Scouting Haskap fields to investigate the nutritional needs of Haskap plants. By Bob Bors

The following is an excerpt from the project "Nutritional and soil requirements for propagating and growing Haskap plants" funded by royalties and the Saskatchewan Agriculture Development fund, #20140239. Photos are shown of the best and worst plants at a grower site followed by soil and leaf analysis and some discussion of the testing. In some cases, problems seem to be cause by soil deficiencies, but other cases may have other problems.

Description of the Orchard survey

Growers were invited to participate in this survey through our website (www.fruit.usask.ca), Dr. Bors mentioned it during meetings and seminars, and some growers were contacted through phone or email.

Leaf and soils samples were taken from healthy and unhealthy plants, with plant descriptions, vigour and health ratings (1 to 5 scale) and photographs. Soil and leaf samples were sent to ALS in Saskatoon. (ALS code for soils: Far-PKG4+Rec-SK) (ALS code for leaf analysis: PM1-AG-SK). The analysis covers; N, NO3, P, K, S, Ca, Mg, Cu, Fe, Mn, Zn, and B for leaf analysis. The soil test will cover the above except for Ca and Mg.

Fields were scouted for unhealthy and superior healthy plants. The goal was to sample the best and worst plants in an orchard. Sampling focused on individual plants rather than attempting soil samples for entire fields. Because haskap has a shallow root system, soil samples were taken from around the drip line of bushes at 0 to 12 inches deep. Leaf samples were taken from the same plants if that orchard was visited during the main part of the growing season (June to early August). Growers often participated in the survey of their orchards and many were aware of problem areas in their fields. Growers often only had two or three varieties in their orchards.

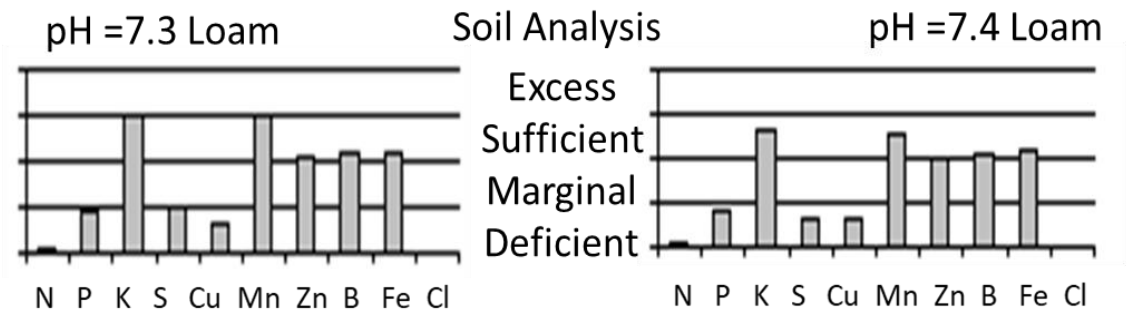
If an orchard was visited later in the season when plants were beginning to go dormant, it was deemed that leaf samples would not be worthwhile to take. Instead, additional soil (4 litres or so) was taken so that plants could be grown in that soil in a greenhouse and leaf samples taken at a later date. Dormant plants of Indigo Gem were grown in the soils with leaves harvested after a period of about 10 weeks, at which point the plants were no longer actively growing but had not yet started to go dormant.

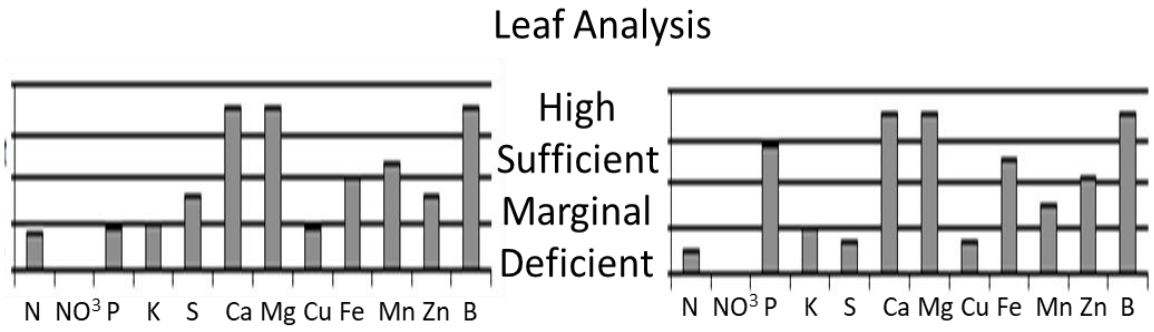
University haskap fields were also surveyed. Haskap is grown in 9 different fields each of which has a long history of use for various horticultural crops going back 90+ years. While soil texture is similar were different fertilizer regiments during the years. Also, University of Saskatchewan haskap project had tremendous amounts of genetic diversity since most of the fields are seedlings from the breeding and we have germplasm from around the world. Known varieties growing a different fields were often sampled. When unusual symptoms appeared on some plants they were also analyzed.

