

Black and red currant cultivars for organic production

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Abstract

*Organic or unsprayed production of black currants (*Ribes nigrum*) and red currants (*Ribes rubrum*) needs cultivars which are resistant or less susceptible to the most common pests and diseases like powdery mildew (*Sphaerotheca mors-uvae*) and leaf spot (*Gloeosporidiella ribis*). The aim of this study was to find promising less disease susceptible, high-yielding cultivars with an acceptable juice quality for organic production. 13 black currants and 10 red currants were evaluated in 2009 in Denmark. The black currant cultivars 'Narve Viking' and 'Ben Hope' were the best cultivars for organic production. They had high yields, good juice quality and resistance to pests and diseases. The red currant cultivar 'Red Poll' had the highest yield, the best juice quality and was most resistant to diseases when grown unsprayed. This cultivar evaluation aiming at finding the best black and red currant cultivars suited for organic production in Denmark is continuing in 2010 and 2011.*

Keywords: Unsprayed, yield, susceptibility to pests and diseases, juice quality, industrial use.

Introduction

Organic or low pesticide production of black currants (*Ribes nigrum* L.) and red currants (*Ribes rubrum* L.) for industrial use needs cultivars which are resistant or less susceptible to the most common pests and diseases like American gooseberry mildew (*Sphaerotheca mors-uvae* Schweinitz), leaf spot (*Gloeosporidiella ribis* Libert), white pine blister rust (*Cronartium ribicola* J.C. Fischer) and black currant gall mite (*Cecidophyopsis ribis* Westwood) or reversion virus (*Atavismus*). Disease infections may cause an early leaf drop followed by reduced yield (Lindhard Pedersen, 1998). The cultivars must also be suited for mechanical harvest and obtain a satisfying juice quality for industrial use. To achieve a satisfying colour in black currant jam or juice a minimum level of 300 mg malvidin chloride per 100 gram berries must be reached and a level of 130 mg per 100 gram berries of ascorbic acid is important to ensure the healthiness of the product (Kaack and Groven, 1981).

In an earlier study the results from the first two fruiting years, 2005 and 2006 from an unsprayed trial including 13 black currants and 10 red currants were reported (Lindhard Pedersen, 2007). The conclusion was that the black currant cultivars 'Narve Viking', 'Tiben', 'Ben Hope' and maybe 'Ben Gairn' and the red currant cultivars 'Rolan' and maybe also 'Augustus' were promising new cultivars for organic or low pesticide production of currants.

The aim of this study was to follow up on these cultivars and to investigate if the promising less disease susceptible, high-yielding cultivars of black and red currants suited for organic industry production were the same when the planting grew older.

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Material and Methods

In April 2003 at Department of Horticulture, Aarslev, 13 and 10 black- and red currant cultivars, respectively, were planted as one-year-old plants at a planting distance of 3.5 x 0.5 m. Plots consisted of 6 bushes per cultivar planted in three blocks and totally randomised inside each block for black and red currants. Planting was done in Mypex™ in the bush row and grass was established in the alleyways. Plants were irrigated the first two years after planting and manuring was done using poultry manure pellets due to leaf analyses. Plants were kept unsprayed. Black currant gall mite and reversion spread by the mite are severe pests of black currants. Big buds infested with gall mites were removed from the planting two to three times during each winter by hand to try to control the pest.

Harvest time and machine harvested yield and berry size were recorded in 2009. Scores for foreign elements in the harvested product, vegetative annual growth, leaf healthiness and infections of occurring pests and diseases were carried out in June, July and August in 2009 on a scale from 1-9, where 1= nothing.

Samples of the harvested berries were collected for analysing of the fruit juice. Samples were stored frozen and analysed autumn 2009. 200 grams of berries were homogenised with 100 g distilled water and the content of soluble solids was analysed with refractometer (Bellingham + Stanley LTD. RFM 330). Content of total titrable acid was measured according to Kaack (1988). Total acids were converted to citric acid, which is dominating in black currants. Content of total anthocyanins was analysed with spectrophotometer (Shimadzu MPS 2000,) according to Wrolstad (1976). Statistical analyses of data were performed using SAS (Version 8 www.sas.com). Differences among cultivars were analysed with GLM-procedure. Means were separated with Duncan's test and statistical significance was defined at $p < 0.05$.

