

# The Arctic bramble (*Rubus arcticus* L.) – the most profitable wild berry in Estonia

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This article presents an overview of the distribution and cultivation of one particular wild Nordic berry – the Arctic bramble (*Rubus arcticus* L.). Tests carried out at the Estonian Agricultural University in 1995 showed that the arctic bramble grows and produces fruit very well in fields. It produces a yield of 20-99 g/m<sup>2</sup> or 194-833 kg/ha. However, the natural Estonian arctic bramble is in danger of becoming extinct in the wild (in the forests of Kaansoo) and therefore the cultivation of this rare local species is necessary. On the basis of the results of two years of tests, we can say that the cultivation of the arctic bramble would enable one endangered species of wild berry to be preserved. At the same time, the profitability of smallholdings would dramatically increase.

**Key words:** wild berry, *Rubus arcticus*, profitability, vegetative growth, yield.

## Introduction

Current economic policies in the Republic of Estonia force those who wish to compete better in both the domestic and foreign markets to look for new possibilities and solutions. One possibility for the secondary utilisation of forests to have emerged in Estonia in recent years is the picking and cultivating of wild berries. In 1996 total exports of frozen wild berries amounted to 14.1 million Estonian kroons (1 million USD) and exports of fresh wild berries to 55 million kroons (3.9 million USD) (Pill, 1997). Bilberries, cowberries and cranberries are well known throughout the world but much less is known about the Arctic bramble (*Rubus Arcticus* L.).

The Arctic bramble is a herbaceous plant belonging to the rosaceous taxonomic family (*Rosaceae* L.). This species has gained attention due to its particularly aromatic and tasty fruit. According to H. Kokko et al (1993) and Ü. Reier (1982), both E. Lönnrot and C. Linnaeus are said to have claimed that the Arctic bramble is the best of all the wild berries to be found in Europe in terms of its taste and aroma and that the best wines ever to have been produced in Scandinavia were made from it. The Arctic bramble is widely known in Finland where it has now become somewhat of a

delicacy and where foodstuffs including it have quite a high price. One kilogram of Arctic brambles costs 11-18 USD in Finland. The constant increase in demand and the irregular yield of the berry in forests have led to its being cultivated. The varieties “Mesma” and “Mespi” have been produced in Finland through natural cloning, and the crossing of these two varieties has produced a third – “Pima”. After Ü. Reier (1982) regular calls to cultivate the Arctic bramble have also been made in Russia over the last 120 years. More serious cultivation attempts have been made by M. Freidling and E. Tsernova in Karelia.

The Arctic bramble in Estonia is a relic of the period of damp and cool subArctic climatic conditions (approximately 10,000 BC). It has been a protected species since 1958 and was included on a red page of “The Estonian Soviet Socialist Republic Red Data Book”. No attempts to cultivate it in Estonia have yet been made. As this rare and very precious species is in danger of extinction in the wild it needs to be cultivated. The objective of this research was to find out the behaviour of a clone of the natural Estonian Arctic bramble under cultivation. Observations have also been carried out in Kaansoo, the location of the only permanent habitat of Arctic brambles in Estonia.

## The distribution and habitats of the Arctic bramble

The Arctic bramble can be found in the Northern hemisphere on areas with cool temperate zone climate. Ü. Reier (1982) has shown that the northernmost point is situated on the Taymyr Peninsula (73 30'N) and the southernmost on Iturup in the Kuril Islands (45 N). The best Eurasian location for the Arctic bramble is between 62 N and 66 N.

Estonia is situated on the southern boundary of the Arctic bramble's area of distribution, or even outside it. The well-known Estonian researcher of Arctic brambles, K. Eichwald (1959), believes that there are three types of habitats in Estonia: a) permanent habitats; b) short-term habitats, to which the species may have been carried by birds and from where it disappeared again some time afterwards due to the lack of suitable growing conditions; c) habitats located on areas which have become unsuitable due to human activities and have been destroyed by them.

K. Jaaniste (1991) has provided data which shows that the Arctic bramble is to be found in Tooma, Lahemaa National Park, Viimsi and Kaansoo. As to the habitat in Tooma, there is a suspicion that it is not a natural habitat. It is situated on the banks of Lake Kaasikjärv in a much frequented location and consists of only odd plants, yet it has remained there for years. The habitat in Lahemaa was only discovered in 1975. It is in a satisfactory condition because it is located in a protected area and access is difficult. The Viimsi habitat was discovered in 1976. It is not in a particularly favourable location as it is too close to some summer cottages. However, despite this the plants are quite vigorous (Jaaniste, 1991). The only one of the habitats which seems to have been formed as a result of the period of subarctic climatic conditions is Kaansoo. This is shown to be the case by the fact that the specific epiphyte *Phragmidium Arcticum* Lager. is only found there.

