Fruit size and shape of haskap berries is an important factor in nutraceutical content, but more research is needed.

By Bob Bors

I was recently asked which haskap varieties are best for nutraceuticals and if wild haskap are the best. If someone asked me about that in person or on the phone I probably would spend 15 to 20 minutes talking about it. But the person asking was doing it through email. What follows is some theories that have not been tested (but seem logical) and some data from previous experiments.

Since most nutraceuticals are produced in the skins of the fruit, berries with more skin per weight are likely to have more nutraceuticals. If nutraceutical production is similar for all haskap skins, one would expect wild haskap to have much more nutraceuticals than cultivars.

I had never heard of any berry breeders or researchers trying to calculate the surface areas of their fruits and try to relate that information to nutraceutical content. The calculations presented below are intended to give an idea of surface area for small versus larger berries.

Calculations:

Assumptions and App used

Assume haskap are round (They come in many different shapes but are somewhat rounded).
If a haskap berry's density is similar to water than a cm^3 = 1gm. I substituted weight for volume in the calculations. I searched "Calculate surface area of a sphere" on google and used the app that came up first.

Wild Haskap

- A 0.2g wild berry would have a radius of 0.36 cm and a surface area of 1.63 cm^2
- It would require 5000 berries to have a kg of fruit
- For a kg of fruit there would be 5000 x 1.63 surface area of skins or <u>8150 cm^2 surface area</u>

Old Cultivars

- An old cultivar with a 1gm berry would have a radius of 0.62 cm and a surface area of 4.83 cm^2
- It would require 1000 berries to have a kg of fruit
- For a kg of fruit there would be 1000 x 4.83 surface area of skins or <u>4830 cm^2 surface area</u>

New cultivars

- A cultivar with a 2.5 gm berry would have a radius of 0.84 cm and a surface area of 8.87 cm^2
- It would require 400 berries to have a kg of fruit
- For a kg of fruit there would be 400 x 8.87 surface area of skins or <u>3548 cm^2 surface area</u>

Conclusion: Based on surface area alone, older cultivars and wild haskap should have 36% and 130% more nutraceuticals, respectively, than newer large fruited cultivars.

Other considerations

The biggest consideration that would alter the above calculations is that haskap comes in different shapes (see figure 1). They can be shaped like cylinders, spheres, hearts, surf boards, tear drops, and more. Some berries are smooth but some are lumpy. Lumpy ones would have more surface area. Skinny berries would have more surface area than fat berries if both weighed the same.

It would be easier to squish the pulp out of berries and weigh the skins to get a skin/pulp ratio rather than try to calculate surface area from such odd shapes.

Figure 1. Haskap comes in many different shapes. The above photo show haskap from the USASK breeding program. Each berry came from a different genotype. All berries are positioned the same way with stem end on the top.

Also, haskap has extra layers of skin). Within each berry are two smaller berries, with their own layer of skin (see figure 2). But it is not known how much each of these layers contribute to nutraceutical content.

Figure 2. A haskap berry cut open to reveal the two berries inside. The extra skins make may be partly why haskap produces more nutraceuticals than other berries. Varieties vary for how much air space there is within their berries. This particular berry has an unusually large amount of empty space.

If a grower or processor wanted to manufacture a nutraceutical product, one might consider sorting for fruit size and use the smaller ones for nutraceuticals and larger ones for food products.

The flesh of the berries seems to be more flavourful than the skins. Perhaps there could be some products that could be made from flesh with skins as a by-product for nutraceuticals.

When measured on a per gram of fruit basis, haskap selections were found to be variable in nutraceutical content (see figure 3). The best sample was 3 times better than the worst for anthocyanins. Unfortunately, that study was done without measuring size of the berries. Also, that

study was done before many of the newer varieties were released. Additional research is required to know the nutraceutical content of current varieties.