Results

The black currant cultivars 'Narve Viking', 'Ben Lomond', 'Ben Hope', 'Ben Tirran' and 'Ben Alder' had the highest yields in 2009 (Table 1). 'Ben Tirran' had the biggest berries and there were no important differences between the cultivars concerning the level of foreign elements in the harvested product. The highest content of soluble solids (sugar) and colour was obtained by the cultivar 'Ben Gairn'. The cultivar 'Tiben' had the highest content of acid in the juice (Table 1).

The black currant cultivars 'Titania', 'Tiben', 'Narve Viking' and 'Ben Hope' had the strongest growth and the healthiest looking green leaves in June 2009 (Table 2). 'Ben Avon' was most susceptible to aphids and 'Baldwin' and 'Ben Lomond' to mildew (Table 2). In August white pine blister rust developed and 'Ben Dorain' was the most susceptible cultivar. 'Baldwin' and 'Ben Lomond' were most susceptible to leaf spot. Due to disease infection the leaf healthiness was reduced in August. The cultivars 'Narve Viking', 'Ben Gairn' and 'Ben Dorain' maintained the best looking healthy leaves in August (Table 2). No other important pests or diseases occurred in 2009. The highest-yielding red currant cultivars were 'Red Poll', 'Rolan', 'Augustus', 'Rovada', 'Roodneus' and 'Tatran' (Table 1). 'Rosetta' had the biggest berries and juice of 'Rondom' had the highest sugar content, while 'Red Poll' juice had the highest content of acid and colour. The red currant cultivars 'Red Poll' and 'Roodneus' had the strongest growth and the healthiest looking green leaves in June 2009 (Table 2). No severe infestation of aphids occurred. In July the cultivars 'Red Lake' and 'Red Start' already had an infection of leaf spot and in late August all the leaves of these two cultivars had dropped due to a severe leaf spot infection (Table 2). All the cultivars had severe infections of leaf spot in August. The cultivars 'Red Poll', 'Roodneus', 'Rondom' and 'Rosetta' had the most healthy looking leaves in August 2009 (Table 2). No other important pests or diseases occurred in 2009.

Table 1: Origin, harvest date, yield, berry size, foreign elements in the harvested product and soluble solids, citric acid and colour content of the juice in 13 cultivars of black currants and 10 cultivars of red currants in 2009.

Black currants	Origin	Harvest	Yield	Berry size	Foreign elements in the harvested product	Soluble solids	Citric Acid	Colour, Malvidin Chloride
Cultivar	Country	Date	Kg/bush	G/100 berries	Score 1-9 1=nothing	%	Mg/g	Mg/100 g
Baldwind	Scotland	3 Aug	1.02 def	49 e	5.3 a	17.4 d	31.8 i	314 i
Ben Alder	Scotland	31 Jul	1.33 abcd	64 cd	4.3 ab	16.7 f	35.4 f	541 d
Ben Avon	Scotland	24 Jul	1,27 bcde	74 bcd	5.0 a	16.3 g	34.3 h	380 h
Ben Dorain	Scotland	27 Jul	0.47 fg	63 d	3.0 b	18.8 c	39.7 d	604 b
Ben Gairn	Scotland	16 Jul	0.64 efg	63 d	4.3 ab	19.4 a	28.2 l	699 a
Ben Hope	Scotland	31 Jul	1.70 abc	74 bcd	4.3 ab	16.5 f	35.0 g	503 e
Ben Lomond	Scotland	31 Jul	1.84 ab	76 b	5.0 a	17.0 e	37.7 e	430 f
Ben Tirran	Scotland	31 Jul	1.50 abcd	87 a	4.3 ab	16.0 h	40.6 c	320 i
Narve Viking	Norway	31 Jul	1.97 a	68 bcd	4.0 ab	15.8 i	29.3 k	496 e
Tiben	Poland	27 Jul	0.90 defg	65 bcd	5.0 a	19.1 b	42.6 a	613 b
Titania	Sweden	21 Jul	0.28 g	71 bcd	4.0 ab	18.8 c	41.2 b	401 g
8944-4	Scotland	22 Jul	0.30 g	44 e	4.3 ab	15.7 i	25,1 m	432 f
8944-13	Scotland	22 Jul	1.09 cdef	49 e	5.0 a	15.1 j	31.1 j	565 c
Red Currants	Origin	Harvest	Yield	Berry size	Foreign elements in the harvested product	Soluble solids	Citric Acid	Colour, Malvidin Chloride
Cultivar	Country	Date	Kg/bush	G/100 berries	Score 1-9 1=nothing	%	Mg/g	Mg/100 g
Augustus	Holland	14 Aug	2.95 ab	30 e	5,0 a	7.8 h	24.9 e	44.4 e
Red Lake	North America	31 Jul	0.25 d	28 e	3.0 c	8.9 f	24.4 f	43.2 e
Red Poll	England	10 Aug	3,53 a	49 cd	5.0 a	13.4 b	29.7 a	95.3 a
Red Start	England	28 Jul	0.16 d	29 e	3.0 c	8.3 g	24.9 e	40.5 f
Rolan	Holland	29 Jul	3.01 ab	55 abc	5.0 a	12.8 c	19.9 h	54.5 d
Random	Holland	29 Jul	1.94 bc	47 d	5.0 a	14.6 a	24.5 f	62.8 c
Roodneus	Holland	3 Aug	2,81 ab	53 bcd	4.7 a	12.8 c	27.1 d	90.4 b
Rosetta	Holland	3 Aug	1.31 cd	60 a	3.7 b	12.4 d	20.8 g	32.5 g
Rovada	Holland	3 Aug	2.82 ab	59 ab	4.0 b	10.8 e	27.4 b	54.0 d
Tatran	Slovakia	7 Aug	2.65 ab	48 d	5.0 a	12.3 d	25.7 d	44.9 e

