticide applicators license.

<http://www.gov.ns.ca/nse/pests/applicatorcert.asp>

Below is a link to the training manual.

http://www.gov.ns.ca/nse/pests/docs/ApplicatorTraining_AgricultureManual.pdf

2.2 Equipment Maintenance and Calibration

Maintenance - All Haskap berry producers who apply their own pesticides or custom applicators who do work in Haskap berry orchards are required to do regular maintenance at least once per year on all spraying equipment. Pumps nozzles, screens, hoses and valves should be checked and replaced if under- performing.

Calibration – Sprayers are to be calibrated a minimum of once per season, so that the overall output is known and the variance of output between individual nozzles is less than + or - 5%.

Perennia has a link to an Environmental Farm Plan Sprayer calibration factsheet on its website.

<http://www.perennia.ca/wp-content/uploads/2016/07/sprayercalibration.pdf>

2.3 Pesticide Storage

If Haskap berry producers store pesticides on farm, the storage facility should meet Nova Scotia Department of Environment guidelines.

<https://www.novascotia.ca/nse/pests/userstorageguide.asp>

The Nova Scotia Federation of Agriculture has a factsheet on designing a pesticide storage facility.

<http://nsfa-fane.ca/wp-content/uploads/2011/06/Pesticide-storage- March-31-2006 .pdf>

2.4 Pesticide Handling and Application

Haskap berry producers should only apply pesticides when conditions permit according to sprayer specifications and pesticide label instructions. Drift reduction technologies are encouraged in all situations.

Haskap berry producers need to strictly follow all pesticide labels as well as local provincial and municipal regulations.

- Have prepared and kept on file with ease of access all Material Safety Data Sheets (MSDS) for all products used.
- Follow all WHMIS regulations

Link to WHMIS information:

<https://novascotia.ca/lae/healthandsafety/docs/WHMISRegsInterpretGuide.pdf>

Haskap berry producers will follow all pesticide labels instructions with regard to pesticide safety and handling. In addition, Haskap berry producers will have on hand during application:

- All applicable safety equipment for the product being applied (ie. Nitrile gloves, rubber boots, respirator, goggles, spray suit etc.)
- Spare safety equipment
- Pesticide spill kit
- Poison control centre number
- Pesticide label including PCP number

2.5 Pesticide Record Keeping

Pesticide application records need to be kept for each orchard and each product applied. The records will include but will not be limited to:

- Application date and time
- Weather conditions at application (wind speed, direction, temp)
- Product name and rate applied
- Application spray volume
- Equipment and nozzles used
- Target pest and stage of pest
- Efficacy of product should be confirmed and noted in records

2.6 Weed Management

Haskap plants do not perform well with weed pressure. The following should be incorporated in to your IPM:

Monitoring - Weed populations should be regularly monitored, and mapped in the spring of and fall of each year.

Identification - Weed identification is critical to proper management. A weed identification guide can be found here: <https://novascotia.ca/agri/documents/weed-identification-guide.pdf>

Physical Controls – Physical removal of any weeds. Cutting of weeds before seed development to prevent weed spread. Mulching with various products can be an effective control. The use of mechanical weeding equipment is not encouraged due to the very shallow rooting system of Haskap plants.

Equipment Sanitation - Harvesters, mowers and other equipment should be cleaned of weed seed prior to leaving a weedy field. This is done to prevent the spread of weeds from one field to another.

2.7 Herbicides and Use

It is strongly recommended that the use of any herbicide should be researched thoroughly prior to using, and only products that are registered for the crop should be used.

Haskap plants will react negatively to applications of Roundup. Roundup may be used as a pre-plant herbicide to eliminate perennial weed species in the fall before planting.

2.8 Insect Management

Monitoring – Monitoring for insects should be carried out on a regular basis. There have been reports of various insects causing some issues.

If problem insect damage occurs please get in contact with Perennia:

<http://www.perennia.ca/fieldservices/fruit-crops/haskap-berries/>

2.9 Disease Management

Monitoring - Plant pathogens should be monitored for on a regular basis.