After K. Eichwald (1958) there are three types of Arctic bramble habitats in Estonia:

- Marshy meadows or marshy areas covered with scattered trees, the areas having been affected by human activity, or areas of undergrowth which have become marshy. These are the best habitats for the Arctic bramble.
- Mixed forests which have become marshy. The Arctic bramble grows here in sparse areas. It does not normally produce fruit in a forest.
- Areas considerably affected by human activity (the edges of ditches, roadsides, baulks).

It has been found that the Arctic bramble has a tendency towards apophysis (human activity helps its distribution) but this is only true to a certain extent. The number of Arctic brambles in Estonia has been constantly falling and this shows the plant's tendency to die out gradually. The main reason for this has been the draining of its habitat areas (Kukk, 1989). Changes in ecological conditions have brought about the flourishing of herbaceous plants, as a result of which the Arctic bramble is left in the shade and then driven out. It may be shaded by either a tree layer or a herbaceous layer. The main trees creating the shade in forests and undergrowth are the spruce, pine, dwarf birch, grey alder, aspen and various willows. In more or less densely meadowed areas the main plants driving the Arctic bramble out are tall and dense suffrutescent Gramineae and sedges (Reier, 1982). E. Kuldkepp (1972) has said that one of the reasons for the gradual dying out of the Arctic bramble is precisely the onward march of undergrowth, as former forest meadows are no longer mown. In Finland it is believed that another factor impeding the spread of the Arctic bramble is the reduction in the number of large forest fires. Such fires led to the destruction of a considerable number of trees and the Arctic bramble therefore found itself with more favourable conditions for growth (Tammisalo, 1988).

On the basis of the above-mentioned and as a result of the observations carried out by the authors it can be said that the fruit of the Arctic bramble will not be obtained naturally in Estonia any more. It is for this reason that we consider it necessary to preserve such a valuable endangered species. Our experiences so far have shown that the Arctic bramble is also capable of successful growth in fields.

## Cultivation of the Arctic bramble

In accordance with agricultural techniques worked out in Finland, the cultivation of the Arctic bramble is very similar to that of the strawberry. The best conditions for the growth are considered to be mineral soil containing humus but the Arctic bramble will also grow in clayey soil. Before planting, a dose of 4-8 kg/100m<sup>2</sup> of Puutarha Y2 fertiliser should be administered (11% N, 11% P<sub>2</sub>O<sub>5</sub>, 22% K<sub>2</sub>O). The requirements for liming depend on the area of cultivation. An important fact to bear in mind is that optimum soil acidity for the growth of the Arctic bramble is pH 4-5.5 (Eichwald, 1959; Kokko et al, 1993). After two years a further 3-4 kg/100m<sup>2</sup> of Puutarha Y2 fertiliser should be added.

The Arctic brambles are planted in beds with plastic mulches as if they were strawberries. They are planted at intervals of 25-30 cm. The Arctic bramble is self-sterile and therefore at least two varieties or clones should be planted alternately in each bed. This will guarantee the best possible conditions for pollination. The plant may also be grown in a bed without plastic but this would arise difficulties in keeping the area free from weeds (Ryyänen, Dalman, 1983; Hiirsalmi, 1989).

The Arctic bramble plantation will begin to bear fruit in the second year of the growth. The best years are generally considered to be the third and fourth years and the plantation as a whole will have a lifetime of 5-6 years. The harvesting period is relatively long (2 months) because the berries ripen only gradually. The fruit of the Arctic bramble is very small, on average 1.0g. One person can therefore manage to pick 0.8-2.0 kg per hour. The first berries ripen at the start of July and the last at the start of September. The yield of the Arctic bramble in the best years in Finland has been 40-60 kg/100m<sup>2</sup> (Mihkiev, 1988; Kokko et al, 1993).

The most common damaging factor is the mildew which causes the epiphyte *Peranospora rubi*, a member of the *Rubus* taxonomic family which induces disease. This mildew infects the leaves, shoots, flowers and fruit of the Arctic bramble. Reddish angular blotches appear on the infected leaves while the shoots, flowers and fruit dry up. This disease can lead to a considerable drop in the yield of the plantations (Parikka, 1996). Grey mould (*Botryotinia fukeliana*) has also been observed on Arctic brambles (Kokko et al, 1993). Not one preparation has yet been approved for overcoming fungal disease although research in this field has begun in Finland (Parikka, 1996).

