

Study of heritage apple cultivars in Norway

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Front cover: The Danish apple cultivar 'Gravenstein'. Photo: Oddmund Frøynes

Back cover: Open flower of the apple cultivar 'Discovery'. Photo: Mekjell Meland

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Preface

The overall goal of the research project NORWEGIAN FRUIT GENETIC RESOURCES; HEALTHY, TASTE & NO WASTE was to evaluate fruit genetic resources of traditional apple, plum and raspberry cultivars in Norway, to promote sustainable and innovative use of these resources by plant breeding programs, Norwegian fruit industry, Norwegian food processing industry, and finally by consumers.

From different *ex-situ* sites located at different regions in total 243 cultivars (139 apple, 64 plum and 40 raspberry cultivars) was tested for agronomic traits and chemical characteristics of the fruits during the years 2018-2021. The composition of individual sugars, acids, the polyphenolic profile was determined in fruits, while content of fatty acids, carotenoids and tocopherols was analysed in kernels/seeds.

This will raise consumer awareness of the need for consumption of food rich in beneficial health compounds and will help with the selection of raw material for the food processing industries for making fresh juices, ciders, jams, and jellies. Oil obtained from kernels/seeds will give an opportunity to the Norwegian industry to develop new products aimed for different purposes (food, cosmetic, fuel).

This NIBIO Book presents data of pomological, agronomical, and chemical traits of total 139 heritage and along with some commercial apple cultivars identifying the most important quality parameters, and selecting cultivars with desirable traits giving valuable information for future breeding programs, the fruit industry, processing industry and public awareness.

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Lofthus, 17.03.2025
Mekjell Meland
Project leader

Summary

This report presents results of apple cultivars and selections studies, performed during 2018-2021 at NIBIO Ullensvang, Njøs Fruit and Berry Centre and Norwegian University of Life Sciences (NMBU) in the frame of FRUIT-N-QUALITY (Evaluation of traditional Norwegian apple, plum and raspberry cultivars) project.

The aim of this study was to evaluate Norwegian heritage apple cultivars from pomological, agronomical, and biochemical point of view, identify the most important quality parameters, and select cultivars with desirable traits for modern markets and breeding purposes.

In total 139 heritage apple cultivars were evaluated. In addition, the chemical contents of the fruits and the seeds are listed for 139 cultivars.

The aim of this study is to evaluate Norwegian heritage apple cultivars from pomological, agronomical, and biochemical point of view, identify the most important quality parameters, and select cultivars with desirable traits for modern markets and breeding purposes.

In total 139 heritage apple cultivars were evaluated during 2018-2021. During the studies heritage cultivars that have never been documented were identified and pomological descriptions of sixteen heritage cultivars were prepared. In addition, the chemical contents of the fruits and the seeds are listed for these cultivars.

Based on individual investigations of various fruit quality characters, cultivar groups with special properties were selected for the industry and as genetic sources in breeding programs.

Based on overall fruit quality, heritage cultivars for fresh consumption are selected: Rondestveit, Løeple, Raud Gravenstein, Sävstaholm, Raud Sävstaholm and Maglemer.

Content

1	Introduction.....	6
2	Materials and Methods	7
3	Results and Discussions	10
4	Conclusions.....	29
5	Acknowledgments	31
6	References	32
7	Supplements	34
	Appendix 1 – Flower, leaf and fruit characteristics	34
	Appendix 2 - Pomological descriptions of heritage cultivars	48

1 Introduction

Several thousands of apple cultivars are described in the literature, but only few of them are dominating in the commercial apple orchards. Still Golden Delicious and Red Delicious take the leading positions in the world market. Even more, one of these two cultivars are parents of other worldwide popular cultivars as Gala, Jonagold or Fuji and Mutsu. Such decline in genetic diversity could lead to the negative consequences in terms on adaptability, resistance and even consumption. Therefore, great efforts were taken in various countries around the globe to establish apple cultivar collections with as much as possible heterogeneous material. Many of these collections are focused to preserve unique apple genotypes to enlarge genetic diversity and to sustain cultural heritage.