Powdery mildew is a known disease that occurs on some varieties mid to late summer. Research has not been done to date on this disease to determine what effects it may have on the plant, or on fruit bud development.

Botrytis can affect shoot growth and cause fruit rot in the crop. This disease generally occurs on plants that have grown too dense. Use proper pruning techniques to reduce this problem.

If problem pathogen damage occurs please get in contact with Perennia:

<http://www.perennia.ca/fieldservices/fruit-crops/haskap-berries/>

2.9.1 Wildlife Management

All efforts should be made to exclude deer, and birds from feeding on fruit and stems.

- Exclusion fencing should be explored.
- Noise makers can be used where appropriate and allowable according to Nova Scotia Regulations (in development).
- Avoidance by scent on field borders can be used for deer. Fencing is more effective.
- Bird netting is the best option for preventing fruit loss to birds. Visual and auditory deterrents have not been used successfully to date.
- Hunting permits may be obtained through the Nova Scotia Department of Natural Resources, but there are strict regulations concerning issuing a nuisance license.

3.0 Nutrient Management

The NSDA lab services available for producers. Link to their lab information:

<https://novascotia.ca/agri/programs-and-services/lab-services/analytical-lab/>

For more in depth analysis A & L Canada Laboratories Inc. in Ontario is a good option. Link to their website: <http://www.alcanada.com/>

3.1 Soil Analysis

Soil nutrient levels can be tested by the NSDA Analytical Lab. Registered farms have special pricing.

Follow the soil sampling guidelines as published by the lab:

<https://novascotia.ca/agri/documents/lab-services/analytical-lab-howto-soiltest.pdf>

Understanding your soil test can be found here: <https://novascotia.ca/agri/documents/lab-services/analytical-lab-understand-soil.pdf>, or consult with a Nutrient Manager Planner.

3.2 Tissue Analysis

Tissue nutrient testing can be tested by the NSDA Analytical Lab. Registered farms have special pricing.

The optimum timing for taking tissue samples on Haskap has not yet been determined, but you can take tissue samples after the bloom, and before the harvest during berry forming period. It's important to take samples at the same time frame, year after year so you can accurately compare tissue test results.

Follow the lab guidelines: <https://novascotia.ca/agri/documents/lab-services/analytical-lab-fruitcroptissue.pdf>

Understanding your tissue test can be found here: [Understanding your soil test can be found here: https://novascotia.ca/agri/documents/lab-services/analytical-lab-understand-soil.pdf](https://novascotia.ca/agri/documents/lab-services/analytical-lab-understand-soil.pdf), or consult with a Nutrient Manager Planner.

4.0 Fertilizers and Application

A Nutrient Management Plan (NMP) can be established based on soil/tissue testing, or a recommended guideline for small fruits. The closest NMP for Haskap appears to be what is recommended for brambles. It is important to fertilize your orchard prior to plant establishment.

Use of fertilizers is regulated by the Canada Food Inspection Agency (CFIA). The *Fertilizers Act* and *Regulations* requires that all regulated fertilizer and supplement products must be safe for humans, plants, animals, and the environment. They must also be properly labelled to ensure safe and appropriate use. The mandate of the CFIA's Fertilizer Program covers a wide range of products sold for agricultural, commercial, and home and garden purposes. Regulated products include farm fertilizers, micronutrients, lawn and garden products as well as supplements such as water holding polymers, microbial inoculants, plant growth regulators, liming materials, and waste-derived materials such as composts and municipal biosolids. All fertilizers and supplements that are **imported** or **sold** in Canada are regulated by the CFIA. The manufacture, proper use and safe disposal of these products are controlled by provincial and municipal rules, and regulations. The CFIA works together with provinces and municipalities to ensure that all fertilizers and supplements meet the highest standards for safety.

Some fertilizers and most supplements are subject to registration and require a comprehensive pre-market assessment **prior** to their import or sale in Canada. Products that are exempt from registration are still subject to regulation and must meet all the prescribed standards at the time of sale or import. Companies that manufacture or import these products may approach the CFIA and request a voluntary pre-market assessment to verify that their products meet the requirements.