In terms of viral diseases, raspberry bushy dwarf virus has been observed on Arctic brambles (Kokko et al, 1993; Karenlapi et al, 1995). It is similarly very little known about Arctic bramble pests. The stings of aphids and bugs, as well as traces of chewing, may be observed on the leaves and fruit. Other pests may include small beetles and insects (*Choleoptera Thysanoptera*) (Reier, 1982; Ryyänen, 1973; Kärenlapi et al, 1995).

## Material and methodology

This experimental research was initiated in spring 1995 in the experimental garden of the Institute of Horticulture of the Estonian Agricultural University in Tartu. The following varieties were used in the trials:

“Pima” is a variety of Finnish origin which was obtained by crossing the “Mespi” and “Mesma” varieties. It is considered to be one of the most fruitful varieties (16.0-32.5 kg/100m<sup>2</sup>) in Finland (Ryyänen, Dalman, 1983). In this particular trial “Pima” has been used as the control variety.

“Mespi” is also a Finnish variety. It is a natural clone which was found as a result of comparison tests. The yield of “Mespi” (9.8-16.5 kg/100m<sup>2</sup>) is less than that of “Pima” but it is also widely used in Finland (Ryyänen, Dalman, 1983).

Clones 033, 039, 004 and 077 are of Finnish origin and were brought into use as prospective clones.

The natural Estonian Arctic bramble clone is from Kaansoo. It will henceforth be referred as “Kaansoo”. Permission was received from the Ministry of the Environment to use this particular protected species in the trials.

Four examples of each variety were used in the trial. The size of each experimental plot was 1 m<sup>2</sup> and they were separated with boards which extended into the soil to a depth of 30 cm. This was necessary to prevent the different varieties becoming mixed, as the Arctic bramble is spread very quickly by rhizomes. Three plants were planted at 36 cm intervals in each experimental plot.

In order to assess the vitality and development of the plants, the height of the plant (in cm) and the number of shoots in the experimental plot (1 m<sup>2</sup>) were measured in both of the first two years of the growth. The berry harvest was collected in the second year, usually once a week.

## Results and discussion

The height of the Arctic bramble plant depends on its growth conditions. In natural growth conditions, the height of the shoot may be 10-40cm (Reier, 1982). The height of the plants at the end of the first year of the growth was 3.7-8.8cm (Table 1). The Kaansoo Arctic bramble grew to be considerably taller than the control variety. In the second year of growth the average height of the plant was 10.7-19.9cm (Table 1). Again Kaansoo grew to be taller than “Pima”.

The results from both years show that the Kaansoo Arctic bramble grows more rapidly than Finnish varieties and clones.

The formation of shoots shows the reproductive-ness of the clones, and this is important in obtaining plant material and in cultivation without plastic mulches (Karp, 1996).

**Table 1.** Plant height in 1995 and 1996

Variety	Plant height, cm			
	1995		1996	
	x	d	x	d
'Pima'	6.0	0	13,2	0
004	6.2	0.2	14.6	1.6
033	3.7	2.3	12.0	-1.2
Kaansoo	8.8	2.8*	19.9	6.7*
0.77	6.4	0.4	10.7	-2.5
'Mespi'	7.5	1.5	15.8	2.6
039	6.6	0.6	12.8	-0.4
LSD95%=2,4		LSD95%=3,1		

By autumn of the first year of the growth there was on average 11.0-38.2 shoots per 1m<sup>2</sup> (Table 2). The variety "Mespi" produced a considerably greater number of shoots. Finnish researchers have also noticed its reproductiveness (Kotilainen, 1989). By spring of the second year there was on average 44.0-207.8 shoots per 1m<sup>2</sup>, but by now it was the Kaansoo variety which was producing considerably more. Clone 033 produced noticeably less shoots. It can therefore be said that the Kaansoo variety showed greater reproductiveness in the second year of the growth.

**Table 2.** The number of shoots in 1995 and 1996

Variety	No. of shoots per m <sup>2</sup>			
	1995		1996	
	x	d	x	d
'Pima'	15	0	88	0
004	15	0	90	2
033	11	-4	44	-44*
Kaansoo	13	-2	208	120*
0.77	14	-1	61	-27
'Mespi'	38	23*	121	33
039	14	-1	70	-18
LSD95%=9		LSD95%=36		

The harvesting period for the Arctic bramble in Finland begins at the start of July and the last berries ripen in September, or in warm autumns even in October (Ryynänen, 1973). In these particular trials harvesting began on 4th July and lasted until 10th September. Berries were picked on a total of ten occasions. The peak of the harvesting period was in the second half of July. The average total yield in the first year was 20-99g/m<sup>2</sup> or 194-833kg/ha (Table 3). The Kaansoo variety produced a considerably higher yield. As the Kaansoo variety also had a greater number of shoots per 1m<sup>2</sup> it could be said that the yield depended on the number of shoots.

