Fruit Varieties Journal 53(2):69-72 1999

Strawberry Cultivars for the Fresh Market in Denmark

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Abstract

13 cultivars were tested for the fresh market. Several characters were evaluated for 2 years including yield, berry size, taste, product quality and disease susceptibility. All cultivars grew successfully but 'Cesena' and 'Thuriga' were too vigorous and yielded too low. 'Kent,' an early to mid season cultivar, and 'Symphony,' a late cultivar, were productive with good quality and low disease susceptibility. Among the mid season cultivars 'Cortina' and 'Hapil' had yields and quality similar to 'Elsanta.'

Introduction

Most Danish strawberry growers cultivate 'Zefyr,' 'Elsanta' and 'Dania,' but their growth habit and state of health is not satisfactory (1, 3, 5). 'Zefyr' and 'Elsanta' are susceptible to mildew (5, 6), while 'Elsanta' is prone to winter frost damage (3) and 'Dania' is frequently attacked severely by gray mold (5). Moreover, 'Elsanta' is often without any taste, if it is harvested before ripening because of its bright and glossy appearance. To find cultivars better adapted to Danish conditions, several trials were conducted (4, 6) and as a result of this work, 'Honeoye' was introduced to Danish growers as an alternative to 'Zefyr' (6). To continue selecting new strawberry cultivars for Danish conditions, 13 cultivars were compared during 1997-1998.

Materials and Methods

The cultivars were planted in the field during autumn 1995 on flat beds without plastic cover. Country of origin and year of introduction is shown in Table 1. All plants were propagated and grown at the institute and each plot consisted of 15 plants spaced 0.33 m apart with 0.9 m between rows and one drip irrigation line in each row. There were 6 replications. In 1996 all flowers were removed from the plants. During the growing season the plants were fertigated in dry periods. Approximately 3 mm of water per day was applied, and it contained 24.5 mg per litre of nitrogen. Nitrogen fertilisation was controlled by leaf analyses each year.

The soil between rows was kept clean mechanically, and plants were sprayed against pests and diseases according to normal practice (2), including bloom sprays against gray mold *(Botrytis cinerea)*. The plants were protected by covering with agryl (fiber cloth composed of polypropylene fibers) during the winter period (1 November - 1 March) in both cropping years.

At harvest, taking place 2-3 times a week, yield, berry size (average of 25 berries), appearence, taste and overall commercial value (ratings) were assessed at each picking time. The latter being the immediate impression of the berries as they appeal to the consumer. Berries less than 22 mm, infested with mildew, gray mold or misshapen are considered not marketable. The percentage of berries infested with gray mold was recorded, and the plants were assessed for susceptibility to mildew, growth habit and runner production. All data were subject to statistical analysis using the General Model of SAS (SAS Institute, Inc., 1989-95, Cary, NC). The least significant differences between means were determined at $P < 0.05$ using Fisher's LSD.

Results and Discussion

Flowering and harvest time

Flowering time was expressed as the date of 50 per cent open flowers (Table 2).

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Table 1. Country of origin and year of introduction of 13 strawberry cultivars.

Cultivar	Country of origin	Year of introduction
Zefyr	Denmark	1965
Kent	Canada	1981
Elsanta	The Netherlands	1975
Cortina	Italy	1992
Sella	Italy	1992
Thuriga	Switzerland	1993
Eros	England	1990
Hapil	Belgium	1978
Gardena	Italy	1992
Gerida	Switzerland	1990
Symphony	Scotland	1994
Cesena	Italy	1982
Dania	Denmark	1982

Bloom was 6 to 11 days earlier in 1998 than in 1997 caused by an earlier spring. The majority of cultivars flowered in the same period, but 'Dania,' 'Cesena' and 'Thuriga' were significantly later.

Harvest time was expressed as the date of 50 per cent of the berries picked (Table 2). 'Zefyr' and 'Kent' are the earliest ripening cultivars whereas 'Symphony,' 'Cesena' and 'Dania' are the latest ripening cultivars.

Table 2. Flowering and harvest time of 13 strawberry cultivars in 1997 and 1998.

	Flowering time[1]		Harvest time[2]	
Cultivar	1997	1998	1997	1998
Zefyr	23/5	14/5	28/6	26/6
Kent	23/5	17/5	28/6	28/6
Elsanta	26/5	16/5	29/6	26/6
Cortina	23/5	15/5	29/6	26/6
Sella	26/5	16/5	29/6	27/6
Thuriga	1/6	25/5	29/6	1/7
Eros	31/5	21/5	1/7	28/6
Hapil	31/5	20/5	1/7	3/7
Gardena	26/5	17/5	5/7	30/6
Gerida	27/5	17/5	5/7	1/7
Symphony	31/5	22/5	6/7	5/7
Cesena	4/6	28/5	9/7	4/7
Dania	1/6	25/5	11/7	13/7

[1]Date of 50 per cent opened flowers.
[2]Date of 50 per cent berries picked.

