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Bioactive berry crops

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Table 1. Mean values of the studied parameters after 1 (1 m) and 2 months (2 m) of aroniia extract therapy in patients with MS.

Parameter	At baseline	After 1 m	After 2 m	Control group
SBP mmHg	143.40±7.87^{xxx}	136.00±12.33^{xxx,***}	131.83±12.24^{xxx,***}	115.32±8.98
DBP mmHg	87.20±9.90^{xxx}	84.24±9.57^{xxx}	82.13±10.33^{xx,*}	72.41±10.49
Body weight kg	84.32±12.53^{xxx}	83.66±12.46	84.40±12.33	68.18±12.14
Waist circumference cm	97.04±9.03^{xxx}	96.44±8.88	96.71±8.53	74.23±9.84
BMI kg/m^2	31.05±3.24^{xxx}	30.8±3.21^{xxx}	30.92±3.21^{xxx}	24.15±1.46
TC mg/dl	242.80±34.48^{xxx}	229.20±34.08^{xxx,**}	227.96±33.07^{xxx,***}	197.45±27.39
LDL-C mg/dl	158.71±35.78^{xxx}	150.00±34.63^{xxx,*}	146.21±34.63^{xxx,**}	119.94±14.02
HDL-C mg/dl	42.91±4.98^{xxx}	44.27±5.89^{xxx}	44.27±6.07^{xxx}	56.72±9.21
TG mg/dl	215.92±63.61^{xxx}	184.60±79.13^{xxx,*}	187.58±90.00^{xxx,*}	91.05±30.15
ET-1 pg/ml	2.44±0.51^{xxx}	1.92±0.39^{xxx,***}	1.74±0.42^{xxx,***}	0.98±0.38
CRP mg/dl	2.62±2.50	2.72±2.49	2.34±2.15	1.3±0.61
Fibrinogen mg/dl	249.20±27.17^{xx}	247.56±35.19^{x}	276.67±57.41^{xxx,*}	214.73±36.69
Fasting glucose mg/dl	92.92±11.03^{xxx}	90.12±11.16^{xxx}	93.92±10.48^{xxx}	77.95±7.36
Uric acid mg/dl	5.86±1.07^{xx}	5.93±1.21^{xx}	5.89±1.20^{xx}	4.91±0.88

*** $p<0.001$; ** $p<0.01$; * $p<0.05$ vs. baseline values; ^{xxx} $p<0.001$; ^{xx} $p<0.01$; ^{x} $p<0.05$ vs. the control group.
SBP – systolic blood pressure; DBP – diastolic blood pressure; BMI – body mass index; TC – total cholesterol; LDL-C – low-density lipoprotein cholesterol; HDL-C – high-density lipoprotein cholesterol; TG – triglycerides, CRP – C-reactive protein; ET-1 – endothelin-1.

Table 2. Mean values of antioxidative enzymes and TBARS after 1 (1 m) and 2 months (2 m) of aronia extract therapy in patients with MS.

Parameter	At baseline	After l m	After 2 m	Control group
SOD (U/g-Hb)	2380.63±419.91^{xxx}	2860.11±508.27^{xxx,**}	3066.53±542.24^{xxx,***}	4458.87±761.01
CAT (U/mg-Hb)	261.30±59.78	208.55±48.09^{xxx,***}	213.34±47.36^{xxx,***}	265.96±30.27
GSH-Px (U/g-Hb)	12.60±5.97^{xx}	17.71±8.99*	19.18±9.09**	18.61±2.49
TBARS (µmol/g-Hb)	0.0712±0.0191^{xxx}	0.0529±0.019^{xxx,***}	0.0362±0.0135^{xxx,***}	0.0237±0.00371

*** $p<0.001$; ** $p<0.01$; * $p<0.05$ vs. baseline values; ^{xxx} $p<0.001$; ^{xx} $p<0.01$; ^{x} $p<0.05$ vs. the control group.