Numbers followed by the same letter for the same species in columns do not differ significantly for $P \leq 0.05$.

Table 2: Scores for growth, leaf healthiness, infestations of aphids, infections of mildew, rust and leaf spot in 13 cultivars of black currants and scores for growth, leaf healthiness, infestations of aphids and leaf spot in 10 cultivars of red currants in 2009.

Black currants	Growth, June	Leaf Healthiness, June	Aphids, June	Mildew, July	Rust, August	Leaf Spot, August	Leaf Healthiness, August
Cultivar	Score 1-9 1= no growth	Score 1-9 1= no leaves	Score 1-9 1= no infestation	Score 1-9 1= no infection	Score 1-9 1= no infection	Score 1-9 1= no infection	Score 1-9 1= no leaves
Baldwind	5.0 cd	5.7 f	1.7 d	3.7 a	1.7 cd	8.5 a	2.2 g
Ben Alder	4.3 d	5.8 f	2.7 bc	1.0 d	2.5 abc	5.8 de	4.8 cd
Ben Avon	5.7abcd	6.3 ef	3.5 a	1.2 d	2.5 abc	4.0 g	5.5 bc
Ben Dorain	4.7 cd	5.7 f	2.5 bc	2.0 c	3.2 a	3.8 g	6.0 ab
Ben Gairn	4.7 cd	5.7 f	3.2 ab	1.0 d	1.5 cd	2.8 h	6.5 a
Ben Hope	6.3 ab	7.3 abcd	2.0 cd	1.0 d	3.2 a	4.7 fg	5.0 cd
Ben Lomond	5.7 abc	7.0 bcde	2.5 bc	3.3 b	2.0 bcd	7.8 ab	3.2 f
Ben Tirran	5.5 bcd	6.7 cdef	2.7 bc	1.0 d	2.5 abc	5.5 ef	5.2 bcd
Narve Viking	6.5 ab	8.0 a	2.5 bc	1.0 d	3.0 ab	1.3 i	6.5 a
Tiben	6.5 ab	7.8 ab	3.0 ab	1.0 d	1.5 cd	6.8 cd	4.3 de
Titania	6.8 a	7.5 abc	3.0 ab	1.0 d	1.0 d	4.8 fg	5.0 cd
8944-4	5.0 cd	4.7 g	2.5 bc	1.0 d	1.2 d	7.2 bc	3.8 ef
8944-13	5.3 bcd	6.5 def	2.0 cd	2.0 c	1.2 d	6.0 de	4.8 cd
Red Currants	Growth, June	Leaf Healthiness, June	Aphids, June	Leaf Spot, June		Leaf Spot, August	Leaf Healthiness, August
Cultivar	Score 1-9 1= no growth	Score 1-9 1= no leaves	Score 1-9 1= no infestation	Score 1-9 1= no infection		Score 1-9 1= no infection	Score 1-9 1= no leaves
Augustus	5.3 bc	7.7 abc	1.3 bcd	2.7 b		9.0 a	1.8 bc
Red Lake	3.7 d	4.8 e	1.2 cd	4.0 a		.	1.0 c
Red Poll	6.8 a	8.0 ab	2.0 a	1.5 de		6.7 d	4.0 a
Red Start	3.3 d	4.3 e	1.3 bcd	4.0 a		.	1.0 c
Rolan	5.0 c	7.3 bcd	1.3 bcd	1.7 de		8.6 ab	2.3 b
Rondom	5.8 b	7.8 abc	1.5 abcd	2.0 bcd		7.8 c	3.5 a
Roodneus	6.8 a	8.2 a	1.7 abc	1.7 de		6.8 d	3.8 a
Rosetta	4.8 c	6.7 d	1.0 d	1.2 e		8.2 bc	3.5 a
Rovada	5.8 b	7.8 abc	1.0 d	2.5 bc		9.0 a	1.3 c
Tatran	5.3 bc	7.2 cd	1.8 ab	1.8 cde		8.5 ab	2.5 b

