Strawberry Cultivar Testing in Norway

J. ØYDVIN[1], M. MELAND[2], A. HJELTNES[3], M. FLØNES[4]

During the 1960's the garden strawberry became the economic most important domestic fruit in Norway. It is now grown commercially in almost all parts of our country, in the south to about 500 m altitude; in northern counties it has become an appreciated plant even in Finmark at 71° latitude. Earliness is a trait of increasing importance to the north and at higher altitudes due to later and shorter growing season. In the Norwegian strawberry breeding program this trait has always been regarded important.

At the beginning of the 1970's 3 selections were named: Glima, Hella and Jonsok. These early ripening cultivars were all selected from the progeny Senga Sengana x Valentine. In the late 70's a new group of genotypes became available for testing. The most promising of these cultivars and selections originated from a cross between Glima and Belrubi. This progeny comprised the selections Solgull, Solprins and V14/31-78 wihch are presented in this paper. Records of processing traits are given by Skrede (1).

Plants for all plots were propagated at the Norwegian Plant Protection Institute, Ås (near Oslo), and planted 22nd June to 13th July 1979 at 3 locations: Ullensvang Research Station (Western Norway), State Experiment Station Kise (Eastern Norway), and State Experiment Station Kvithamar (Central Norway). At each location the plants were grown in 4 randomized blocks of 7 plants per plot, each plant spaced 33 cm apart in the row and held as single plant. At Kise the plants were grown in single rows 120 cm apart and mulched annually with grain straw. At Ullensvang and Kvithamar the plants were grown in double rows 45 cm apart on 15 cm high beds covered with black polyehtylene. Standard fertility, herbicide, fungicide and pesticide programs were used at all locations except at Kvithamar where the genotypes were tested without any use of fungicides.

Fruit number and yield as well as number of fruits damaged by rot were recorded for every pick throughout two or three fruiting seasons (1980-82). Three to four crops of fruit, and more at higher altitudes, are common practice in our country.

Results

The results are presented separately for each location and each year for total fruit yield, mean fruit size and earliness using Senga Sengana the predominant mid-season cultivar grown in Norway and Zefyr the leading early cultivar, as standards. All figures given in the tables are based on sound fruits; those for mean fruit size are based on records for all pickings throughout the season.

Total Fruit Yield (Table 1). Fruit yields were generally medium high during first fruiting season, high in the second season and very high in the third season. Solprins showed to be a good performer and outyielded the standard clones in accumulated fruit yields at all locations. V14/31-78 was an even more consistent good cropper, while Solgull performed only moderately well.

Fruit Size (Table 1). Fruit size was generally good in the first crop of fruit, and smaller in the others. However, the new cultivars showed a less decrease in fruit size than Senga Sen-

[1]Research Scientist, Institute of Genetics and Plant Breeding, Agricultural University of Norway, N-1432 Ås-NLH.
[2]Research Scientist, Ullensvang Research Station, 5774 Lofthus.
[3]Research Scientist, State Experiment Station Kise, 2350 Nes.
[4]Research Scientist, State Experiment Station Kvithamar, 7500 Stjørdal.

Table 1. Total yields and mean fruit size of strawberries at 3 locations, 1980-82.

