and moderate size with reniform petiolar glands. About 300 hours below 7°C are required for strong bud development and bloom. Flowers are showy and self-fertile. Full bloom occurs about 7 August and full foliation occurs by 15 August (Table 2).

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Performance in Denmark of 16 European Varieties of Sweet Cherry

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Abstract

Fruit quality and productivity of 16 European sweet cherry cultivars (*Prunus avium*) were evaluated during the years 1995-1999 in Denmark. High resistance to fruit cracking and large fruits are the most important quality characteristics under the Danish climatic conditions. In order of ripening the following selections are of greatest interest: *'Nabigos'* is of interest for precocity, productivity and large fruits for the early season. A high cracking index reduces its value in rainy regions. *'Gardel'* has almost the same qualities, but ripens one week later. *'Giorgia'* is also a very productive midseason cultivar, and the fruit is firmer and has a lower tendency toward cracking. *'Techlovan'* had very large and very firm fruits but the trees were not productive. The late ripening *'Gégé'* is of interest for the lowest cracking index in this series of cultivars and for its very late flowering as a pollinator for late flowering, compatible cultivars.

Introduction

Cultivars of sweet cherries are continuously collected for an evaluation of the commercial value under Danish conditions. Precocity, high productivity, cracking susceptibility, and the size of the fruit are considered as the decisive characteristics in an evaluation of the potential commercial value. In this preliminary evaluation with only a few trees of each cultivar, a tendency of cropping can only be estimated. In earlier reports about 200 cultivars have been evaluated. (18, 19, 20)

Material and Methods

The propagation material received in February 1994, was grafted on 'Colt' rootstock. In the fall of 1994 three trees of each cultivar were planted at a spacing of 5 x 3 m in a screening trial for a preliminary evaluation of the fruit quality and yield potential.

Date of flowering was recorded over a 5 year period and fruit related characteristics over the 3 years 1997-1999 (3rd-5th leaf). Date of flowering was determined when 90% of flowers were open. Each year fruit

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size (measured as average fruit weight), cracking index and firmness were determined 3 times with 2 to 4 days interval during the ripening season. For each of these determinations a sample of 50 well developed fruits were used. The annual date of ripening was an average of the 3 dates of sampling. Tendency toward fruit cracking was determined as cracking index over a 6 hour period. An index of 100 indicates that all fruits cracked within 2 hours after immersion in distilled water and an index of zero means that no fruits cracked within 6 hours of immersion. Fruit firmness was assessed subjectively on a scale from 1 being very soft to 5 as very firm. Productivity of the trees was rated 1-9 (1 = no or single fruits; 9 = very heavy crop) the last 3 years. Four cultivars produced their first fruit in the last two years, and the 7 cultivars: *Duroni 3, Francesca, Heidi, Inga, Naremi, Olympic* and *Royalton* have not yet or only a single year given fruits enough for a judgement. All results are shown in table 1 in descending order from earliest ripening cultivar to latest.

Results

Date of flowering

In all years, the flowering period overlapped for at least 3 days for all cultivars. However, the earliest blooming cultivars, such as 'Nabigos,' may not be pollinated satisfactorily with the latest and vice versa. The annual variation in the date for full bloom between earliest and latest cultivar was from 8 to 10 days. The annual average blooming date for all cultivars differed 4 days from earliest to the latest year.

Date of ripening

The date of ripening in each year is an average of three pickings, judged visually from skin colour and fruit size. The whole ripening period covered 18 days with

Table 1. Date of flowering 1996-99, fruit characteristics and productivity 1997-99, average of years.

Cultivar	Days ± 'Vani' Flowering	Days ± 'Vani' Harvest	Size G/fruit	Cracking index 1-100[1]	Firmness 1-5[2]	Productivity 1-9[3]
Merchant	–3	–14	9,1	57	1,0	1,5
Nabigos	–5	–14	9,2	95	2,0	4,3
Johanna	+2	–11	7,4	25	1,2	3,7
Erika	+1	–11	7,8	53	2,0	3,2
Giorgia	–1	–9	7,8	35	4,8	3,8
Vanda	0	–7	8,8	37	3,7	1,8
Techlovan	–4	–5	10,8	69	4,8	1,5
Castor	0	–3	8,5	24	2,0	1,7
Van	0	0	8,4	68	4,7	—
Diana	–1	+1	6,1	31	5,0	1,8
Corinna	–3	+1	7,2	31	4,8	1,3
Gégé	+3	+5	8,4	19	3,0	2,8
Results 1998-1999						
Margit	+1	–7	9,0	57	3,3	1,6
Namare	–2	–1	7,4	76	3,3	1,5
Namosa	+1	0	9,4	66	3,0	1,3
Noire de Meched	+4	+4	10,4	70	3,8	1,6
LSD (5%)	—	2,8	0,4	17,3	0,5	0,8