**Table 3.** Total yield in 1996

Variety	Yield,		
	g/m <sup>2</sup>		kg/ha
	x	d	
'Pima'	45	0	379,0
004	34	-11	286.0
033	34	-11	286.0
Kaansoo	99	54*	833.0
077	27	-18	227.0
'Mespi'	39	-6	328.0
039	20	-25	194.0
LSD95%=36			

**Profitability of cultivation the Arctic bramble**

The results of experiments and trials carried out over recent years have shown that berry growing could be a worthwhile and profitable alternative to traditional agricultural production in Estonia. Over the years, attempts have been made to grow many different varieties of berries in Estonia with the objective of finding new cultures which would be suited to the Estonian climate and which would help maintain and develop production in rural areas. These tests have shown that cultivation of the Arctic bramble in Estonian climatic conditions is profitable and that it does have good future prospects.

Over several decades, the Arctic bramble has been a very important raw material in the spirits and liqueur industry in the Scandinavian countries.

The results of the trials performed in Estonia and Finland clearly show that, in terms of cultivation technology and technique, growing Arctic brambles is a very similar process to growing strawberries.

Analysis of production expenditure also showed that the expenditure needed for cultivating Arctic brambles was comparable to that needed for cultivating strawberries.

In accordance with the literature used in this research, the production cycle of an Arctic bramble plantation lasts for six years (Kokko, 1992). Taking Estonian agro-climatic conditions into consideration it should be possible to obtain 3-4 harvests from any production plantation. Expenditure on plantation exploitation would increase after this time and it is therefore sensible to recultivate the old plantation and replace it with a new one. Taking the production process of Arctic bramble cultivation as the starting point, expenditure can be divided into four categories. First of all, pre-planting expenditure is considered. This involves

work to prepare the land both for production plantations and also mother plantations. Pre-planting expenditure has shown upon analysis to account for approx. 6% of total expenditure (Table 5).

In the second stage, expenses made at the time of planting are considered. This accounted for approx. 43% of the total.

Finnish and Estonian trials have indicated that the Arctic bramble grows well in plastic mulches, that using this form of cultivation technology enables expenditure on weed control to be reduced by 18%, and that the quality of the berries is good. The items which require the greatest expenditure during this period are the plastic mulch and the Arctic bramble planting material. It has been asserted that we would be able to reduce expenditure during the planting period if we could produce planting material for the production plantations ourselves (Table 4). However, it is certainly necessary to use disease-free planting material for the mother plantations. Taking into consideration the fact that 20 runners were obtained from 1m<sup>2</sup> during the trials, then a mother plantation with approximately 3,300 plants would be required for a production plantation of 1 ha. As a point of comparison, the

**Table 4.** Arctic bramble cultivation expenses in mother plantation in 1995

Expenses	standard expenses no, kg, l	time h	kg\USD, no\USD USD/h	total USD
<b>Expenses in mother plantations of 1400 m<sup>2</sup> with the planting scheme 1.2x0.35</b>				
<b>Pre-planting expenses for growing arctic brambles</b>				
Ploughing		1	8.57	8.6
Chemical weed control		1	8.57	8.6
Cultivation		0.5	8.57	4.3
Supplying mineral fertiliser		0.5	8.57	4.3
Fertilisers Y 2	70		0.42	29.4
Herbicides	0.7	12.3	8.6	
<b>Total</b>				<b>63.7</b>
<b>Expenses at the time of planting</b>				
Black plastic	49			0
Installing plastic		2	2.7	5.4
Rent of plastic machine		2.5	8.57	21.4
Arctic bramble plants	3392		2.35	7971.2
Planting		22	0.1	1.1
<b>Total</b>				<b>7999.1</b>
<b>Looking after the plants in mother plantations</b>				
Maintenance work		33		0
Cutting of runners		34	0.57	3255
Making root cuttings		24	1	1628
Other expenses				1500
<b>Total</b>				<b>4883</b>
<b>Total expenditure</b>				<b>12946</b>

