

## **Highbush Blueberry Production in Quebec.**

Michel J Lareau, Producer  
291 Grand Pré, St-Jean-sur-Richelieu, J2Y 1J5  
Tel : 450 347-0219, e-mail : [mjlareau@sympatico.ca](mailto:mjlareau@sympatico.ca)

Before 1970, there was not more than 1 hectare of highbush blueberries in Quebec. Today, there are around 200 producers producing about 200 hectares.

Highbush blueberries are still a marginal production. The productivity is often affected by sudden and intense cold (under -30C). The crop needs are contrarily to other popular fruit productions, highbush blueberries need a light and acidic soil.

In the end, an investment of about \$30 000 per hectare is required to start planting. On a promising site, production will start after 3 years and will reach its optimum productivity only after 8 or 10 years. It is important to make the least possible errors at planting. Here are the base requirements.

### **Site Selection**

As the plant has a marginal hardiness, choose a site protected by the wind and with 125 to 145 frost free days. A side hill with a good drainage and cold air circulation are appropriate; good sites for apple production in the south of Quebec have similar characteristics.

Large accumulation of snow insures fruit buds protection, at least those found at the base of the plant. The use of an artificial or natural windbreak is beneficial for all in colder regions.

The presence of blueberries grown in the peat bogs of Quebec does not show that they have a tolerance to wet lands. Productivity will always be higher in well drained sites.

### **Soil Type Selection**

The ideal type of soil is sandy or gravelly, with a pH between 4,2 and 5,2, average fertility (phosphorus and potassium levels respectively at 200 and 400 kg/ha) and containing at least 5% of organic matter. Excess or deficiency in water may be disastrous, the soil must be well drained and have a good water holding capacity.

Avoid organic soils which stay cold in spring and release, when they drain, nitrogen late in the season, which can cause serious problems at freezing through lack of hardness to the cold.

A soil who doesn't meet those criteria could support a productive blueberry field by using acidifying products like sulphur, a sulphate basis fertilizer as well as an input of organic matter such as wood residue products, peat moss, etc. But the cost of these improvements may decrease the profitability of this production.

## **Soil Preparation**

As with all perennial crops, this step is the most important and often takes 2 years to accomplish.

*Drainage:* The water table should never be closer than 20 cm from the surface 24 hours after a big rain; in all the other periods, depth should be about 60 cm. In heavy soils and lack of sufficient slope, surface drainage may be improved by leveling. If in doubt, it is recommended to use raised-beds.

*Fertility:* Take soil analysis to insure an adequate fertility. Add missing elements, above all the phosphorus, to meet the needs in the roots area. Raspberry requirements in phosphorus, potassium and magnesium can be used as a guide.

*Organic matter:* Expensive, organic amendments are solutions for marginal soils, such as in heavy soils with a high pH and lack of moisture. A level of 5% of organic matter is a minimum. Because of its acidity, peat moss incorporated in the soil before planting is ideal.

*Acidity:* If require, soil has to be acidified one year before by incorporating sulphur to combat previous liming. The application rate may vary between 500 and 1500 kg/ha depending on the soil texture. It is impossible to acidify adequately a heavy soil with a natural high pH. Some soils may need to be limed (rare).

## **Plant Selection**

Choose plants at least 2 years old with a good root system and between 35 and 40 cm high. Ideally, use plants in pots, bare roots plants kept dormant can do well too. The price depends on number purchased, the size and the type (bare root or in pot). Plants in pots make maintenance easier in case of a delay in planting.

In Quebec, there is not any certification program for blueberry like there is for strawberry and raspberry. It is however possible to find some nurseries to supply plants of good sanitary quality. It is necessary to assure variety identification and good plant condition if they are in transit long.

Propagation by wood cutting or mound layering is possible but hard; not advised for producers wishing to start quickly.