Effect of Aronia Aronox extract 3 x 100 mg/day in 25 Metabolic Syndrome humans compared to 22 healthy humans

Broncel et al. 2010

Aronia – production of tasty and health preserving berries

- **Innovationsloven, August 2009- July 2012.** cooperation with 3 growers (specialised in: vegetative plant propagation, pressing techniques, Aronia berry production, 16 ha)

- The overall aim of the project is to develop the basis for an increased Danish production of tasty and healthy Aronia products of high and standardised quality as a prerequisite for a future documentation of Aronia products with functional claims on human health.

- Content:
- 1) develop efficient vegetative propagation methods (including on farm methods) to ensure the use of superior and true to type cultivars
- **2) investigate variation in taste and quality of juice from different cultivars and at different harvest times to attempt to overcome problems with taste and aroma and define the optimal cultivar and harvest time**
- **3) investigate how postharvest processing can assist in improving taste and quality of juice,**
- **4) investigate how bioactive compounds vary with cultivar, harvest time and processing of juice and**
- 5) investigate effect of different fertiliser regimes on yield and quality of berries.

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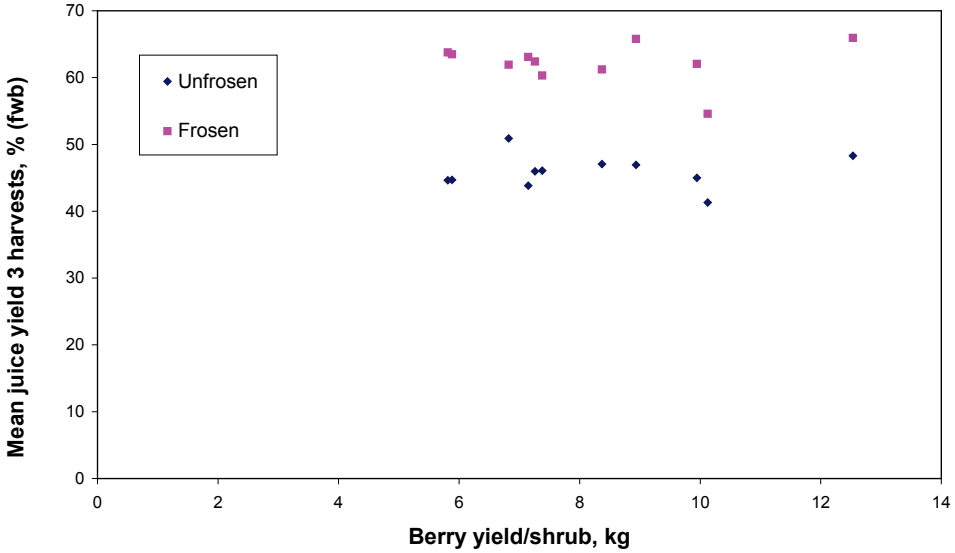
- Selected preliminary results:
- Variation in selected quality parameters of berries depending on cultivars, harvest time, year and correlated to yield pr shrub.
- clones harvested three times 2009 and some clones harvested in 2010.
- Juice pressed from fresh or frosen (-20°C) and thawed berries
- Standardised pressure and processing.



Cultivar	Id number	Malvin, g/l *
Aron seedling	5	**1,656**
Aron seedling	8	**1,565**
Aron seedling	11	**1,584**
Aron seedling	13	**1,406**
Aron seedling	17	**1,506**
'Aron' Langkærgård		**1,392**
'Nero' Langkærgård		**1,112**
'Viking' Langkærgård		**1,378**
'Nero' Årslev		**2,361**
'Viking' Årslev		**1,603**