[1]100 = maximum susceptible to rain cracking
[2]1 = very soft; 5 = very firm
[3]1 = low or more no yield; 9 = very high yield.

'Merchant' as an early cultivar and 'Gégé' as a late cultivar.

Fruit size

Fruit size is a very important quality characteristic. Cultivars with fruits smaller than 7.5 g. will not be accepted in Denmark for a potential commercial cultivar. Almost all the varieties had a very good fruit size. An exception was 'Corinna,' which were too small. In fruit size 'Techlovan' was outstanding in this collection.

Cracking index

The selections varied greatly in their cracking susceptibility, from the very resistant 'Gégé' and 'Castor' to the very susceptible 'Nabigos.'

Firmness of the fruit

A rating of 3.5 is considered as a satisfactory firmness. Many of the selections fulfill this requirement, however, several varieties were too soft.

Productivity of the trees

This evaluation does not adequately estimate yield potential over years of the cultivars, more reliable results would need more years. However, early productivity is considered important enough for a preliminary screening of varieties. Most cultivars seem satisfactory in this respect, but some of them were too low yielding to have any future under Danish conditions. During the experimental years spring frosts occurred to such an extent that the most sensitive cultivars, regardless of flowering time, were damaged by spring frost and reduced yield.

Discussion

The most important characteristics of the cultivars are briefly discussed. The origin, year of introduction (named) and pollination are given as far as they are known.

'Castor.' Origin: Holland. A midseason cultivar with medium sized, soft fruits, but with a very low cracking index. As the trees had low productivity the cultivar does not seem to be of further interest. Reference: 17.

'Corinna.' Origin: Vittoria x (Moretta di Cazzano x Durona di Padova). Tested as R43. Verona, Italy 1985. The firm, rather small fruits ripen in the late midseason. In Italy the fruit was found large and very suitable for mechanical harvest and transportation. In Italy the trees were very productive but in France and in this test the yield has been low. References: 8, 15.

'Diana.' Origin: Moretta di Cazzano x Durona di Padova. Tested as I 38. Verona, Italy. The fruit ripens late midseason, is very firm and had a low cracking index, but the fruit is too small. In Italy and France the trees were productive but in Denmark the yield has been very low. References: 9, 10, 15

'Erika.' Origin: 'Rube' x 'Stechmanns Bunte,' tested as R/ST 198. Jork, Germany 1976. An early cultivar with medium sized, soft fruit. The trees have, as in Germany, been precocious and productive. Its growth is flat and open. 'Regina,' 'Viola' and 'Schneiders' were in Germany found to be pollinators. It was recommended in 1989 as a major cultivar in Northern Germany. Reference: 25.

'Gégé'(R). Origin; Lot-et-Garonne, France 1987. A late cultivar with large fruits and the lowest cracking index in this series. The trees have, as in France, been precocious and productive, but in Belgium the yield was low. Its very late flowering may be of use a pollinator for other late blooming, compatible cultivars. References: 11, 15.

'Giorgia.' Origin: Caccianese x ISF 123. Verona, Italy 1985. The cultivar is of interest for very firm fruits with rather low cracking index in the early midseason and the precocious and productive trees. In contrast to Italian results, the fruits have been only of medium size. It can be pollinated by 'Van' and 'Starking.' References: 2, 3, 7.

'Johanna.' Origin: 'Schneiders' x 'Rube,' tested as 57/104. Jork, Germany 1990. It is an early variety and as in German observations was precocious and very productive. The fruit ripens early, is medium in size and soft but had a very low tendency toward cracking. The trees are

medium in vigor and has a good branching habit. It can be pollinated by 'Van' and 'Hedelfinger.' Recommended for testplanting. Reference: 25.