Location and cultivar	Yield, kg/daa[1] 1980	1981	1982	Sum	Fruit size, g/fruit 1980	1981	1982	Mean
ULLENSVANG:								
Solprins	1454a[2]	2402a	2827ab	6683a	11.2a	8.8bc	8.9b	9.6b
V14/31-78	1376a	1946ab	3130a	6452ab	9.3bc	9.0b	7.7bc	8.6bc
Senga Sengana	1364a	2068a	2298bc	5730ab	9.7b	8.0cd	8.1bc	8.6bc
Zefyr	727bc	1579bc	2113bcd	4419bc	7.6d	6.7e	8.3bc	7.5c
Solgull	658bc	1466c	1418de	3542cd	11.7a	10.1a	11.9a	11.2a
KISE:								
Solprins	720c	1908b	2908a	5536b	9.7bc	9.4a	10.6a	9.9b
V14/31-78	1527a	2216a	3338a	7081a	9.7bc	8.9ab	7.6c	8.7cd
Senga Sengana	1498a	1600c	2257b	5355b	10.6b	7.8bc	7.2c	8.5cd
Zefyr	1479a	1164d	1157d	3800c	8.7c	7.7bc	8.9b	8.4d
Solgull	747bc	1230d	2300b	4277c	12.0a	10.3a	10.0a	10.8a
KVITHAMAR:								
Solprins	1679a	2045a		3724a	12.9bc	9.3		11.1
V14/31-78	1301b	1481bc		2782bc	13.2abc	8.8		11.0
Senga Sengana	1328b	1288bcd		2616bc	10.9c	9.1		10.0
Zefyr	1036b	1300bcd		2336c	10.7c			
Solgull	1101b	1157cd		2258c	15.5a	9.0		12.2

[1]daa = 0.1 hectare.
[2]Values followed by the same letter are not significant at the 5% level according to Duncan's Multiple Range Test.

gana. That is well demonstrated at Kise where the fruit size of Solprins in the third season equals that of Senga Sengana in the first season. On an average Solgull produced the largest fruits followed by Solprins. Zefyr and Senga Sengana produced the smallest fruits.

Earliness (Table 2). The locations of fruit ripening were in the order: Ullensvang, Kvithamar, Kise; the season was later in 1981 than in the other years. The season of ripening pattern was similar at all locations: Solprins being the earliest followed 1-2 days later by Zefyr and V14/31-78, and 7-10 days later by Senga Sengana as a mid-season cultivar.

Discussions

The results of these trials show that Solprins consistently produced very good crops with the exception of the results at Kise in the first fruiting season. The low yield record at Kise this year is most likely due to smaller plant size since only very young plants of Solprins were available for planting at this location in 1979.

Several strawberry fields in South Norway were damaged during the winter 1980/81 due to lack of snow cover and low temperatures, and that might have affected the fruit yields of Solgull in the following season. Solprins was, however, consistently high in yield that year and outyielded the standard cultivars at all locations. Solprins is our first released strawberry cultivar which combines high fruit yield with large fruits and early fruit ripening. Solprins and Solgull seem to maintain a larger fruit size as the plants grow older, than Senga Sengana

does; that is of course of great importance both from the grower's and the picker's point of view. The selection V14/31-78 has smaller fruits than Solprins and Solgull and will not be released.

Description of Cultivars

Solprins (Glima x Belrubi) early, tested as No. V24/92-78. Fruit: conic, large size, skin medium to darker red, flesh medium firm, firmer than Senga Sengana, moderately juicy, medium acid, good flavor. Medium capping ability — suitable for fresh fruit, freezing and processing. Plant: vigorous, very productive, foliage resistant to leaf scorch and fairly resistant to mildew, susceptible to fruit rot. Under high humid growing conditions the first ripe and largest fruits somewhat susceptible to cracking on the fruit neck. Introduced in 1980 by the Agricultural Research Council of Norway in co-operation with the Norwegian Plant Protection Institute, Ås.

Zefyr (Valentine x Dybdahl) early. Fruit: blunt conic, the first fruits irregular in shape some broad and wedged, large to medium size, skin medium to lighter red, flesh light red, medium firm to soft, juicy, fair to good flavor. Poor capping quality — suitable for early fresh market. Plant: moderately vigorous, medium productive, foliage resistant to leaf scorch, very susceptible to mildew, usually slightly better than Senga Sengana against fruit rot. Introduced in 1965 by State Experiment Station Spangsbjerg, Denmark (2).