* mean of 3 harvest times 2009, frozen berries

Pre-frozen berries gives higher juice yield at same pressure

Variation in anthocyanin content of juice between cultivars

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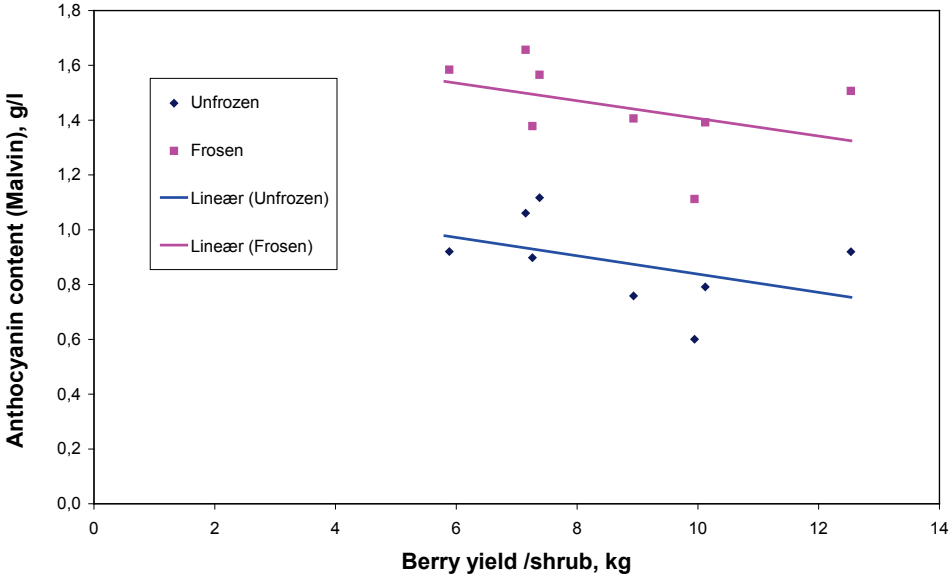
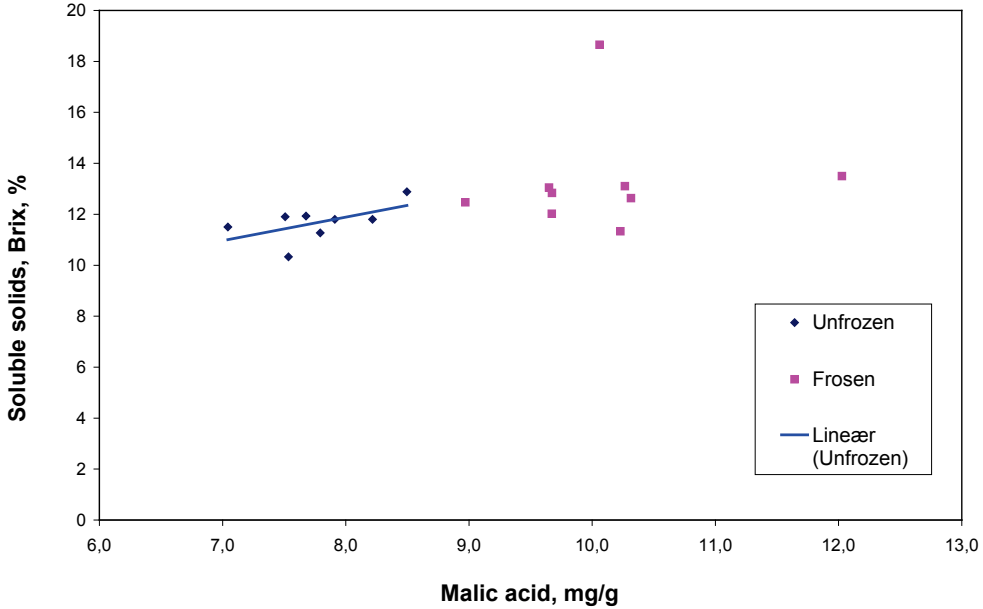