Case #1:

Best

Worst





Comments:

- Best plants were twice as tall as the worst
- Soil test: samples similar but slightly better for best plant
  - N levels in Soil test likely incorrect,
- Leaves
  - S & Mn higher in best plant's leaves
  - P is 3x higher in worst plant's leaves, doesn't fit with soil data

Discussion:

- The worst plants were much smaller than the best but the leaves didn't look much different. But plants were in the stage of changing colours for fall. Perhaps, had they been observed in the middle of the growing season leaf colours might've been different between the larger and smaller plants.
- This grower had clover as a groundcover between rows. Clover was regularly mowed to reduce competition between haskap plants and the clover. The grower had modified his mower to throw the cut clover into the base of the plants to serve as a mulch.
- A possible cause for having little or no nitrogen in the soil sample could be that samples were held too long before being taken to the testing facility. Some forms of nitrogen can evaporate. Also, nitrogen easily leaches from soil. If rain had been occurring in large amounts before the sample taken, nitrogen may have leached into deeper areas of the soil. In this project we were only measuring the upper foot of the soil which is where most haskap roots reside.
- The best plant was at least marginal in several areas while the worst plant was deficient in N, S, Cu.
- it is strange that phosphorus was so much higher in the worst plant's leaves.
- It was noted that the worst plants were in areas where clover would not grow. So perhaps the worst plant was not receiving any benefit of clover mulch and that may have been partly why nitrogen levels were a bit lower in the leaves.

Case #2

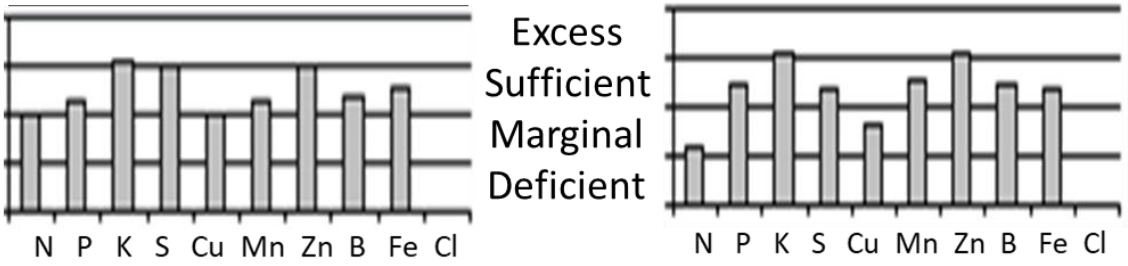
Best

The most vigourous plants in the survey, >5ft

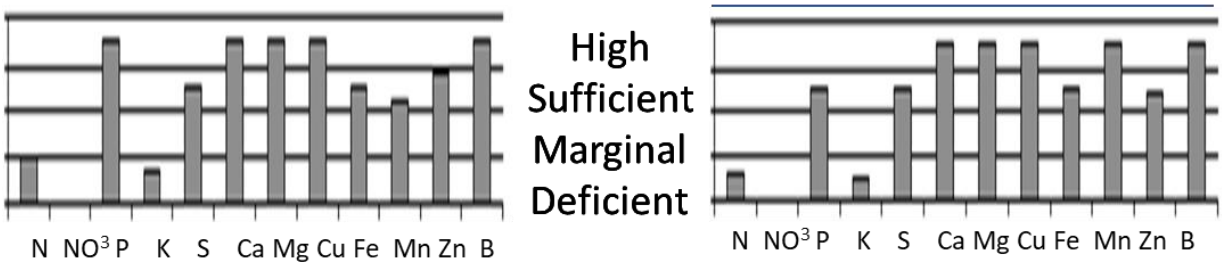
Worst

In a different area, heavily stunted but younger plants

pH = 7.0 Soil Analysis pH = 7.9



Leaf Analysis (on GH grown plants on field soil)



Comments:

- Soils: almost 2x N higher for best, other nutrients similar
- Better plant has much more P in leaves and slightly more N
- Best leaves are deficient for K but worst leaves deficient for N & K.
- Best plants are neutral pH but worst is alkaline

Discussion:

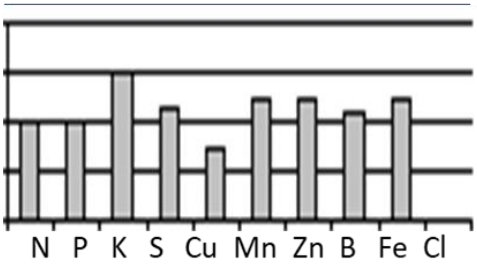
- The best plants were the tallest plants seen in the soil survey. The grower had obtained seedlings from the U of S plants during our earliest days of breeding. Quite likely, these were also the oldest plants surveyed and were about 12 years old. The grower was quite happy with the production of these plants.
- Unfortunately, we don't know the genetics of these plants but quite likely they are descendants from our better Russian varieties which are more vigourous than our first generation of varieties namely Tundra, Borealis, and the Indigo series. It may be that his younger plants are indigo series and would not be expected to be as tall but even so the younger plants stunted for their age even by Indigo series standards.
- At the time of visiting the grower there were no leaves for analysis so large soil samples were taken and plants were grown in the greenhouse for a couple months and that's how the leaf analysis was done.
- The best plants had much more nitrogen in the soil which resulted in more nitrogen in the leaves.
- There were dramatic differences in pH between the two soils with the neutral pH being the best.
- The best plants were sufficient for every nutrient.
- It was noted that the best plants were on the edge of the grower's backyard while the worst plants were much further from the house. Perhaps, the best plants were more regularly watered if the grower was watering his lawn?