'Margit.' Origin: Open pollination of 'Germersdorfer.' Hungary 1991. The large fruits ripens in the early midseason. The trees had up to now only a very light fruit set. In Hungary the trees were medium fertile and the fruits suited for mechanical harvest. Reference: 1.

'Merchant.' Origin: John Innes, England 1982. Tested as J.I.11376. The variety major merit is its early ripening combined with very large fruits, but they are very soft. In England, Switzerland and Norway the trees were productive, but in this test the trees have had a low yield. It belongs to pollination group 0. In Norway the variety has been recommended as a test variety. References: 13, 14, 23.

'Nabigos.' Origin: 'Querfurter Königskirsche' x 'Souvenir des Charmes.' Tested as Pi-Na 620. Dresden-Pillnitz, Germany 1994. An early variety with very large fruits for its season, but they were soft and had a very high cracking index. As in Czech and German observations the trees are precocious and very productive. It belongs to pollination group S4S5. The trees are medium in vigour and have a good branching habit. Recommended for test planting due to the very large fruits in an early season. Reference: 22.

'Namare.' Origin: Open Pollination of 'Grosse Schwarze Knorpel.' Tested as Na 720. Dresden-Pillnitz, Germany 1994. The fruit has only been tested two years due to low precocity. However, in Germany the trees have been very productive. The qualities of the fruit were not good enough for further interest. Reference: 23.

'Namosa.' Origin: Open pollination of 'Fernstädter Schwarze.' Tested as Na 24. Dresden-Pillnitz, Germany 1986. The very large fruits ripen in the late midseason. In contrast to the breeders results, the trees have been very low yielding. Reference: 12.

'Noire de Meched.' Origin: Iran. Tested in France as Clone INFL(R) V 2678 T. The fruit was only analyzed in two years due to low precocity. The fruit ripens very late and was very large. The flowering period was very late. In France it is described as "Variété importantes" due to good productivity of large, firm, long stemmed fruits that are easy to pick. References 9, 10, 11, 16.

'Techlovan.' Origin: 'Van' x 'Kordia.' Holovousy, Czech Republic 1991. A midseason cultivar with outstanding large, firm fruits. The yield on the young trees has been low in contrast to results in Czech Republic where it yielded more than the productive 'Van.' Pollinators: 'Oktavia' and 'Stella.' Deserves further interest. References: 4, 5.

'Vanda.' Origin: 'Van' x 'Kordia.' Holovousy, Czech Republic 1991. It ripens in the early midseason, with large and rather firm fruits. In Czech Republic the trees were very productive, but in this trial the yield on the young trees has been very scarce. References: 4, 6.

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Girdling Grapes — Pn and CHO

Girdling reduced mid day Pn of 'Flame Seedless' and stomatal conductance by 50% for 4 weeks after treatment at fruit set. Diurnal measurements of leaf non-structural carbohydrates (CHO) was not influenced by girdling. Girdling increased berry size, girdling reduced stomatal conductance which resulted in less transpiration and a more favorable vine water status. From Williams et al. 2000. Amer. J. Enol. Vitic. 51(1):49-54.

Apple Root Restriction, Irrigation, and Rootstock

'Queen Cox' apple trees on M.9 or MM.106 rootstocks were planted within root restrictive membranes buried in the soil and compared with trees planted without membranes. Half of the treated and control trees were irrigated using a trickle system and the other half did not have supplementary irrigation. Root restriction reduced greatly the extension shoot growth on the trees by reducing the numbers and mean length of the shoots. Shoot growth on restricted trees terminated very early in the season. Irrigation, in contrast, increased the numbers of shoots and the mean individual shoot length. Root restriction reduced the mean individual size of spur and extension shoot leaves. Significant interactions between root restriction, irrigation and rootstock treatments were recorded over six seasons. Irrigation only partially alleviated the reductions in growth induced by root restriction. Root restriction increased the numbers of floral buds formed per unit trunk cross-sectional area in all years. The overall effect of root restriction was to reduce (by 50%) the annual and cumulative yields per tree, whilst supplementary irrigation had the reverse effect, increasing cumulative yields by approximately 100%. The treatments had similar effects on the yields of Class I (> 65 mm diameter) fruits. Yield efficiency (yield per trunk cross-sectional area) was increased in all years by the irrigation treatment, but decreased in two of the four years by root restriction. From: Webster et al. 2000. J. Hort. Sci. & Biotech 75(2):181-189.