

# Breeding the Boreal Series of Haskap (*Lonicera caerulea*)

Bob BORS Department of Plant Sciences, University of Saskatchewan, SK

## ABSTRACT

The Boreal series of haskap varieties was created from a strategy to combine desirable attributes of germplasm from Russia, Japan and the Kuril islands. Selection for vigour and general health occurred in the greenhouse. Field evaluations 5 to 7 years later were made of thousands of seedlings of which 200 superior selections were analyzed for fruit qualities in the lab. Breeding with diverse genotypes resulted in many selections exceeding parental germplasm for various desirable characteristics. For example, average fruit weights of Boreal Blizzard and Boreal Beauty are greater than other cultivars and about twice as heavy as most cultivars. Boreal Blizzard has half the acidity of most Haskap varieties while Boreal Beast is the only cultivar that ripens in August in Saskatchewan. Boreal Beast was chosen as a pollinizer for the other two Boreal varieties as it had compatible pollen and bloom time largely overlapped. Its flavour ratings were among the highest over several years of evaluation. The strategy of intercrossing diverse germplasm is resulting in transgressive segregation from which breakthroughs in haskap breeding are occurring.

## Background

The U of SK first varieties (Tundra, Borealis and the Indigo Series) were hybrids between Russian and Kuril accessions. These varieties showed superior characteristics for fruit quality and size compared to their parents. But early breeding at the U of SK was limited to only 4 parents obtained in 1998 (1).

By 2008, much germplasm from Russia, Japan and the Kuril Islands had been collected and observed for several years with desirable and undesirable characteristics noted in general within each group (figure 1). By that time the program had over 20 named Russian varieties, 30 clones of Japanese selections, and several Kuril varieties (1,2,3).

The crossing strategy was to intercross the 3 groups of Haskap to incorporate desirable characteristics of the 3 groups. It was hoped that hybrid vigour might occur that might make some offspring superior to their parents (2, 3, 4).



## Material and Methods

From 2008 to 2010, 14 Russia cultivars, 6 Kuril selections and 88 Japanese selections were used as parents in 450 combinations of controlled crosses. A goal had been to create at least 50 seeds per cross. Crosses were done between the 3 groups (R x K, R x J, J x K) or with selections to result in hybrids that had all 3 groups.

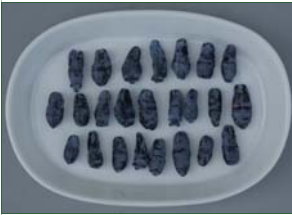
Seeds were germinated during winter and field planted in summer. Approximately 25% of seedlings were discarded that showed poor growth. An estimated 16,000 seedlings were planted at high density in a 4 acre area.

Seedlings were field evaluated when they reached 4 years of age or older. Superior plants were tagged throughout the growing season. The best of these had fruit harvested and evaluated in the lab. 26 (2012), 126 (2013) and 81 (2014) advanced selections were analyzed in the lab for various fruit characteristics. The Boreal series was selected from among these selections.

Important selection criteria (2, 3):

- Flavour
- fruit size
- Productivity
- suitability for machine harvesting
- later ripening time to extend the haskap season beyond previous cultivars

Figure 1. Fruits of Russian, Kuril and Japanese germplasm typical of the parents used in crosses from 2008 to 2010. They are depicted close to actual size on this poster along with general observations made previously about each group (2,3). Each berry is from a different accession. Each berry is arranged with the stem end facing up. Note: Several recent Russian and Japanese varieties tend to be much larger than these.



### Kuril varieties (below)

- oval, thick fruit
- ripen evenly
- ripen late
- hold on when ripe
- Ranged from 1.0 to 1.5 g/berry
- low productivity
- short sturdy bushes
- Mildew resistance



### Japanese Seedlings & Selections (above)

- oval or pointed fruits, thick
- ripen unevenly
- most ripen mid season
- hold on when ripe
- ranged from 1.25 to 1.75g/berry
- tall bushes
- productive

### Russian Varieties (above)

- long, thin, & flat
- ripen evenly
- ripen early
- fall off easily when ripe
- ranged from 0.6 to 1.1 g/berry
- tall bushes
- productive



## Results and discussion

**Fruit Size and Flavour** Among advanced selections it was fairly common to find fruit averages higher than any of the parents used in breeding (figure 2). A wide diversity in Sugar and acidity levels resulted in a wide range of Sugar : Acid ratios (figure 3) Many selections, including the Boreal series had long fruit length like Russian cultivars but wider girth like Kuril and Japanese germplasm (figure 4).