CFIA has a searchable product database. A link to that database can be found here:

<http://www.inspection.gc.ca/plants/fertilizers/eng/1299165827648/1299165914316>

4.1 Application Granular Fertilizers

Applications should be made when conditions are dry and when vegetative growth has begun. Split applications can be beneficial.

Growers should regularly calibrate fertilizer spreaders. Spreader calibration should be provided by the manufacturer of the spreader.

4.2 Liquid fertilizers

There are many types of liquid fertilizers, and these can be applied to the plants at many times of the year.

- Growers should ensure that the timing of application makes physiological sense for the plant to enhance production, and allow for crop safety.
- Growers must ensure that any liquid fertilizer, and any other tank mix partner is compatible.

4.3 Soil Amendments

There are many natural and alternative sources of nutrient amendments. Growers should ensure the content of these amendments, and ensure that it is an approved amendment by CFIA.

CFIA has a searchable product database where a link to that database can be found here:

<http://www.inspection.gc.ca/plants/fertilizers/eng/1299165827648/1299165914316>

5.0 Orchard Management

5.1 Crop monitoring

Growers should record regular visits to orchards to observe crop development, pest levels and general plant vigor.

5.2 Pruning

Pruning, with proper pruning tools, should be started by year three of growth in order to remove low growing branches that are difficult to harvest and open up the plant for airflow to reduce disease incidence. Pruning may also be used to create a more upright plant that is easier to harvest mechanically.

As a suggestion you should start pruning by about the second year by thinning out the weak shoots, and cutting off any cross-over branches. After the third or fourth year, you can remove

about 1/3 of the branches. Try to save the vigorous one-year shoots, remove any drooping branches, and any weak twigs. You may have to try a few different techniques to see which works technique works best for your operation.

The best time to prune is late fall, or winter.

5.3 Alleyway Care and Maintenance

It is recommended that alleyways between rows are seeded with beneficial cover crops. A cover crop mix can be used, or a single variety. Growth height of any plants growing in alleyways should be kept under 6". Alleyway plant growth adds organic matter to the soil in the orchards, and helps to retain moisture. Cover crops may also add beneficial nutrients to your orchard.

More information can be found here:

<https://blogs.cornell.edu/newfruit/files/2016/12/bbcovercrops-1rc66ra.pdf>

5.4 Refuge Areas

Areas are left around field edges, and in non-productive areas, to grow naturally and encourage native pollinators and other beneficial insects.

- Old rock fences and piles, old slash piles and native plants can encourage native pollinators.
- Hedge-rows will allow for a wind reduction and snow build-up on fields which will help with winter protection. This is critical in some locations. Hedge row height needs to be kept relatively low in order to keep shading impacts limited.

6.0 Pollination

Pollination is critical to fruit forming. Adequate pollinating units, and how they are managed is critical to ensuring adequate yields.

6.1 Management during the Bloom

Avoid fertilizing, and applications of pesticides during the bloom. This is to avoid disturbing pollinators as much as possible.

6.2 Managed Pollinators

Information concerning Haskap pollination with managed bee hives has yet to be published. The following link is for wild blueberries, but this might be similar for Haskap: <http://www.perennia.ca/wp-content/uploads/2016/04/Effect-of-HB-stocking-density-on-WB.pdf>

Key notes are:

- Stocking density per acre of 5 honeybee hives or 3 bumble bee hives (or 1 quad).
- Using managed bees for pollination acts like an insurance policy even if the local bee population is healthy.

Since Haskap plants are some of the earliest blooming plants in the spring, weather and temperatures play a huge role in the effectiveness of managed honeybee colonies.

Managed bumblebee hives will likely perform better as bumblebees will pollinate flowers at lower temperatures.

6.3 Attracting, Maintaining Wild Pollinator Populations

Native pollinators should be encouraged in Haskap orchards.