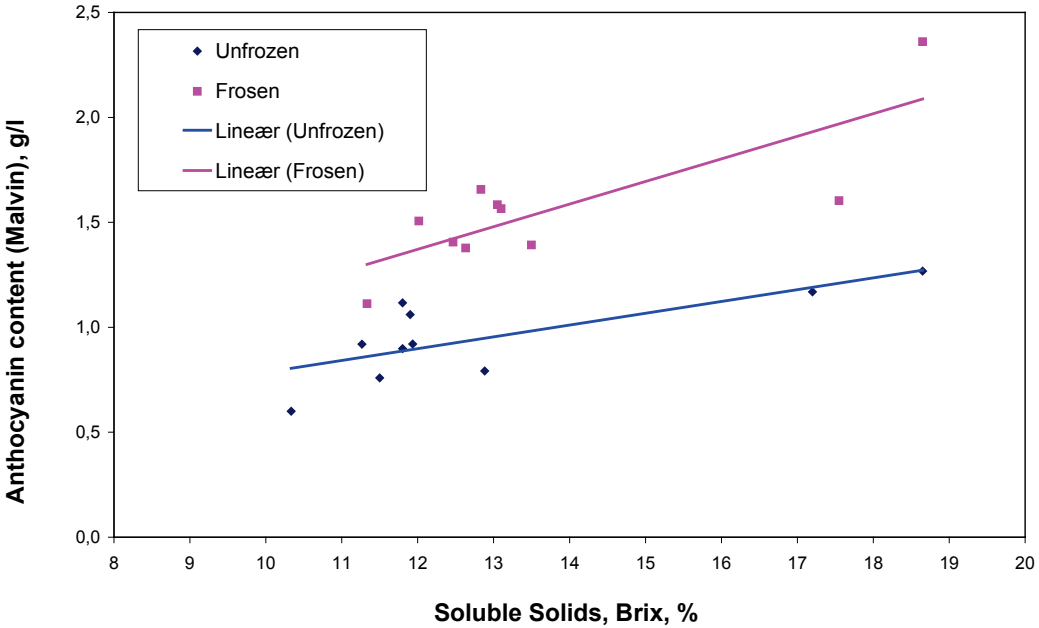
Anthocyanin content is higher when frozen berries are pressed.

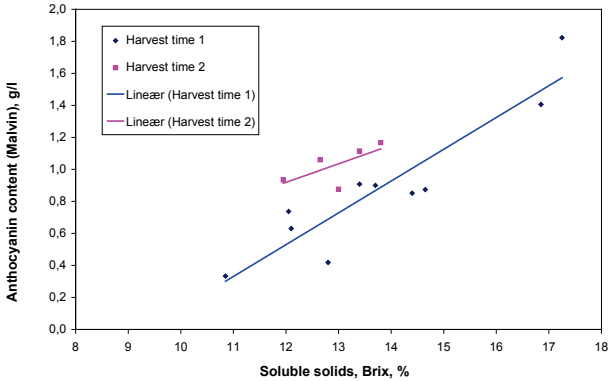
Tendency for lover anthocyanin content in shrubs with higher yield of individual shrubs.

Variation between clones

Brix value is only little affected by freezing of berries, whereas total acid content is increased in juice from pre-frozen berries.







Positive correlation between Brix and anthocyanin content in single clones in both years

	Harvest time 2009		
Content	09-sep-09	16-sep-09	23-sep-09
Malic acid	10,56	10,32	9,30
Brix	12,35	12,63	12,84
Malvin	1,79	1,29	1,23

Changes in juice quality when harvesting 1 w before normal, normal and 1 w after normal harvest time (Mean of 9 clones, frozen)

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Development of a European blueberry production in Denmark

European bluebery, Bilberry
(*Vaccinium myrtillus* L.)

Martin Jensen, senior scientist

Department of Foodscience, Faculty of Science and Technology

The Interreg IVB
North Sea Region
Programme

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What is needed and what are we doing on blueberry at DFS, Aarhus University?

- Significant improved berry yield/plant is needed (selection and breeding).
- Significant more efficient and non-expensive vegetative propagation Is needed.
- Developing efficient mechanical harvesting is critical to reduce cost of harvest.

Ongoing

–Collecting and comparing the best genetic plant material from wild Danish populations

–Develop propagation techniques: vegetatively in vitro or cuttings, and from seed

–Develop cultivation concept on acidic soils or on setup beds/rows

Future

–Develop mechanical harvesting machine (black currant concept will likely work)

–Develop berry products together with growers and industry

–Investigate bioactive compounds in berries and how they may be used to produce added value of blueberry products