### **Choice of cultivars (variety)**

High bush blueberries varieties of American origin are limited in hardiness. Some like Bluetta, Northland, Northblue and Patriot appeared to be a bit more rustic. Also, Bluejay, Berkeley, Bluejay and Bluecrop are already proven, at least in Southern Quebec. Duke, Draper, Reka, Spartan, St-Cloud, Polaris, Hardyblue and Chippewa are also promising. Finally, Nelson, Elliott and Bluegold would be interesting if a September harvest is desired.

Plant at least 3 different cultivars because of the pollination requirements. If pollinizers are well distributed, it is possible to plant 75% of the favourite cultivar. In colder areas, choose cultivars which are better when protected by snow. As well, early cultivars are better in cold. Table 1 below gives a summary of the principal characteristics of varieties available in Quebec.

### **Planting**

Planting is mostly done in the spring to make sure to keep roots moist, but without submerging them too long in water.

Put each plant in a shovel hole (or a furrow of a plough) just to the point that the root collar is just under the soil surface once the soil is packed down around the plant. Roots must be covered with 5 cm of soil. It is possible to plant through black plastic mulch. Always look at the advantages and disadvantages of this system before using it.

Keep a distance of 1 to 1,5 metre on the row and 2,4 to 3,7 m between the rows based on the equipment and the tractor. After planting, cut the flower buds (the biggest) located at the end of the stems. It may be profitable to cut those stems at the soil surface less vigorous but ramified and carrying the flower buds. The re-growth will be the best.

Wet the roots and the soil around the plants especially if plants are in pot or already bursted, it is very hard to remoisten again a soil or a dried sod through a drip line irrigation system.

## **Soil improvement and mulch**

Even if it represents additional costs, improving the soil with peat moss or decomposed saw dust is often essential to the establishment of a blueberry field. It increases the water and nutritional elements holding capacity and creates a modeling rooting medium for a quick growth at the roots.

To correctly prepare the soil in the rooting area, at first, it is better to make a trench and to fill it in with organic matter. After incorporation with a tiller is done, plantation is made in the amended soil. If no improvements have been made before planting and the organic matter is low, add between 15 and 25 litres/plant of wet peat moss to the soil to cover the roots.

As the decomposed saw dust is not always available, fresh material is often used with disastrous results. The use of additional nitrogen is absolutely necessary to reduce problems of nitrogen deficiency when fresh material is used. Improving the soil with peat moss can avoid problems as well this material has often an ideal pH for the blueberry.

As mulch, saw dust and other wood residues (wood shaving, chipped branches) are the best. We need a mulch of at least 10 cm thick on 1m wide all along the row. Ideally, added some at the end of each season helps to maintain the desired thickness and to balance the fertility. Mulch is not necessary if soil conditions are appropriate for the blueberry. On the other hand, it insures a certain control of annual weeds (but not perennial) and a better distribution of the irrigation water.

## **Irrigation**

After site and soil choice, irrigation is one of the most important factors that determine the success of a blueberry planting. Even with mulch, irrigation is absolutely necessary for blueberry production. Irrigation facilitate quick establishment of plants, allows the production of big fruit and insures the necessary growth for a plentiful harvest the next year.

Blueberry plant needs 3,0 cm of water per week during all the growing period and the drip line irrigation system is a better one for this type of plantation. Several systems and materials are available. Consult a specialized firm for more information.

## Fertilization

The young blueberry plant's mineral needs are easily met; we often injure it in over dosing. Under normal planting conditions (early May), apply 15g of ammonium sulphate (21-0-0) per plant around the start of June followed by a second application of 15 g by the end of June. Blueberries prefer nitrogen in the form of  $\text{NH}_4$ , predominant in acidic soils;  $\text{NO}_3$  may be harmful. Therefore if you prepare the soil before planting, it is not necessary to apply anything other than nitrogen in the planting year.

Low rates are often applied manually in small plantations; you can place fertilizer around the base but never closer to 30 cm from the crown of the plants. To optimize fertilizer usage, you can use fertigation or add low doses of fertilizer when irrigating. If not, make use of the rain or the sprinkler to get fertilizer quickly to the roots and incorporate as quickly as possible.