Case #3:

Best

Worst

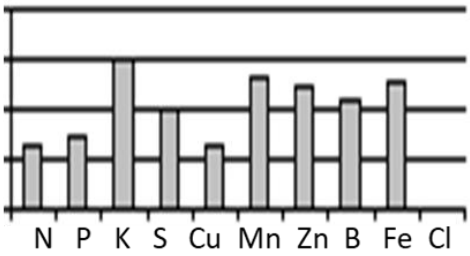
pH = 6.8 Loam



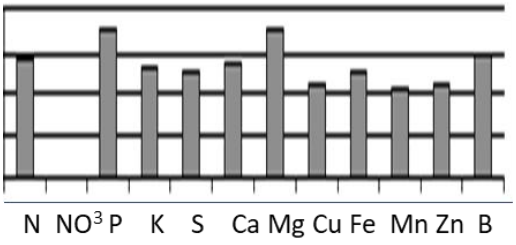
Soil Analysis

Excess
Sufficient
Marginal
Deficient

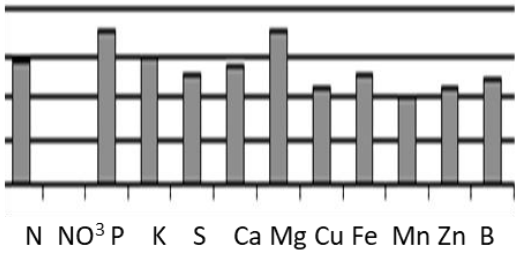
pH = 6.8 Loam



Leaf Analysis



High
Sufficient
Marginal
Deficient



Comments:

- Plants look similarly healthy
- But the best plants had lots of fruit and the worst plants didn't have much fruit

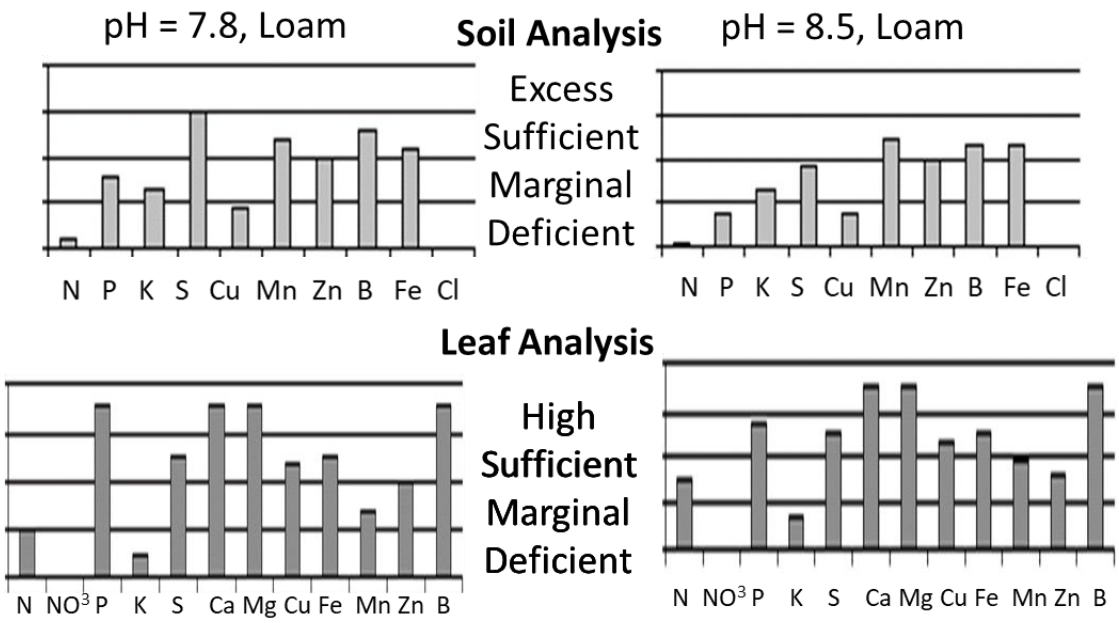
Discussion:

- This grower had the most vigourous two and three-year-old plants we had seen in the survey. All plants in the field looked great.
- the grower had been unable to obtain beehives for his plants. This made us wonder if it was poor pollination that caused the 'worst' plants to have no fruit or if possibly it might be that too much nitrogen could have caused plants to be more vegetative and less fruitful? In other crops like tomatoes too much nitrogen can drastically yield if plants go vegetative instead of reproductive.
- The grower fertilized his plants through the drip irrigation system. He had been using organic liquid fertilizer.
- Each row in his field was set up with intake valves such so he could do different fertilizers for each row in his field if he wanted. He had not yet started experimenting with different fertilizers.
- Results of the leaf analysis likely indicate that the best and worst plants are very similar quite likely it was just poor pollination that caused some of his plants to have poor fruit set.

Case #4:

Best

Worst



Field Notes:

- Both plants were Indigo Gem.
- The best plant looked healthy and was a hedge where all the indigo plants had grown together.
- The worst plant was small wimpy in a wet area with weeds. Leaf curl was common and most had brown edges.
- The best plant had better drainage. The worst plant was in a very muddy wet area. It was raining during the visit.

Discussion:

- Soil analysis showed similar levels of nutrients for both plants except for phosphorus which was higher in the worst plant's area.
- Both areas had loam soil.
- The worst plant had much higher pH 8.5 while the better plant at a pH of 7.8.
- The low nitrogen in the soils for both plants may have been caused by leaching during the rain. Leaf analysis indicates both plants were at least marginal for nitrogen levels.
- Leaf analysis showed the worst plant was deficient in potassium and the photo shows brown edges on leaves, which fits with general characteristics of potassium deficiencies.
- Close up of the worst plant (below) fits classic description of potash deficiencies. In this case the deficiency is caused by high pH combined with only marginal amounts of K in the soil.

