In 1989, a BC based apple fruitlet mineral analysis project was initiated by Okanagan Federated Shippers Association to develop guidelines for fruit nutrient levels associated with high quality fruit. BC Tree Fruits Cooperative continued this project and, with support from the New Tree Fruit Variety Development Council, developed specific guidelines for Ambrosia apples. All work was led by Dr. William (Bill) Wolk.

Ambrosia Fruitlet Sampling

BRITISH COLUMBIA | Ministry of Agriculture and Food

COLLECTING the Sample

Collect 30 fruitlets in the field per uniform block

(1 fruitlet per tree)

Sampling must be done in a way that ensures the fruitlet mineral data are comparable year to year; thus, collection should occur at a similar stage of development. The concentration of all minerals in apple fruit tissue tends to decline over the course of a season. **The recommendations developed for BC are based on a specific timing of six weeks prior to anticipated harvest.** For example: South Okanagan (Oliver) sampling dates for Ambrosia are frequently in the third week of August, but this can vary block by block with microclimates and management practices. Why this timing? When sampling earlier in the season, fruit mineral concentrations are declining quite rapidly; this will result in greater sampling error in the data for comparing to standards or past seasons. Additionally, early season samples are not as accurate as an indicator of quality and storage potential as samples collected later in the season. This tool has been found to be very beneficial for informing storage management and long-term orchard nutrient management decisions. It is not meant for informing corrective nutrient decisions for the fruit in the same year as sampling. Sampling on an annual basis allows growers to see trends and the ultimate impact of nutrient programs on the change of mineral concentrations in the fruitlets.

SAMPLING TIPS:

- Uniformity of samples is key. Group areas to be sampled by variety, soil, tree health/age, etc.
- Ensure to sample apples from all parts of the block, except the edge rows. A sample should consist of fruit taken from the tops/bottoms, insides/outsides, North/South, and East/West sides of trees.
- The fruit in the sample should be representative of the crop in the field.
- Avoid areas with anomalies. For example, if it is a light crop, avoid the odd tree that has a heavy crop and avoid sick trees.

PREPARING the Sample

Reduce chances of contamination (no soap or other residues on the fruit or tools)

PREPARATION STEPS:

1. **Contact the lab** to determine the maximum sample size they can process in a commercial blender with distilled water. Many labs prefer samples to be between 1200-1800 g (ideally 1500 g).

2. **Sort the 30 apples for uniformity in size** and remove the five most "different" fruitlets from the sample (biggest, smallest, injured, etc.) and weigh the remaining 25 fruitlets for sample processing and record the total weight. If total weight is above the maximum size lab will allow, then follow all steps. If the total weight is below the maximum, then follow all but step 6.

3. **Gently wash fruitlets** under running tap water to remove spray residues. You do not need to scrub them hard.

4. **Remove stems** from the fruitlets because they are extremely high in minerals and can mask the actual fruit mineral levels in the sample. To do this, place the fruitlet on a cutting board and use the point of the knife to remove a cone-shaped piece of flesh down to just below the bottom of stem (~1cm deep to ensure no stem material remains).

   Caution, do not hold the fruitlet in the palm of your hand to cut the stem, or you may cut yourself.

5. **Make two longitudinal cuts as an "X" from the top down to create four wedges.** Keep two opposing wedges from each fruitlet in the sample and discard the others. The minerals are not equally distributed around the circumference of the fruit or from top to bottom. The sun side of the fruit will have higher mineral concentrations than the shade side and the stem end has higher concentrations than the calyx end. As a result, the mineral concentrations in a single wedge of fruit are not representative of the entire fruit. Research has shown that the minerals in two opposite wedges are reasonably representative of the whole fruit.

6. **If you need to reduce the total sample size, it needs to be done proportionately.** Depending upon how much you need to reduce the sample size, you can cut bigger (x) and smaller (y) opposite sections. It is best to make the sample as close as possible to the maximum size allowable. Do not leave this to the lab.

9

7 **Next, use a pointed device to remove seeds from seed cavity,** as they too are higher in minerals than the rest of the fruitlet. Sometimes the wedges need to be cut in half again to remove all the seeds.

8 **Once all 25 fruitlets have been cut, weigh and record** the fresh weight of the prepared sample you will be sending to the lab. You will need to include this information with the sample.