Apple genetic resources are preserved in many national, regional or local apple collections. During the last few decades genetic evaluation has been very extensively used and many apple collections worldwide were screened (Hokanson et al, 2001; Routson et al., 2009; Nybom and Garkava-Gustavsson, 2009; Lacis et al, 2011; Sikorskaite et al, 2012; Garkava-Gustavsson et al., 2013; Pérez-Romero, 2015; Larsen et al., 2017; Heinonen and Bitz, 2019; Testolin et al, 2019; Magby et al., 2019; Mažeikienė et al., 2019).

Apple genetic resources in Norway are conserved in a number of local clonal archives (Sæther et al., 2021). Genetic characterization in some of these apple accessions was done as well to assess the genetic diversity (Gasi et al., 2016). Out of 181 analysed accessions, from six *ex situ* collections located in western and south-eastern Norway, 158 displayed a unique SSR profile. However, pomological and chemical contents of the fruit from these *ex situ* collections are still not documented as is usually not done in previously mentioned genetic studies.

The importance of research and conservation of local, traditional cultivars is evident as this genetically heterogeneous material represents a potential source of positive pomological traits and resistance to biotic (including pests and diseases (Paap et al., 2016) and abiotic stress (Kellerhals et al., 2004). Therefore, heritage apple cultivars should be included and used in the breeding programs (Tóth et al., 2004) or having special features and high disease resistance local apple cultivars can be directly cultivated in orchards (Brown, 2015; Kiraly et al., 2015; Wicklund et al., 2021).

Most of commercial orchards in Norway use intensive orchard management practice and are established with modern international cultivars. Traditional varieties are almost not grown in commercial orchards. Meanwhile, there is growing interest from the consumers for local grown fruits and increased demand for health benefits. Such changes in consumer's demand give new tasks for horticulture and can be partly solved by comprehensive evaluation and re-selection of heritage cultivars.

The scientific project FRUIT-N-QUALITY (Evaluation of traditional Norwegian apple, plum and raspberry cultivars) was started in 2018. To develop results for a robust, efficient use of genetic resources and to maintain a database of valuable agronomic and commercial traits of apple, plum and raspberry to meet consumer and industry needs, it is aimed to:

- Develop the database of agronomic traits within genotypes suitable for breeding programs, fruit industry, processing industry, and innovation partners.
- Evaluate and document sensory and chemical characteristics of fruits, important for the fruit and food processing industry to develop new products.
- Analyse bioactive compounds with high biological importance in seeds/kernels of apple, plum and raspberry to develop significant health and/or economic benefits of possible new products.

The aim of this study is to evaluate Norwegian heritage apple cultivars from pomological, agronomical, and biochemical point of view, identify the most important quality parameters, and select cultivars with desirable traits for modern markets and breeding purposes.

2 Materials and Methods

One hundred thirty-nine heritage apple cultivars were tested at Hjeltnes, Lofthus, Njøs and Ås in 2018 – 2021. At Hjeltnes trees were propagated on M.26 rootstock and planted during 1995 – 1998. At Njøs trees were propagated on M.9 rootstock and planted during 2014 – 2015. At Ås trees were propagated on the M 26 rootstock and planted during 2010-2015. All of them are having a unique SSR profile what was proved by Gasi et al. (2016). Commercial cultivars Aroma, Rubinstep, Elstar and Summerred were propagated on M.9 rootstock and planted during 2010 – 2012 at Lofthus.

Planting distances in the row were 3 m for apple trees on M.26 and 1 m for trees on M.9 rootstock.

Each cultivar was replicated from 2 till 3 times with one tree per plot.

The phenological stages (Table 1) and harvest dates and maturity (1. Extremely early, 2. Very early, 3. Early, 4. Early/mid-season, 5. Mid-season, 6. Mid-season/late, 7. Late, 8. Very late, 9. Extremely late) were assessed every year.

Table 1. Flowering stages and BBCH scale (Meier et al., 1994)

Code	Description
60	First flowers open
61	Beginning of flowering: about 10% of flowers open
62	About 20% of flowers open
63	About 30% of flowers open
64	About 40% of flowers open
65	Full flowering: at least 50% of flowers open, first petals falling
67	Flowers fading: majority of petals fallen
69	End of flowering: all petals fallen

Flower diameter (mm) and position of stigmas relative to anthers (below, same level, above) were recorded.