Close up of leaves showing leaf edges burned. This commonly seen in many plant species as a symptom of potassium deficiency.

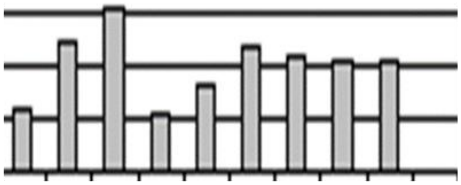
Case #5

Best

Good

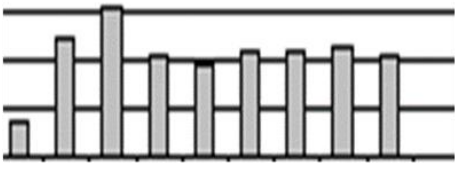
Soil Analysis

pH = 7.3, Sandy Loam

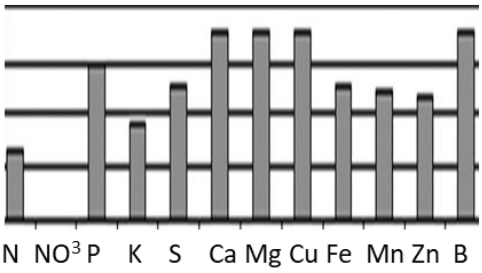


Excess
Sufficient
Marginal
Deficient

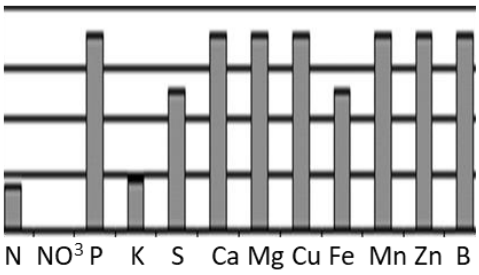
pH = 7.5, Sandy Loam



Leaf Analysis



High
Sufficient
Marginal
Deficient



Field Notes:

- all the plants at this farm looked pretty healthy
- plants were being fertilized through the irrigation system

- farm was hilly
- the grower was training the plants to have single trunks
- the larger plants listed as best were a season older, but seemed slightly better

Discussion:

- leaf analysis looked better for most levels of nutrients than the soil. Likely this was because of the fertilizer and run through irrigation in the sandy loam soil could have had some leaching.
- the better plants had higher amounts of N and K and their leaves
- The soil was closer to neutral than many soils in the survey. But plants still had problems with potassium uptake somewhat alkaline soil.

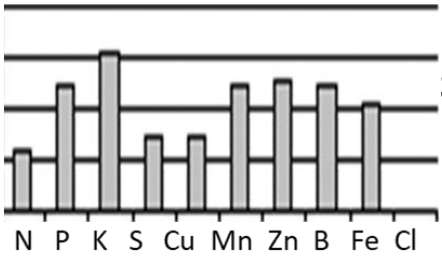
Case #6

Best

Worst

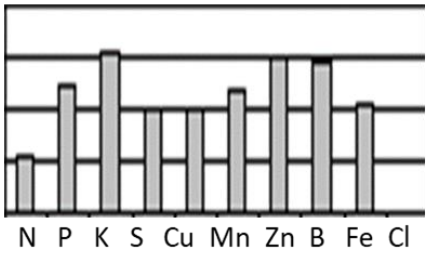
Soil Analysis

pH = 7.7, Sandy Loam

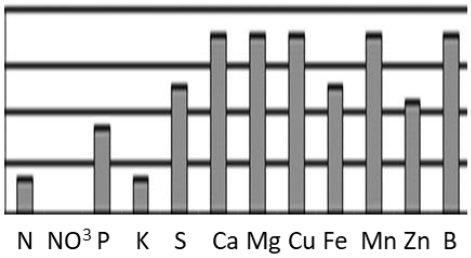


Excess
Sufficient
Marginal
Deficient

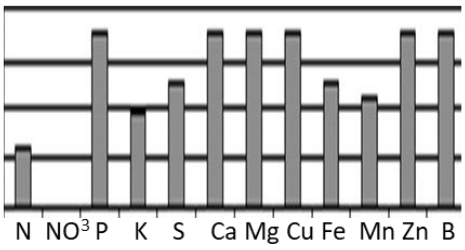
pH = 7.6, Sandy Loam



Leaf Analysis



High
Sufficient
Marginal
Deficient



Field Notes:

- the best plants were in an open area and were full-grown plants perhaps a decade old
    - various materials were being used to mulch the older plants
- the worst plants were in a shady area but the plants looked healthy
    - they were mulched with leaves

Discussion:

- soil and leaf analysis was slightly better for the worst plants
- shady conditions seem to be the main reason younger plants weren't as robust.