9 **Clearly label the sample identification** with a permanent marker on a new, clean plastic bag (12 lb bags are a good size). Put the sample in the bag and knot it tightly. Also, include a list of corresponding fresh weights for each sample submitted to the lab, as they need it to report results in ppm Fresh Weight.

10 **Keep prepared samples cold** until shipped. Try to ship within 48 hours of preparation.

SUBMITTING the Sample

Most labs are now familiar with fruitlet analysis and report their results in parts per million fresh weight. Because leaf tissue is reported on a dry weight basis, if a lab has not previously done fruitlet analysis, it might report fruitlet results as dry weight. Such data would not be comparable to most published fruitlet recommendations.

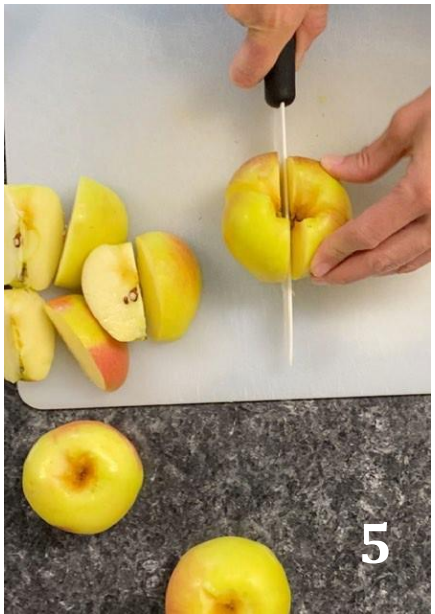
To avoid confusion, make sure the lab:

- Analyzes and expresses results on a fresh weight basis and
- Reports results for all minerals as ppm values.

Standard fruit and fruitlet tissue recommendations are expressed in mg/100g Fresh Weight. To convert ppm Fresh Weight to mg/100g Fw, simply shift the decimal one place to the left.

63 ppm fresh weight = 6.3 mg/100 g Fw 1348 ppm fresh weight = 134.8 mg/100 g Fw

Depending upon how much you need to reduce the sample size, you can cut bigger (x) and smaller (y) opposite sections.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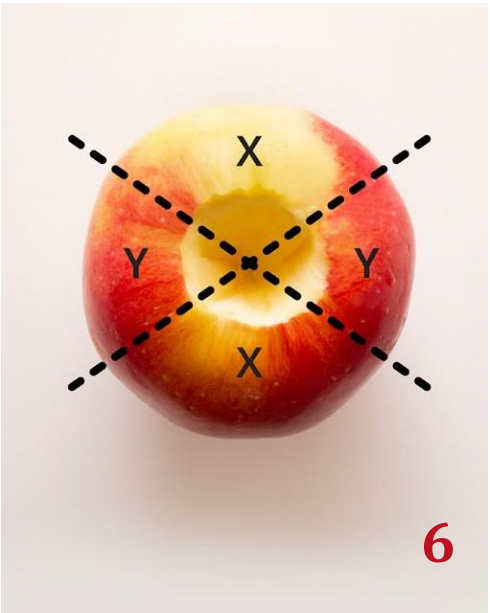