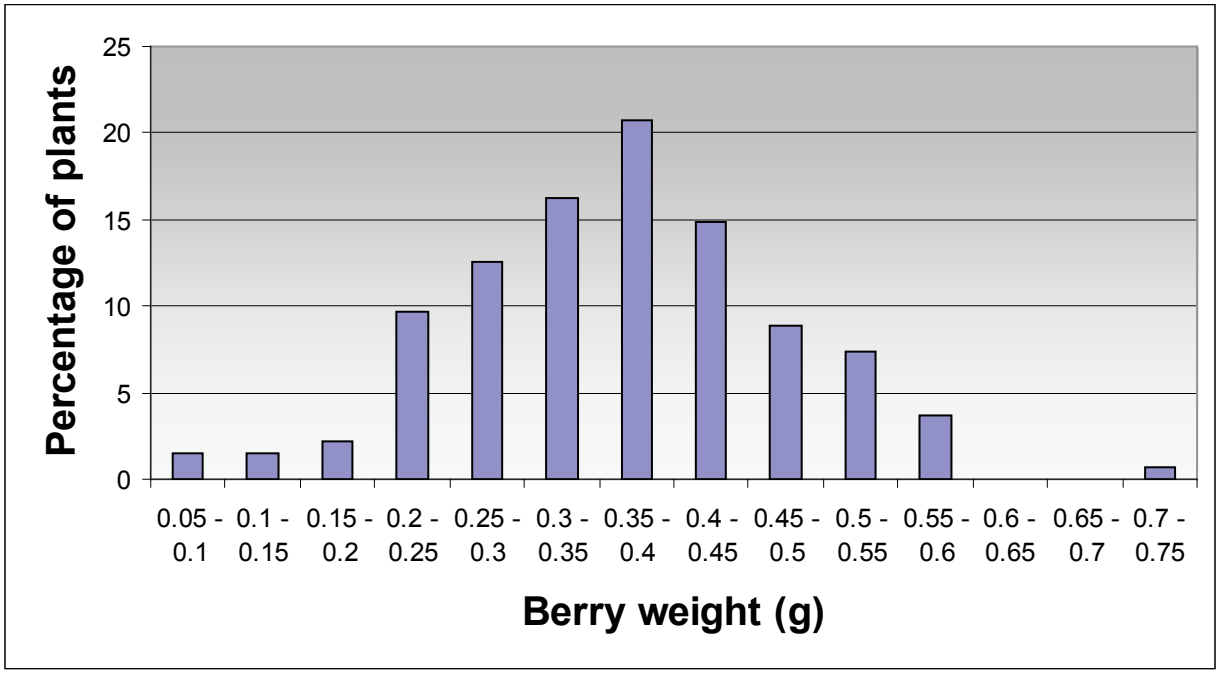
–Investigate clinical effects of selected products for 'functional claims' for prevention of diseases/health promoting.

Danish Blueberries: Development and activation of Danish genetic ressources.

- Danish Food Agency genetic conservation programme -1 may 2009 to 31/12 2011)

- **Aim:** The overall aim of the project is to develop a knowledge basis for future use of wild bilberries and conserve interesting genetic ressources of Danish **bilberries** (**V. myrtillus**).

- Specifically it is the aim to:
- 1) **Identify and collect** superior clones from the entire country and describe genetic variation.
- 2) Propagate plants and establish two copies of **in vivo genebank plantings**, that in addition will function as a clonal comparison trial and a source of genetically superior seeds of bilberry in the future.
- 3) Do a first **characterisation of variation** in plant material (propagation, growth, plant health, adaptation to environmental cultivation) and **berry quality**
- 4) Assist activation of Danish genetic ressources of bilberries by development of ideas for future use of bilberries at an 'Idea camp' with a.o. growers, food manufactorers, chefs . Demonstrate how new bilberry areas can be established by direct sowing of superior seeds.



Clonal variation in growth habit

Large variation in berry weight and berry frequency was found between clones and locations

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Berrymeat
Use of herbs, fruits and berries for preservation of organic meat products

Optimal and reproducible content of preservative compounds in organically grown herbs and berries: genetics cultivation, processing, storage

- **Workpackage**:
- Development of production of organic herbs and berries in Denmark with high and stable preserving effect and unique new taste used in organic meat products
- (EU aims to reduce nitrit and salt in food)

- Focus : Listeria, Salmonella and E. coli.
- **1. Pre-screening** in Radial diffusion assay – identification of candidate species .
- **2. Second bouillon screening test** – app. 12 chosen species
- **3.** Effect of **processing** for increased preservation effect.
- 4. Effect of **storage on** preservation effect.
  - **Examine content of bioactive compounds depending on** 3 and 4 in few sp.