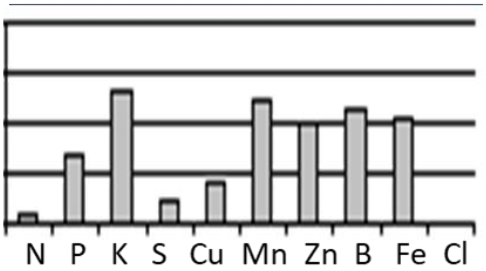
Case #7

Best

Worst

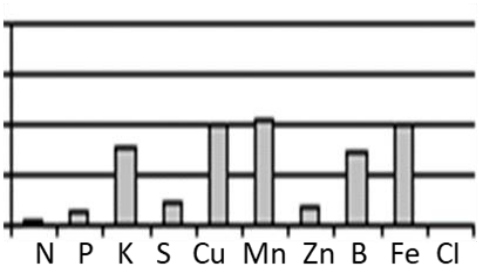
Soil Analysis

pH = 7.9 Sandy Loam

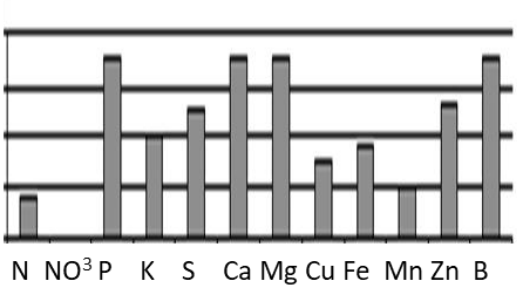


Excess
Sufficient
Marginal
Deficient

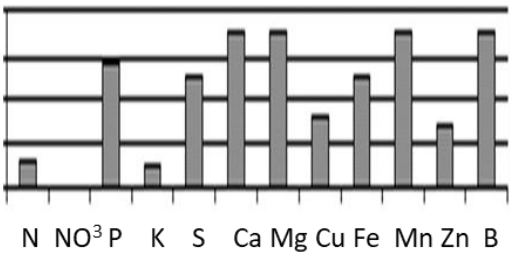
pH = 8.5, Clay Loam



Leaf Analysis



High
Sufficient
Marginal
Deficient



Field Notes:

- plants were in different fields not close to each other
- the worst plants were on a steeper slope and may have had some erosion
- the worst plants also had powdery mildew symptoms
- there had been much rain before the soil samples were taken

Discussion:

- soils were quite different between the two fields. They had different pHs, soil textures, and mineral amounts.
- It seems odd that leaf analysis looked much better than soil analysis. Perhaps the recent rain had leached more nutrients from the soil but the plants had captured nutrients earlier.
- The worst plants were severely lacking in N and K and were and soils with much higher pH.

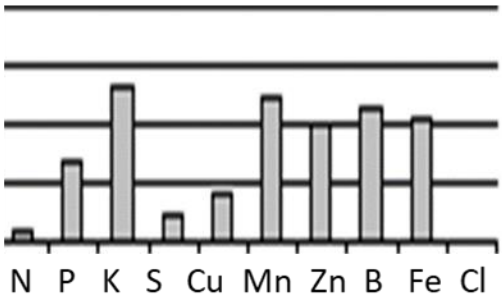
Case #8

Best

Worst

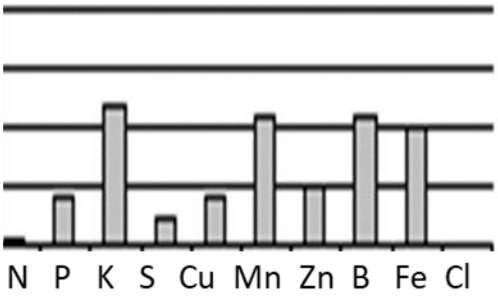
Soil Analysis

pH = 7.9, Sandy Loam

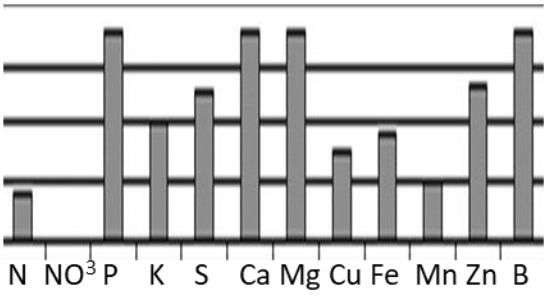


Excess
Sufficient
Marginal
Deficient

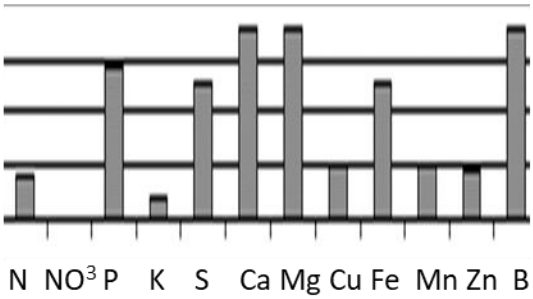
pH = 8.1, Loam



Leaf Analysis



High
Sufficient
Marginal
Deficient



Field Notes:

- this is from the same farm shown in case #7. The worst plants in this case is from a third field

Discussion:

- The best plants were slightly deficient in N.
- The worst plants results show a common scenario of high pH soils whereby leaf analysis shows C, Cu, Mn, and Zn are low. But it is odd that Fe was within an acceptable range. Perhaps the grower had done some foliar spraying with iron?