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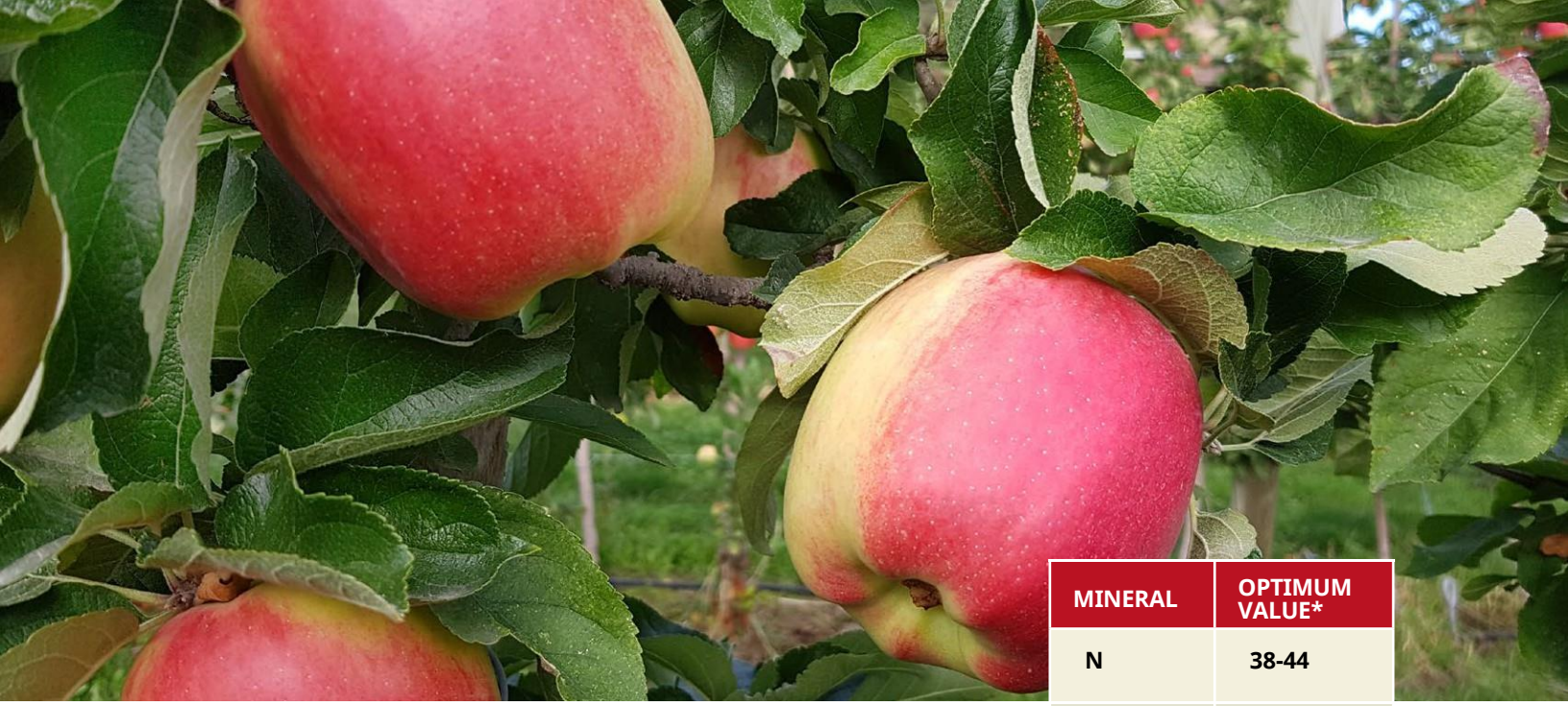

INTERPRETING the Sample

The minerals of most interest in an apple fruitlet mineral program are N, P, K, Ca, Mg and B. Although there have never been any consistent relationships between fruitlet Zn and quality or storage potential, Zn results for fruitlets are useful because orchards in BC tend toward Zn deficiencies.

Optimum values for Ambrosia fruitlets sampled six weeks before anticipated harvest are shown and expressed on a fresh weight basis.

Bear in mind that not all relationships are seen in all varieties. Also, within a given variety where a relationship is known to exist, it does not necessarily occur every year. For storage disorders, such as bitter pit, relationships are much more likely to occur in years when the incidence is moderate to high and less likely in years when the incidence is negligible.

Some leaf and fruitlet nutrients are correlated; i.e. when the level is high in the leaf, it is also generally high in the fruitlet or if low in one then low in the other. Boron is the most highly correlated nutrient between leaf and fruitlet followed closely by N. Leaf and fruitlet P are moderately correlated. Leaf and fruitlet K, Mn, Zn, Cu and Fe are slightly correlated in most years. Leaf and fruitlet Ca and Mg are poorly correlated.

To learn more about fruit and tree problems associated with either excessive or deficient fruitlet mineral concentrations in BC apple orchards, visit: http://www.bctfpg.ca/horticulture/fruit-tree-nutrition.

MINERAL	OPTIMUM VALUE*
N	38-44
N/Ca	<5.0
N/K	<0.35
P	11.0-14.0
P/N	>0.26
K	120-130
K/Ca	<15
Ca	>8.5
Mg	6.0-6.5
Mg/Ca	<0.8
B	0.28-0.35
B/Ca	0.03-0.04
Zn	>0.04

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BC TREE FRUITS