**Table 5.** Expenses and income from the cultivation of Arctic brambles in 1996-1997

Variable expenses	Standard expenses no, kg, l\ha	Time h\ha	kg\USD, no\USD USD\h	1996 total USD\ha	1997 total USD\ha
<b>Pre-planting expenses for growing Arctic brambles</b>					
Ploughing		3	8.57	25.71	0
Chemical weed control		4	8.57	34.28	0
Cultivation		2	8.57	17.14	0
Supplying mineral fertilisers		2	8.57	17.14	0
Fertilisers Y 2	500		0.42	210	0
Herbicides	5		12.28	61.4	0
<b>Total</b>				<b>365.67</b>	<b>0</b>
<b>Expenses at the time of planting</b>					
Black plastic	350		2.68	937.3	0
Installing plastic		8	8.57	68.6	0
Rent of plastic machine		12	2.4	28.6	0
Arctic bramble plants	23738		0.05	1186.9	0
Planting		210	1.14	239.82	0
<b>Total</b>				<b>2461</b>	<b>0</b>
<b>Looking after the plants in production plantations</b>					
Maintenance work		158	0.57	90.06	131
Additional planting		17	1	17	25
Cutting of runners		36		186	271
Making root cuttings		23	1.14	26.22	38
Spraying plants with fungicides		4	8.57	34.28	50
Fungicides and insecticides		2.5	24	60.7	133.5
<b>Total</b>				<b>319</b>	<b>649</b>
Land tax	1.20%		0	8.57	0
<b>1st year of harvest</b>					
<b>Expenses of harvesting and selling the yield</b>					
Harvesting the yield		72	9.5	684	684
Freezing				914	0
Electricity				28	45
Transporting berries to Finland				714	714.3
Other expenses				150	219
<b>Total</b>				<b>2490.6</b>	<b>1662.1</b>
<b>Combined expenses for year 1 and 2</b>				<b>5645</b>	<b>2311</b>
Payment made for arctic brambles in Finland			14.3	USD/ha	
Yield t	0.7		10000	USD/ha	10000
<b>Net income</b>			<b>4355</b>	<b>USD/ha</b>	<b>7689</b>

price of a healthy Arctic bramble plant is 0.42 USD whilst the price of a runner from a mother plantation is 0.05 USD. There is an eightfold price difference when compared to healthy plant material.

During the period of the growth and development of the plants it is certainly necessary to maintain the plantation and remove any new runners. Resources are required for this maintenance work but they amount to only some 5.6% of the total expenditure.

The requirement for expenses increases in the harvesting period when the berries are ripe. The berry of

the Arctic bramble is small and this complicates the harvesting procedure. Research has shown that one person (with average harvesting capacity) is capable of picking approximately 9.8 kg of berries a day. It has been proved that the average yield of the Arctic bramble is 700-1200 kg/ha. Therefore, in the case of a yield of 700 kg of berries, harvesting will take 72 hours. A survey of Arctic bramble growers showed that they paid the pickers on average 1 USD/kg. Expenditure made on wages for harvesting the entire 1 ha field on average was 714.2 USD. The berry of the Arctic bramble is very fragile and it consequently must be refrigerated very quickly and then transported to the wholesaler, processor or final consumer.

It would be practical for berry growers to have their own refrigerators or to use the services of a refrigerating plant for that purpose. Finland has been the main importer of the Arctic bramble and the industries there pay around 14.2 USD for one kilogram of berries. It is therefore possible to receive an income of 10,000 USD/ha in a year. The net income from the first year of harvest would be 4350 USD. Expenses fall in the second year and the net income would increase by around 57% over the first year. However, new investments must be made during the second year in a new plantation. The growing of Arctic brambles has hitherto proved to be the most efficient in Estonian conditions. The Arctic bramble is a profitable type of berry with good future prospects. Agro-technical experiments and experiments comparing varieties should be expanded and deepened in the future in order to find even better possibilities for efficient production.

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**ПОЛЕНИКА – САМАЯ ЦЕННАЯ ЯГОДА В ЭСТОНИИ**

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*Резюме*

В статье приводится краткий обзор о распространении и культивации лесной ягоды Северного полюса – поленики (*Rubus arcticus* L.). Из результатов опыта, проведенного в 1995 г. в Институте садоводства при Эстонском Сельскохозяйственном Университете, выяснилось, что поленика растет и плодоносит в культуре при полевых условий хорошо и дает урожай 20...90 г/м<sup>2</sup> или 194...833 кг/га. В диких природных условиях в болотистых лесах Каансоо (Западная Эстония) поленике грозит вымирание, поэтому необходимо сохранение этого редкого лесного вида. Ягоды поленики являются важным и дорогим артикулом во внешней торговле их следует выращивать в культуре.

**Ключевые слова:** лесная ягода, *Rubus arcticus*, вегетативный рост, урожай, доходность.