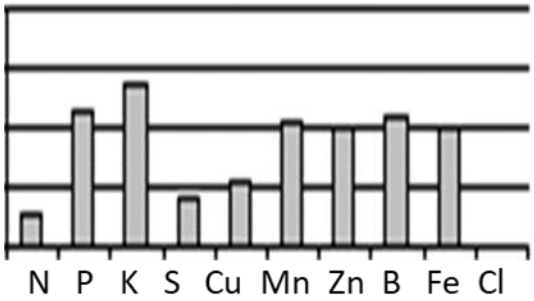
Case #9

Best

Worst

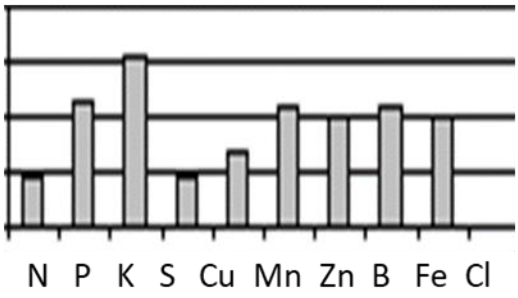
Soil Analysis

pH = 7.8, Loam

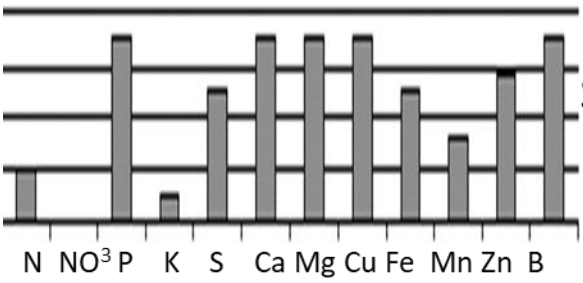


Excess
Sufficient
Marginal
Deficient

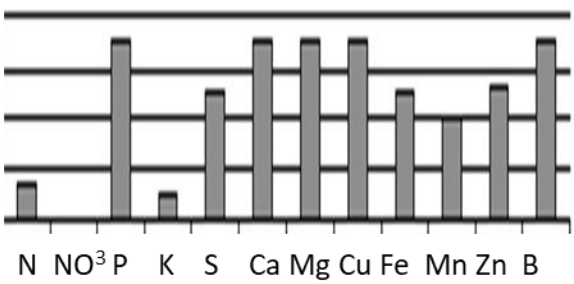
pH = 7.8, Loam



Leaf Analysis



High
Sufficient
Marginal
Deficient



Field Notes:

- Worst plants were much younger and many weeds were in that row.
- There were 5 plants that were dead in the same row as the worst plant
- Leaf analysis was done using the soil from this location to grow plants in the greenhouse.

Discussion:

- soils from the two locations were virtually identical
- when plants were growing the greenhouse from the soils there leaf analysis was very similar
- There does not seem to be a nutritional cause of the worst plants. Perhaps the worst plants were suffering from not being irrigated or weed pressure was high?

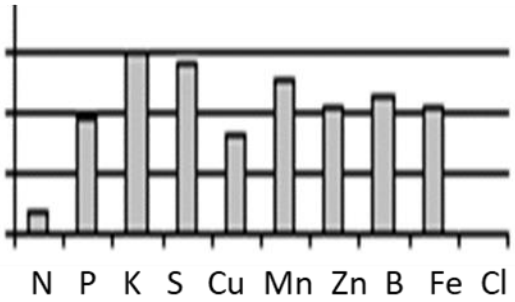
Case #10

Best

Worst

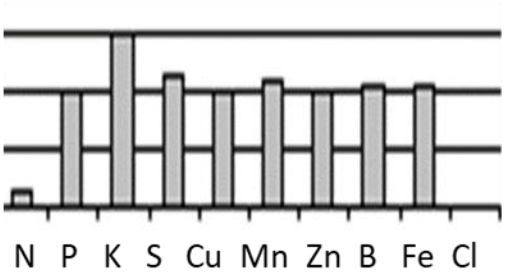
Soil Analysis

pH = 7.3, Clay Loam

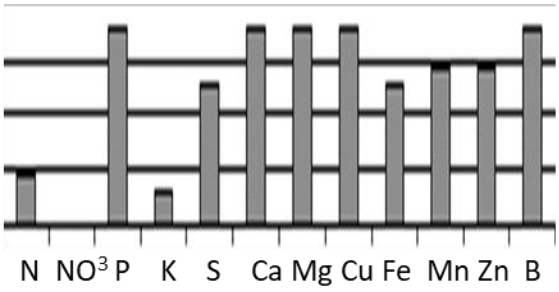


Excess
Sufficient
Marginal
Deficient

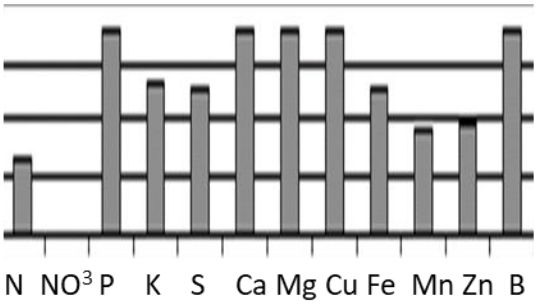
pH = 7.9, Clay Loam



Leaf Analysis



High
Sufficient
Marginal
Deficient



Field Notes:

- both plants were Russian varieties but it was unknown which varieties they were

- leaf analysis had to be done on plants grown in the greenhouse

Discussion:

- both soil tests show low levels of nitrogen
- the worst plant's soil had more N and K when new plants were grown in that soil
- it seems unlikely that poor nutrition was the cause of the worst plants being more stunted