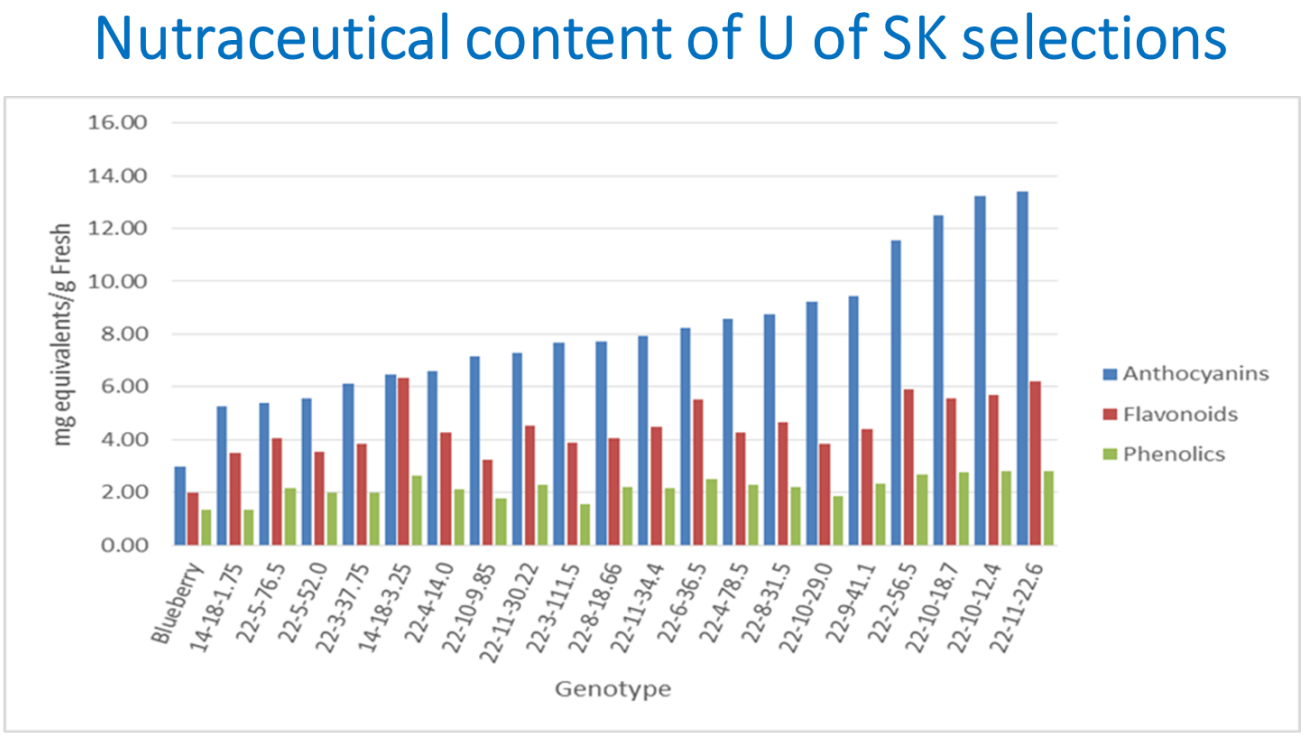

Figure 3. Some of our advanced selections were screened in 2012 by James Dawson. The general goal was to work out the techniques and to see how much variation was in our advanced selection. Full information on this research is in the final report ADF#20110039 (a link is available on the haskap page of the www.fruit.usask.ca website). The blueberry measured was a cultivated variety (not wild) bought at a grocery store. Perhaps if wild blueberries had been chosen, they might have been twice as good.

A logical way to investigate genetic ability to produce nutraceuticals would be to extract skins and measure that as well as total nutraceutical content per berry. It could very well be that some haskap skins are better than others for making nutraceuticals.

There is in fact a subspecies of haskap (called Stenantha) that has 5 times more phenolics than other cultivars tested (per James Dawson research). The big problem is that it has small berries that taste disgusting!

It seems doubtful that breeding for smaller berries would work out. We'd have to breed varieties that make more fruit but smaller ones in order to keep the same yield. If one was to make bigger bushes that make more berries, wouldn't it be better to have those bigger bushes have bigger fruit too?

We are hoping to do more nutraceutical screening of our own breeding lines and varieties by the 2019 growing season. We have a large trial of 30+ varieties from various breeding programs that will be producing fruit in 2 or 3 years that would also be worthwhile testing.