- **5. Organic cultivation trials in** 3-5 chosen species:
  Effect of **cultivars**, clonal differences
  Effect of **harvest time, year**
- Effect of organic cultivation methods (**fertilizer**)

- Impact on **preservation capacity and concentration of bioactive compounds** (correlations and understading of preservation effect)

- **Aim: optimal quality**, safe dosis, **reproducibility o**f preservation effect.

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Populær navn	Latinsk navn	Produkt	Antal sorter testet*
Frugt og bær			
Sortrøn (surbær)	Aronia melanocarpa	Bær, juice og pomace	Flere sorter
Storfrugtet blåbær	Vaccinium	Bær	Flere sorter
Almindelig blåbær	Vaccinium myrtillus	Bær	Flere kloner
Mosebølle	Vaccinium ulignosum	Bær	1
Tyttebær	Vaccinium vitis-ideae	Bær	Flere sorter
Tranebær, Europæisk	Vaccinium oxycoccus	Bær	Flere sorter
Tranebær, storfrugtet	Vaccinium macrocarpon	Bær	Flere sorter
Solbær	Ribes nigrum	Bær	7 sorter
Ribs	Ribes rubrum	Bær	7 sorter
Hindbær	Rubus idaeus	Bær	Flere sorter
Brombær	Rubus fruticosus	Bær	(8 sorter?)
Havtorn	Hippophae ramnoides	Bær	1
Hyben rose, rynket rose	Rosa rugosa	Bær (uægte frugt)	1
Hyldebær	Sambucus nigra	Bær (evt. blomst)	1
Slåen	Prunus spinosa	Frugt	1
Skovæble, vild æble	Malus sylvestris	Frugt	1
Chili	Capsicum annuum	Frugt	Flere sorter
Kommen	Carum carvi	Frø	1
Enebær	Juniperus communis	Frugt	1