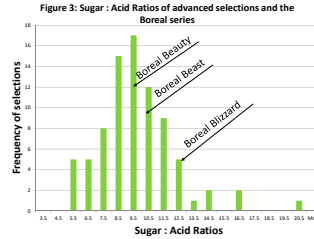
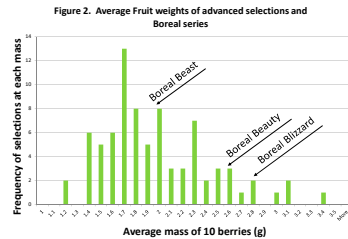


Figure 3. The Boreal series of haskap and important characteristics that led to naming and releasing them. Berries shown are close to actual size.



### Boreal Beast (below)

- J x (K x R) hybrid
- 2.0 g avg fruit wt.
- Very productive
- High flavour ratings
- Extended bloom period can pollinate both B. Blizzard and B. Beauty



### Boreal Beauty (above)

- JRK hybrid with open pollination involved
- 2.6 g average fruit with 3.7 g max
- 2<sup>nd</sup> heaviest fruit on the market
- Ripens 3 to 4 week after our previous varieties

### Boreal Blizzard (above)

- J x R hybrid
- 2.8 g average fruit weight, largest fruit of any haskap cultivar on the market
- 3.9 g max weight
- Low acid
- Ripens 1 week after previous U of SK cultivars



## Results and discussion continued

### Ripening Time

Among the seedling population it was common to find selections ripening at similar times to Russian and Japanese parents. But none of the advanced selection ripened as late as the last ripening Kuril selections. However, Boreal Beauty and 2 other selections ripened later than Japanese types and similar to some of the earlier Kuril types. Kuril types have very low productivity and are not viable options for commercial production. The late ripening characteristic of Boreal Beauty represents a breakthrough in late ripening for commercial cultivars.

### Yield

Yield was only evaluated by a visual rating system. It was observed that some bushes took on a weeping habit due to high fruit loads. Hybrids with Kuril lineage in their background tended to be more sturdy and less prone to weeping.

### Suitability for machine harvesting

Progress was made in this direction. The ability for fruit to hold on strongly was very common as was firm fruit and even ripening. The ability to hold onto fruit is particularly important for genotypes with heavier fruit. None of the heaviest fruit were oval in shape, but all had stretched and pointed berries. Previously it had been observed that oval berries handled better in sorting lines. Kuril germplasm in breeding often resulted in shorter plants that would be more difficult to harvest. But some of the RJK hybrids (like Boreal Beauty) possessed sturdy branches similar to Kuril parents but were not short.

### General Conclusions

Observations on breeding with haskap concurs with Gerbrandt (5) that transgressive segregation occurs for several important traits when using diverse germplasm for breeding. Progress is being made in bringing together desirable characteristics in new cultivars. The Boreal series not only extends the growing season of previous varieties but also possess many superior characteristics.



## REFERENCES

1. B. Bors and J. Thompson, 2009. Haskap Breeding & Production Final report, ADF Grant 2006-0140. Saskatchewan Agriculture. 60 pages.
2. B. Bors, 2009. Breeding of *Lonicera caerulea* L. for Saskatchewan and Canada. Proceedings of the 1<sup>st</sup> Virtual International Scientific Conference on *Lonicera caerulea* L. Sponsored by Russian Academy of Agricultural Sciences, Ministry of Agriculture, All-Russian Horticulture Michurin Institute. 13 pages.
3. B. Bors, P. Reimer, E. Sawchuk, R. Sawatzky, J. Dawson & E. Gerbrandt, 2012. Haskap Breeding and Production. Final Report. ADF Grant 2008-0042. 88 pages.
4. B. Bors, E. Sawchuk, P. Reimer, R. Sawatzky, T. Kaban, J. Dawson, and E. Gerbrandt, 2014. Breeding and selection of Haskap for nutritional and agronomic suitability, Final Report. Saskatchewan Agriculture ADF# 2011-0039. 85 pages.
5. E. Gerbrandt, 2017. Diversity of adaptation, agronomic potential and fruit quality of *Lonicera caerulea* L. PhD thesis, University of Saskatchewan. 380 Pages.

## Acknowledgements

This research was funded through the Agricultural Development Fund of Saskatchewan Agriculture and through Royalties paid by Propagators of U of SK fruit cultivars.

## Further information

Program Website: [www.fruit.usask.ca](http://www.fruit.usask.ca)  
 Grower website: [www.haskap.ca](http://www.haskap.ca)