Solgull (Glima x Belrubi) early to mid-season, tested as No. V23/159-78. Fruit: round conic, large and maintain fruit size well throughout the fruiting season. Skin medium red, flesh medium to lighter red, firmer than Senga Sengana, moderately juicy, good to very good flavor. Rapid to harvest by hand, easily hulled—suitable for fresh fruit, freezing and processing. Plant: runners abundant, vigorous, high yield potential but usually only medium productive, foliage resistant to leaf scorch, susceptible to mildew and fruit rot. Introduced in 1980 by the Agricultural Research Council of Norway in co-operation with the Norwegian Plant Protection Institute, Ås.

Table 2. Earliness illustrated by the dates when a yield corresponding to 300 kg per daa[1] were harvested at 3 locations, 1980-82.

Location and cultivar	1980	1981	1982	Mean
ULLENSVANG:				
Solprins	19/6	30/6	23/6	24/6
Zefyr	25/6	1/7	24/6	27/6
V14/31-78	26/6	5/7	24/6	28/6
Solgull	26/6	4/7	27/6	29/6
Senga Sengana	1/7	11/7	1/7	4/7
KISE:				
Solprins	13/7	13/7	12/7	13/7
Zefyr	9/7	17/7	15/7	14/7
V14/31-78	7/7	16/7	12/7	12/7
Solgull	13/7	17/7	14/7	15/7
Senga Sengana	17/7	22/7	17/7	19/7
KVITHAMAR:				
Solprins	5/7	9/7		7/7
Zefyr	6/7	10/7		8/7
V14/31-78	5/7	9/7		7/7
Solgull	9/7	14/7		12/7
Senga Sengana	11/7	18/7		15/7

[1]daa = 0.1 hectare.

Senga Sengana (Sieger x Markee) mid-season. Fruit: blunt conic, large to medium size, skin fairly dark red, flesh medium red, medium firm, juicy, good flavor. Easily capped — suitable for fresh fruit, freezing and processing. Plant: vigorous, productive, foliage resistant to leaf scorch, under certain growing conditions somewhat susceptible to leaf spot, fairly resistant to mildew, susceptible to fruit rot, suffers from low-temperature injuries after hard winters lacking snow cover. Introduced in 1954 from Sengana GmbH, Hamburg (2).

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Response of Peach Trees to Various Planting Distances[1]

FRED O. HARTMAN AND ROBERT G. HILL, JR.[2]

A fruit tree survey, published in 1976, revealed that 54 percent of the apple trees in Ohio orchards were on size-controlling rootstocks (4). This figure was up from 25 percent in 1968. Plantings on size-controlling rootstocks have facilitated closer planting distances and, therefore, more trees per acre. With the apple, such rootstocks usually result in flower-bud formation at an earlier age and increased yields per acre compared to trees on standard rootstocks.

Increasing interest continues to be shown relative to closer planting distances for peach trees than the conventional 20′ x 20′ used in the past. Before more progress in closer spacing of peach trees may be made, obtaining satisfactory dwarfing rootstocks or another acceptable commercial method must be found to reduce tree size and increase early yields. However, to date, a commercially accepted dwarfing rootstock for the peach is not available (5).

In recent years, a number of experimental and commercial peach plantings have been made in Ohio and other states where trees have been planted at closer spacings, both within and between the rows, than the traditional distances used in the past (2, 3, 6). Hayden and Emerson (2) were successful in confining peach trees to close spacings by summer pruning (hedging). This type of pruning requires special equipment and results in pruning wounds which may become entry canker sites. A trend of planting more trees per acre appears to be continuing with the peach and also other stone fruits as has occurred with the apple. The present study was undertaken to evaluate a system of dense planting coupled with early selective tree removal on peach orchard efficiency.

Materials and Methods

A peach planting consisting of 270 trees was established on a desirable site on the Jackson Branch of the Ohio

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[2]Professor, Professor and Associate Chairman, Department of Horticulture, respectively. Ohio Agricultural Research and Development Center, The Ohio State University, Wooster, Ohio 44691.