The table 2 below can be use as a nitrogen fertilization guide for the first years of establishment. Soil and/or leaves will have to be analyzed periodically in the following years to assure appropriate application of fertilizer.

If necessary, use a form of sulphate K (potassium) and Mg (magnesium) like Sulpomag. There is a risk of deficiency in iron if the pH is too high, correct deficiencies based on soil analysis. Finally deficiencies in nitrogen caused by use of fresh saw dust should be monitored.

**Table 2. Nitrogen fertilization with ammonium sulphate (21-0-0) according to the age and the development stage of the plant.**

Age of the plants	Quantity of 21-0-0 (in gram) per plant <sup>2</sup>			Total/year in kg/ha <sup>3</sup>
	Bursting	Fall of the petals	End of June	
Planting	-	15	15	65
1 year	15	15	20	110
2-3 years	20	30	30	175
4-5 years	35	35	35	230
6-7 years	40	40	40	265
8 years and +	45	45	45	300

<sup>1</sup> According to the requirements ( $\text{pH} < 5.0$ ), use urea with the appropriate modifications in the rates.

<sup>2</sup> One table spoon of 21-0-0 weigh 20 g.

<sup>3</sup> Plant about 2 200 plants/ha.

## Seeding Grass Paths

Grass seeding of paths is without a doubt a recommended practice. Grass reduces erosion, reduces weed invasion, increases the soil bearing capacity and improve the soil structure and water infiltration.

Blend of grass with a quick establishment without spreading into the rows are preferred like the fescue/bluegrass with a bit of ray grass. Pasture blends are often used because they are cheap. White clover included in several blends may be invasive. Seed very early in the spring or at the end of the summer at a rate of 30 to 50 kg/ha. Native crops can also give an adequate cover for the paths.

Mow the paths regularly to prevent invasion in the rows. Applying a herbicide along the paths can minimize invasion in the rows of the grass.

### **Weeding, diseases and insects**

An efficient weeding during the first years following the planting is essential to prevent envision of perennials, always more difficult to get rid of. Weeds take away nutrition and water that the plants need to ensure its quick growth. The choice of the herbicides that can be used the first year is limited. Manual weeding is necessary. Even later, it is often necessary to manually weed because rarely does herbicide assure a complete kill.

Problems of diseases or insects are unusual during the first years, however, it is important to know them. The “guide de protection du bleuetier en corymbe” from the CRAAQ is strictly necessary for whomever starts this production. For the organic producers, the “guide de culture biologique du bleuetier en corymbe” is also available to the CRAAQ.

### **Pruning**

Pruning is done at the end of the winter before bursting. Minimal pruning is required during the first 3 or 4 years after planting. All the stunted or too ramified stems have to be cut to the ground. To not delay growth, remove all of the flowers from the poorest plants and the plants with too many flowers, even during the 2<sup>nd</sup> year. Once the plant is growing, keep 2 new and well developed stems per year.

After the 4<sup>th</sup> year, there should be 7-8 stems on the cultivar that put forth the most suckers. After removing the damaged wood, make selective cuts on certain stems to promote a balanced development of the new stems, to facilitate the harvesting and subsequent pruning. Too many new stems from the same point on the crown may make their cut difficult when they will reach 2 cm of diameter.

Cultivars with open and nodding attitude are pruned to improve the erected and central stems (ex: Blueray). Those who tend to have too many stems concentrated in the middle are pruned to clear the middle for stems in outer edges of the bush (ex: Bluecrop). With bushing cultivars like Northland, remove the excess of branching too low to pick up and make more accessible the fruiting zone.

Usually, stems are renewed by cutting them to the ground every 7-8 years or before if they lack in vigour. This lack of vigour shows up when several short brushwoods giving small fruit appear. The best fruit appear on the 3-4 years vigorous stems. Note that it could favour selective pruning on some large main stems on cultivars such as Berkeley, Duke and Spartan because they sometimes produce few suckers.