Numbers followed by the same letter in columns do not differ significantly for $P \leq 0.05$

Discussion

The highest yielding Norwegian cultivar in 2009 'Narve Viking' was also the highest yielding cultivar when the planting was young (Lindhard Pedersen, 2007). The Scottish cultivar 'Ben Hope' was also among the highest yielding cultivars both as young and older plants (Table 1). Both cultivars had a satisfactory juice quality and a strong growth in 2009. Especially 'Narve Viking' was rather resistant to the common diseases and kept the healthy green leaves until late August, 2009. 'Ben Hope' is a promising cultivar for organic production as it is resistant to gall mites. However, it is more susceptible to leaf spot than 'Narve Viking'. The two cultivars 'Tiben' and 'Ben Gairn', which were promising as young plants (Lindhard Pedersen (2007), had low yields in 2009 (Table 1). 'Ben Gairn' is an interesting cultivar for organic production as it is resistant to the reversion virus. In 2009 it had a good juice quality with very high sugar and colour content and 'Ben Gairn' is also rather resistant to the common diseases. However, it had a low yield in 2009.

'Titania' and 'Ben Alder' were earlier recommended for organic production (Lindhard Pedersen 1998), but in this investigation and in Lindhard Pedersen (2007) the yielding of 'Titania' was very low. Ben Alder is still among the highest yielding cultivars, it had a satisfactory juice quality, but the leaf healthiness was rather low and it was susceptible to rust and leaf spot.

'Ben Lomond' and 'Ben Tirran' are two rather old Scottish cultivars, which are used in conventional production in Denmark. Unsprayed they are among the highest yielding cultivars and have a satisfactory juice quality. Their leaf healthiness was not very good in 2009 and 'Ben Lomond' was one of the most susceptible cultivars to mildew and leaf spot. Only the variety 'Baldwin' was more susceptible. Despite that 'Ben Lomond' and 'Ben Tirran' were rather high-yielding in 2009. This was also found by Lindhard Pedersen (1998).

'Ben Dorain' was a healthy plant with low susceptibility to diseases and a good juice quality. But the yield was low in 2009.

2009 was generally a dry year with rather low precipitation during the growing season. This probably resulted in the small berry size for both black and red currants compared to earlier conventional cultivar testing in Denmark (Vang-Petersen, 1998 a and b).

The red currant cultivars 'Roland' and 'Augustus' were promising cultivars for organic production when the plants were young (Lindhard Pedersen 2007). Also in this evaluation these two cultivars are among the highest yielding. However, these cultivars were very susceptible to leaf spot and had poor leaf healthiness in August 2009 (Table 1 and 2). The highest yielding cultivar in 2009 was 'Red Poll'. This cultivar also had a very fine juice quality with high sugar content and the highest content of acid and colour and best looking leaves and the lowest susceptibility to leaf spot in 2009. 'Roodneus' was also high-yielding, had good-looking leaves and was among the cultivars with lowest susceptibility to leaf spot.

This cultivar evaluation aiming at finding the best black and red currant cultivars suited for organic production in Denmark is continuing in 2010 and 2011.

Conclusion

The black currant cultivars 'Narve Viking' and 'Ben Hope' were the best cultivars for organic production. They had high yields, good juice quality and resistance to pests and diseases. But also the more disease susceptible cultivars 'Ben Lomond' and 'Ben Tirran' had high yields and good juice quality when grown unsprayed.

The red currant cultivar 'Red poll' had the highest yield, the best juice quality and was most resistant to diseases when grown unsprayed. 'Roodneus' also had a high yield and acceptable juice quality and disease resistance.

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