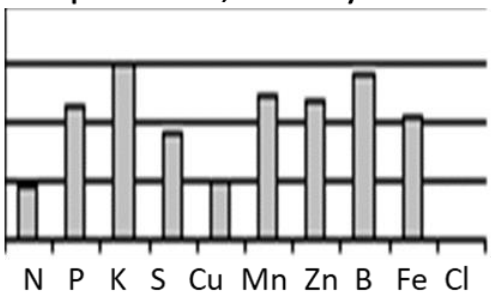
Case #11

Best

Worst

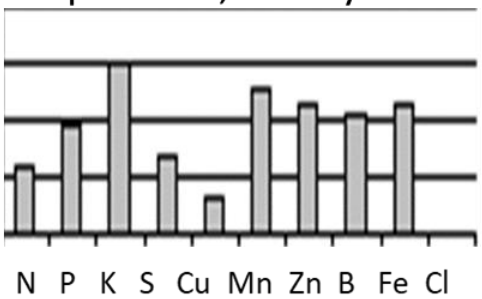
Soil Analysis

pH = 7.7, Loamy Sand

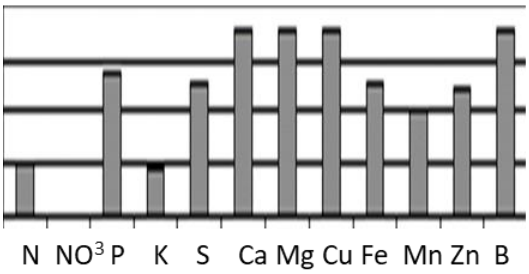


Excess
Sufficient
Marginal
Deficient

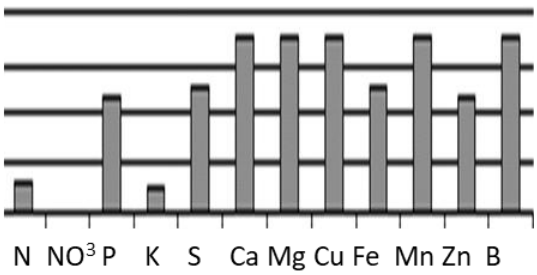
pH = 7.0, Loamy Sand



Leaf Analysis



High
Sufficient
Marginal
Deficient



Comments:

- Soils were sandy
- Best plants were at the bottom of a slope, worst plants at the top

Discussion:

- water availability could have been 1 of the factors involved since the top of the hill would have dried out a lot quicker than the base and any rainfall would've gone down the slope.
- The worst plants were highly deficient in N and K.
- Both soils had very high levels of K, but it is unexpected that the worse plant had a more neutral pH. Usually, deficiencies and K are associated with alkaline soils.

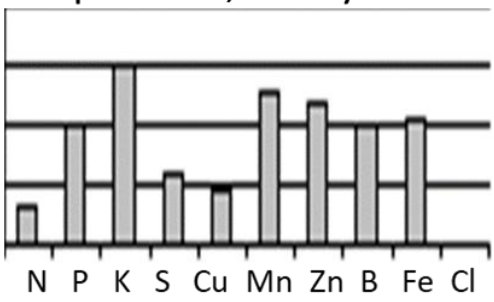
Case #12

Best

Worst

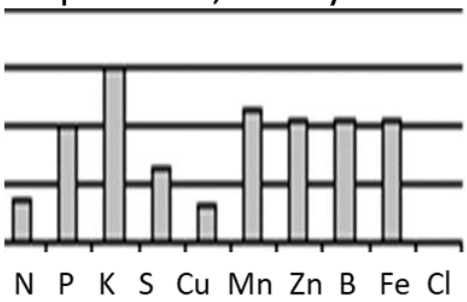
Soil Analysis

pH = 7.3, Sandy Loam

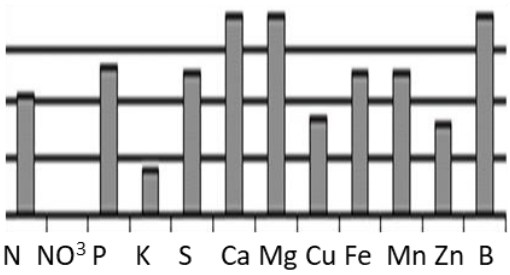


Excess
Sufficient
Marginal
Deficient

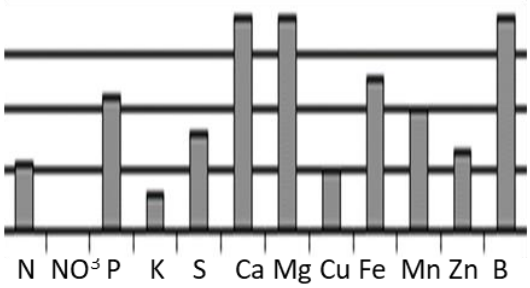
pH = 7.3, Sandy Loam



Leaf Analysis



High
Sufficient
Marginal
Deficient



Comments:

- The best plant looked green and healthy
- The worst plant had curled somewhat brown leaves symptomatic of mildew

Field Notes:

- the best plant was the variety tundra
- the worst plant was a pollinator. Growers didn't know the name but likely it was Berry blue as that was a common pollinator in that era.

Discussion:

- the best plant had almost twice as much nitrogen in its leaves compared to the worse plant
- the best plant had slightly more K and a lot more Cu.
- quite likely mildew was a major contributor to the appearance. Berry blue is much more susceptible to it than tundra
- Berry Blue is a much larger variety than tundra, perhaps the Berry blue plants needed higher levels of nutrients and then showed lower concentrations of N and K.