- Native plants, and a diverse habitat, around a Haskap orchard will help to promote more native pollinators.
- Orchards with large tree line perimeters tend to have more native pollinators.
- Larger orchards may have a reduced diversity, and number, of native pollinators.
- Planting native wild flowers in buffer zones around an orchard will help to promote a healthy native bee population.
- Using flowering cover crops in orchard alleyways will help to promote a healthy native bee population

7.0 Harvesting

All harvesting needs to be performed according to Good Agriculture Practices (GAP). CanadaGAP is a food safety program for Canadian companies that produce, handle and broker fruits and vegetables. The program has received full Canadian Government Recognition. Following these standards will help to ensure that the food produced in your operation is safe for human consumption.

Link to CanadaGAP website: <http://www.canadagap.ca/>. The manual for fruits and vegetables can be downloaded from the manual download link.

7.1 Harvesting

Harvesting conditions greatly affect fruit quality. Harvesting is done when conditions are close to optimal, whenever possible.

- Harvesting during rain should be avoided or when fields are wet.
- Harvesting in extreme heat and humidity reduces berry quality and should be avoided if at all possible.
- Dry conditions below 20 degrees Celsius are ideal for Haskap berry harvest.
- All equipment is to be kept clean as per CanadaGAP standards.
- Harvested berries should be cooled down as quickly as possible after harvest to preserve quality.

7.2 Personal Hygiene of Workers during Harvest

Humans may be a source of biological contamination (e.g., Hepatitis A, Salmonella, E. coli O157:H7) especially if they are unable to properly wash their hands. Therefore, it is important to provide personal hygiene facilities and to keep them well maintained.

- Sufficient personal hygiene facilities must be available. All facilities must be accessible, properly stocked, cleaned and well-maintained.

- Employees must be trained on good personal hygiene practices and safe product handling to help prevent the biological, chemical and physical contamination of product. Job-specific training is also important to ensure food safety related practices are adhered to.
- Employee training should be performed as per CanadaGAP standards

7.3 Identification and Traceability

Harvested berries that are identifiable, and traceable, can easily and quickly be traced back to the point of origin. Contaminated berries can be distinguished from berries that are not, and berry loss may be limited in the event of a recall (i.e., one identified lot versus an entire harvest).

- Use CanadaGAP standards for implementing a traceability system.

7.4 Storage of Berries

Proper storage of berries will reduce the risk of biological, chemical and physical contamination.

- Harvested product must be held or stored in designated areas and handled under the proper conditions to minimize contamination.
- Follow CanadaGAP standards for storage of berries.

7.5 Transportation

Transportation vehicles that do not have properly cleaned and/or maintained food contact surfaces may be a potential source of contamination to product. Product release procedures include inspecting outgoing product for signs of contamination before loading onto vehicles.

- Follow CanadaGAP standards for shipping berries.

Link to CanadaGAP website: <http://www.canadagap.ca/>. The manual for fruits and vegetables can be downloaded from the manual download link.

8.0 Business Risk

8.1 Crop Insurance

Haskap berry operations currently do not qualify for crop insurance through the Nova Scotia Crop and Livestock Commission.

8.2 Agri-Invest

Any farm can enroll in the Agri-Invest program. Agri-Invest is a self-managed producer-government savings account that allows producers to set money aside which can be used to recover from small income shortfalls, or to make investments to reduce on-farm risks.

Link to Agri-Invest: <http://www.agr.gc.ca/eng/?id=1291828779399>

8.3 Agri-Stability

Any farm can enroll in the Agri-Stability program. AgriStability provides support when you experience a large margin decline. You may be able to receive an AgriStability payment when your current year program margin falls below 70% of your reference margin.

Link to the Agri-Stability program: <http://www.agr.gc.ca/eng/?id=1291990433266>

Appendix

The purpose of this section is for recording version changes to this document when it is required.

Version changes should adhere to the formatting used in the document. Website links should be updated whenever necessary. Brief notes concerning document changes should be noted below with dates. The main document version number, and date, should be updated once changes are implemented.

Version Changes

Version 1.1 – January 2018 - changes reviewed by Rachael Cheverie and Chris Berry to NMP, lab testing, pruning, pesticide use, formatting, web link corrections, and general wording.

Version 1.2 – February 2018- minor spelling corrections and grammar changes.