If there is too much vigour but few productivity in spite of a low pruning, cut the nitrogen fertilizer. If there is a lack of vigour remove the poorest wood, make sure to have good fertility (pH, nitrogen and other elements, O.M.), of adequate input of water during the summer and of an adequate drainage. Choose cultivars that ripen early.

Extreme cold conditions may require modifications to the conventional pruning. If there is a good protection by the snow during the winter time, we can promote shorter fruiting stems. So, the stocky cultivars like Northblue, Northland, Bluetta and Patriot can be more easily protected. Pruning that clears the centre of the plant and promotes nodding stems may be considered to keep the fruiting wood low to insure protection by snow.

### **Harvesting and marketing**

The highbush blueberry gradually ripens its fruits during a period that can be spread to 5 weeks. For an optimum flavour, pick the fruit one week after the full blue coloration of the fruit. Then, space the following harvesting 7 to 10 days. The sale of not fully ripened fruit may give the impression that this type of blueberry gives a poorer fruit compare with the dwarf blueberry plant.

With a minimum of publicity, it is possible to consider a significant increase of the demand regardless of the imports from outside. Quebec highbush blueberries have a good eating quality and can bring a premium on the local market. Optimization of the selling price through the self-picking or the retail of a high quality product and a good proximity to a heavily populated area will surely appeal to the producer of this delectable fruit which the nutritional value has been repeatedly demonstrated.

### **Conclusion**

Highbush blueberry is a crop whose profitability is very uncertain mainly because of its lack of hardiness. It is however possible to consider its commercial cultivation for some restricted plantations on the most favorable sites. It's still an exotic fruit for which the conservation before and after harvesting is very positive for both the consumer and the producer who cannot afford losses like those often encountered in the strawberry or the raspberry's production.

So, those who can meet the basic requirements (site, soil, high investments), provide manual labour not always well paid and wait from 8 to 10 years before to reach their maximal productivity, will benefit from the longevity (20 years and more on the good sites) of that crop.

## **References**

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Bleuet en corymbe, Guide de protection. Publication VU-074  
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**Table 1. Characteristics of the best highbush blueberry cultivars for the Quebec<sup>a,b</sup>**

Variety	Season	Hardiness	Yield in Quebec	Need for pruning	Fruit's characteristics				
					Size	Colour	Scar	Hardness	Flavour
Bluetta	1	5	4	3	3	2	2	3	3
Duke	2	4	4-5	3-5	4	3	5	5	5
Polaris	2	4-5	2	3	2-3	4	5	4	5
Reka	2	4	4	3	3-4	3	4	4	4
St.Cloud	2	4	3? <sup>c</sup>	3	4	2	3	3	5
Spartan	2	2	3	5	5	5	3	2	4
Hardyblue	3	3	3-4	3	2-3	2	3	4	4
Northblue	3	5	3	2	3-4	1	2	1	3
Northland	3	5	5	1	2	4	3	3	4
Chippewa	3	3	2	2	2	5	4	3	4
Patriot	3	4	4	3	3-5	3	4	3	3
Blueray	4	4	4-5	3	4	3	3	4	5
Bluejay	4	3	3-4	4	3	5	5	5	3
Berkeley	4	2	3	5	5	4	2	4	3
Bluecrop	4	3	4	4	4	4	5	5	4
Nelson*	5	4	3	3	5	4	5	4	4
Bluegold	5	3	4	2	3	4	5	4	3
Elliott	5	3	3	4	3	5	5	5	3-4

<sup>a</sup> Except for « Season » et « Colour », the number generally reflects the desirability. **Season** (1-5, early to late); **Hardiness** (1-5, not very rustic to very rustic); **Yield** (1-5, low to high); **Need for pruning** (1-5, high to low); **Size** (1-5, small to big); **Colour** (1-5, dark to pale); **Scar** (1-5, big to small); **Hardness** (1-5, soft to hard); **Flavour** (1-5, tasteless to tasty).

<sup>b</sup> Some significant regional differences in the behaviour of cultivars. Check the descriptions in the text for precisions about this.

<sup>c</sup> Actually, not known enough in Quebec.