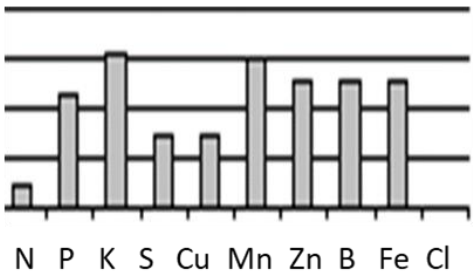
Case #13

Best

Worst

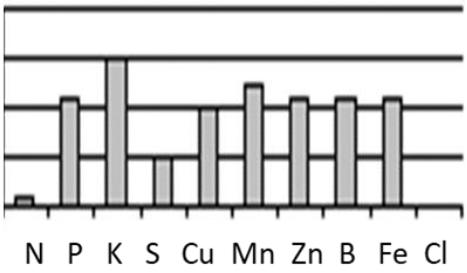
Soil Analysis

pH = 7.1, Loam

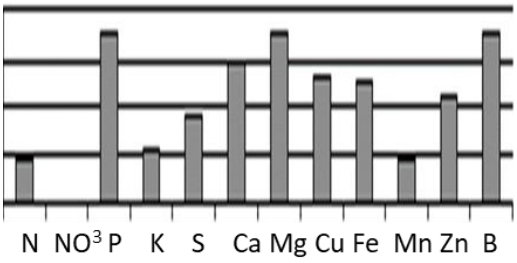


Excess
Sufficient
Marginal
Deficient

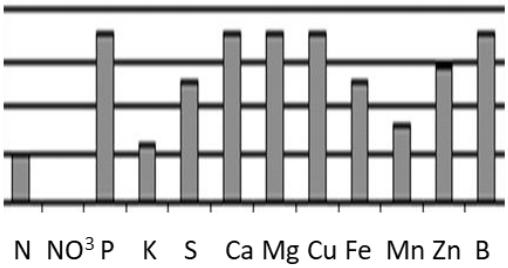
pH = 8.0, Clay Loam



Leaf Analysis



High
Sufficient
Marginal
Deficient



Comments:

- The best plant seem to be in a better drained area
- The worst plant was on the edge of a lower area where plants had died or were stunted

Field Notes:

- plants were about 5 years old seemed rather short for that age
- the main variety being grown was indigo gem which is known to be short

Discussion:

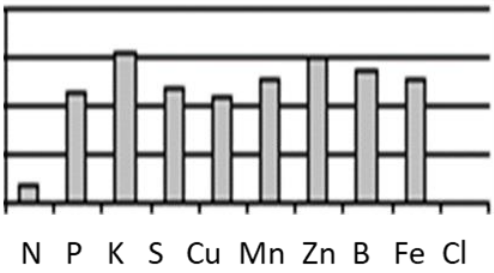
- nutritional analysis looks very similar for both soils and leaves
- the worse plant is at a much higher pH but that does not seem to have affected the mineral uptake
- worse plant has more clay in the soil
- quite likely it is water drainage this the major problem in the poor section of this field

Case #14

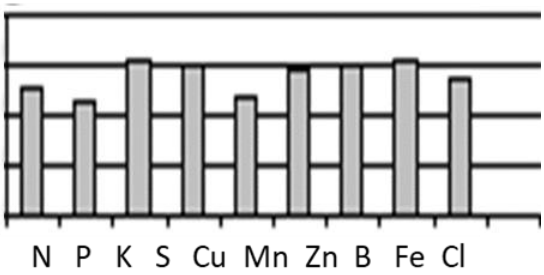
Best **Worst**

Soil Analysis

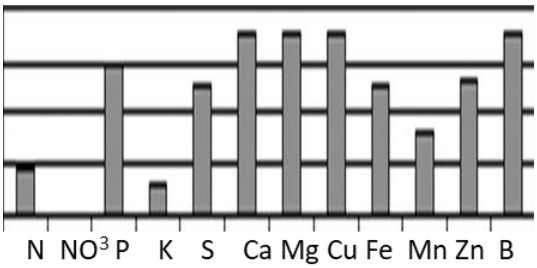
pH = 7.4, Loam

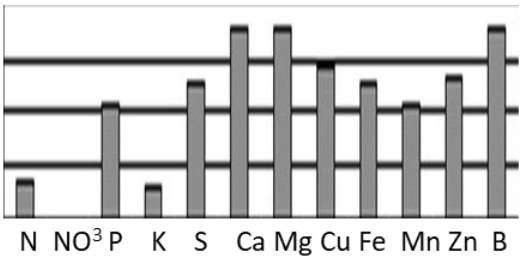


pH = 8.1, Loam



Leaf Analysis





Comments:

- The best plant was part of a variety trial where all plants looked fairly healthy
- The worst area was said to be saline. Soil was sampled for plants to be grown in the greenhouse

- Field Notes: the soil collected from the worst site was on the edge of a sluice it would have been poor drainage

Discussion:

- the soil analysis showed that the worst site was indeed severely saline
- however, plants were able to be grown in that soil and leaf testing done.
- Both the best plants and the saline area had similar nutritional analysis but the saline area also had much higher pH
- Unfortunately, notes were not taken on how the plants to in the greenhouse. That they grew at all may have been if the saline was leached out by being watered a couple times a week

Conclusion

The company that did the soils and leaf analysis for this project, no longer gives recommendations for how to amend soil. The various categories of levels of nutrition for each nutrient was most likely based on Apple research for which there have been many studies spanning decades.

More details on the soil and leaf tests are explained in the article “Examples of leaf deficiencies and conditions associated with high pH” on this website.