Yield

Yield records are given in table 3. Most of the cultivars yielded lower in 1998 than in 1997. Despite an earlier spring in 1998, pollination seems to have been poorer as a considerable amount of the berries were distorted and misshapen. Among the early cultivars, 'Kent' yielded satisfactorily but with only medium sized berries. The mid season cultivars 'Hapil' and 'Gerida' had a medium yield of large berries both years, whereas the late cultivar 'Symphony' had a higher yield and larger berry size than 'Dania.' 'Cesena' and to a lesser extent 'Thuriga' yielded very low and may not be suitable under Danish conditions.

Table 3. Yield and berry size of 13 strawberry cultivars in 1997 and 1998.

	Marketable yield Metric t per ha		Berry weight grams	
Cultivar	1997	1998	1997	1998
Zefyr	22.2	14.6	12.6	11.9
Kent	31.1	18.6	13.3	13.9
Elsanta	19.3	8.8	13.9	13.7
Cortina	16.1	14.9	16.6	13.1
Sella	12.8	11.3	22.9	18.7
Thuriga	8.0	2.6	15.1	10.4
Eros	11.8	14.0	18.7	17.8
Hapil	14.7	15.5	19.4	20.5
Gardena	15.8	11.3	13.9	15.2
Gerida	22.7	17.1	12.7	13.4
Symphony	14.1	22.8	15.7	13.1
Cesena	0	2.2	17.2	20.1
Dania	20.9	8.4	12.0	11.4
LSD	4.9	6.3	2.5	2.7

Berry quality

The berry characteristics in table 4 is the subjective assessment of three samples. Color is described as light, medium or dark. It is assumed that berries, which are glossy and of light red color are the most attractive to the consumers. 'Elsanta' in this assessment was not assessed

Table 4. Descriptions based on assessed berry characteristics of 13 strawberry cultivars in 1997 and 1998.

Cultivar	Color	Flavor	Adherence of calyx	Commercial value
Zefyr	medium red	medium	medium	poor
Kent	medium red	good	medium	medium
Elsanta	medium red	good	medium	medium
Cortina	light red	medium	medium	good
Sella	light red	poor	medium	good
Thuriga	dark red	good	medium	medium
Eros	medium red	medium	medium	medium
Hapil	light red	medium	medium	medium
Gardena	medium red	medium	medium	poor
Gerida	light red	poor	medium	medium
Symphony	dark red	medium	medium	good
Cesena	dark red	medium	medium	medium
Dania	light red	medium	weak	good

until it developed medium color as an attempt to improve quality by delaying harvest time. 'Elsanta' when picked light red has a lack of taste. Flavor is described as poor, medium or good, and only berries of 'Kent,' 'Elsanta' and 'Thuriga' were considered of good flavor. Adherence of calyx did not differ significantly among the cultivars.

Considering the total commercial value, several of the cultivars might be useful under Danish conditions. Of the cultivars assessed in this trial, 'Kent,' 'Cortina,' 'Sella' and 'Symphony' rank highest in overall appearance.

Plant growth and health

According to table 5, 'Cesena' and 'Thuriga' are very vigorous cultivars. 'Gerida' and 'Cortina' produced many runners, whereas 'Thuriga,' 'Symphony' and 'Dania' produced very few runners.

Table 5. Vegetative growth and disease attacks, av. 1997-1998.

Cultivar	Plant growth rating 1-5[1]	Runner production rating 1-5[2]	Gray mold % of harvest	Mildew rating 1-5[3]
Zefyr	2.7	1.7	1.5	3.8
Kent	3.3	1.3	6.3	0.8
Elsanta	2.7	1.3	2.3	3.0
Cortina	3.0	2.8	3.0	1.3
Sella	2.5	1.7	7.0	0.8
Thuriga	4.2	0.7	10.9	1.5
Eros	2.2	1.8	4.7	2.4
Hapil	2.2	1.5	1.6	2.8
Gardena	2.5	2.0	1.8	3.0
Gerida	2.3	3.1	0.2	3.1
Symphony	3.2	0.8	2.5	2.3
Cesena	4.5	1.6	16.2	1.6
Dania	3.8	0.8	8.3	1.2
LSD	0.6	1.1	5.0	1.0

[1] 1 weak, 3 medium, 5 vigorous growth.
[2] 1 few, 3 medium, 5 many runners.
[3] 1 no attack, 3 medium attack, 5 heavy attack.

As to gray mold, 'Cesena' and 'Thuriga' seem to be very susceptible cultivars, whereas 'Zefyr,' 'Elsanta,' 'Gerida' and 'Gardena' seem prone to mildew. 'Cortina,' 'Hapil' and 'Symphony' seem to be cultivars with low susceptibility to both gray mold and mildew. Low disease susceptibility is a factor of increasing importance due to consumers' negative attitudes to the agricultural use of pesticides.

Conclusions

All the cultivars could be grown successfully except for 'Thuriga' and 'Cesena,' which yielded very low and cannot be recommended under Danish conditions. 'Kent' and 'Symphony' are productive cultivars with a good quality and moderate disease resistance and may replace 'Zefyr' and 'Dania.' Even though 'Kent' is not quite as early as 'Zefyr,' and 'Symphony' not as late as 'Dania,' their productivity and disease resistance qualify them as good alternatives. 'Cortina' and 'Hapil' could be grown as mid season cultivars, with a similar yield to 'Elsanta,' although they were not as attractive.

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