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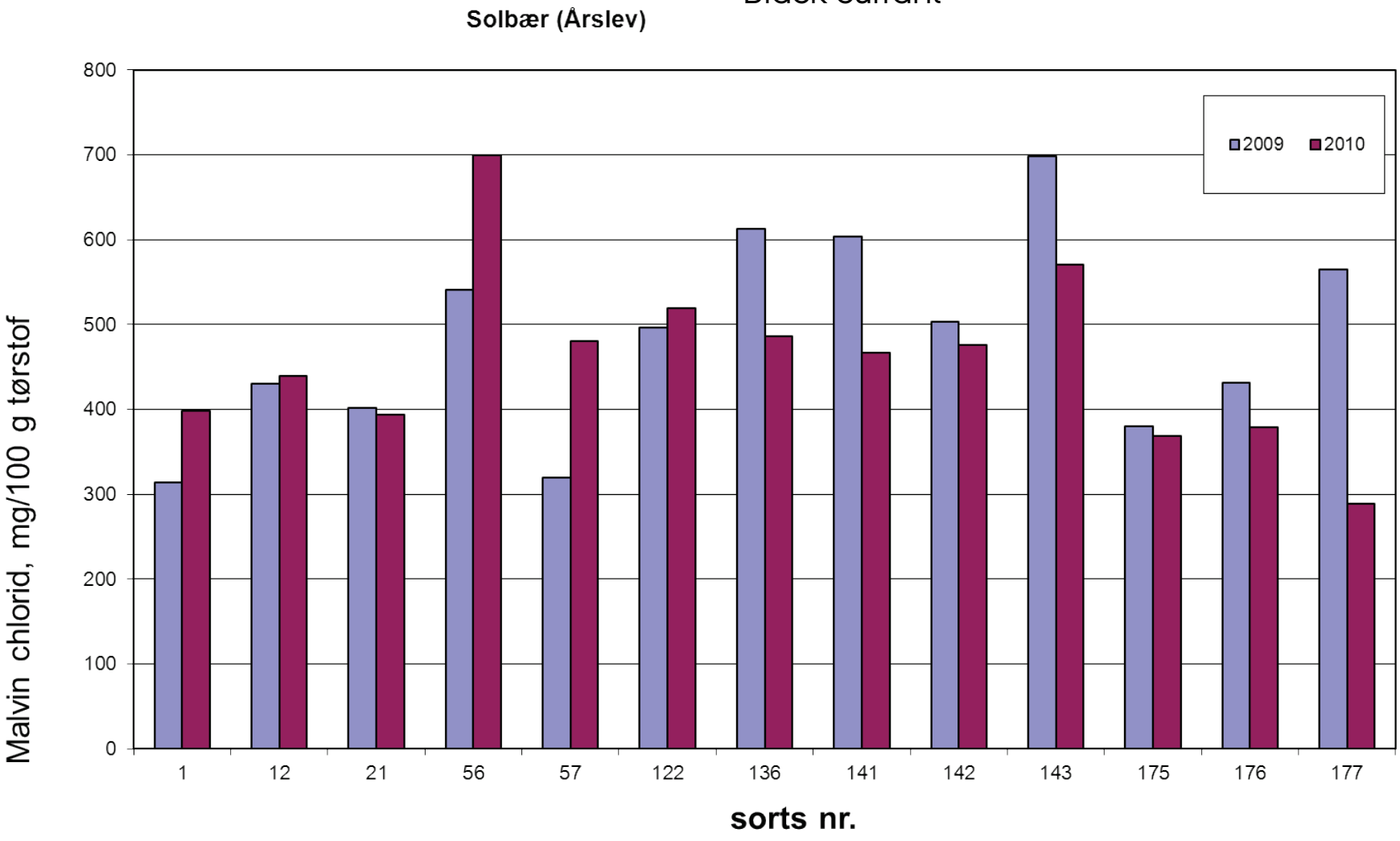
Black currant



Blade (blad-blomst)			
Græsk origanum	Origanum vulgare subsp. Hirtum	Blade	1
Vild Merian	Origanum vulgare	Blade	1
Timian	Thymus vulgaris	Blade	1
Rosmarin	Rosmarinus officinalis	Blade	1
Salvie	Salvie officinalis	Blade	1
Vintersar	Satureja montana	Blade	1
Sommersar	Satureja hortensis	Blade	1
Pebermynte	Mentha x piperitae	Blade	1
Velduftende kamille	Matricaria recutita	Blomst	1
Almindelig porse	Myrica gale	Blade/blomst	1
Humle	Humulus lupulis	Blomst	Flere sorter

Stængel			
Rabarber	Rheum rhababarum	stængel	5 sorter
Løg			
Hvidløg	Allium sativa	løg	1
Ramsløg	Allium ursinum	Løg, blade	1
Rod			
Peberrod	Armoracia rusticana	rod	5

Alm. blåbær

Species going to step 2 screening

Aronia melanocarpa

Blueberry Vaccinium myrtillus and corymbosum

Black and red currant, Ribes nigrum and R. rubrum

Sea buckthorn, Hippophae rhamnoides

Elderberry, Sambucus nigurm

Prunus spinosa

Hop flowers, Humulus lupulus

Salvia officinalis

Winter sar, Satureja montana

Onions, Allium ursinum

Roots, Armoracia rusticana

- **Choosing cultivars after their content of**

- Acids – malic acid, ascorbic acid, citric acid
- Anthocyanins
- Phenols - flavonoids
- Terpenes – essential oils
- Isothiocyanate
- Alicin

- Combining different species with different compounds may give additive preservation effect and reduce problems of inferior taste due to high concentration of one species/bioactive compounds

- Up – concentration needed? Extraction?
- Water soluble or oil soluble? Delivering preservative effect in water phase in meat.

- Pasteurisation needed of herbs and berrys - effect on biocative compounds?

- Combining taste - preferences