Leaf blade length (mm) and width (mm) was measured using the sample of 10 leaves. Leaf blade length/width ratio was calculated.

Incisions of leaf blade margin was evaluated in upper half of the leaf. Five types of incisions were determined using the sample of 10 leaves: crenate, bicrenate, serrate type 1, serrate type 2, biserrate (Fig. 1).

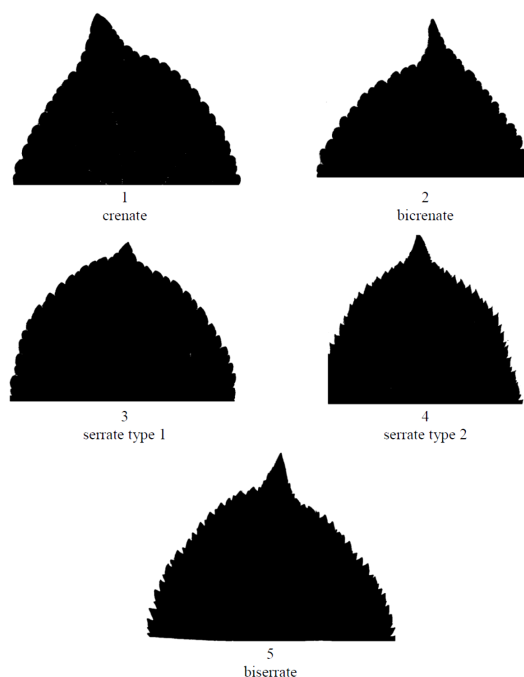


Fig. 1. Type of apple leaf blade margin.

Average fruit weight (g) was calculated based on all fruits per every tree and total yield.

Fruit quality characteristics were determined on samples of 10 randomly collected fruits per tree.

Fruit cover colour (blush) was evaluated visually in 1-9 point scale, where 1 – 0% of blush, 9 – 100% of fruit surface is covered by red blush.

Fruit firmness (kg cm²) was measured by fruit texture digital measurer Durofel® 25 (Copa-Technology CTIFL, France) using standard probe 0,25 mm, taking average of two records from the opposite sides of peeled fruit.

Soluble solid content (%) was measured by Atago® Pallete Digital refractometer PR-101 (Atago®, Tokyo, Japan).

Fruit taste (0-6 points, where 0 - extremely poor, 3 – intermediate, 6 - excellent), attractiveness (0-6 points, where 0 - extremely poor, 3 – intermediate, 6 - extremely attractive), and aroma (0-4 points) was evaluated by trained panellists.

The total phenol content (TPC) in apple fruits was evaluated by using the Folin–Ciocalteu method. The TPC was expressed as gallic acid equivalents (GAE) in mg/100 g. Antioxidant activity (FRAP-method) was analysed according to Benzie and Strain (1996) and expressed in $\mu\text{mol/g}$.

The vitamin C content (mg/100 g) was analysed by HPLC, using the Acclaim Polar Advantage II C₁₈ column 5 μm (150 x 4.6 mm) as stationary phase with 20% meta phosphoric acid adjusted at pH 2.00 as mobile phase and glass carbon as working electrode. The calibration standard of ascorbic acid was from 1- 50 ppm. The recovery of the method was from 91 to 109%.

Other fruit characters were recorded according to UPOV and Eufrin apple descriptors:

- length and width (cm), measured maximum height and maximum diameter,
- general shape, evaluated visually and classified as cylindrical waisted, conic, ovoid, cylindrical, ellipsoid, globose, obloid (fig. 2),
- ribbing, evaluated visually and classified as absent or weak, moderate, strong,
- bloom of skin (absent or weak, moderate, strong)
- greasiness of skin (absent or weak, moderate, strong)

- ground colour (not visible, whitish yellow, yellow (as 'Golden Delicious'), whitish green, yellow green ('Cox's Orange Pippin'), green ('Granny Smith'),
- hue of over colour – with wax bloom removed (no over colour, orange red (as Cox's Orange Pippin), pink red (Cripps Pink), red (Gala), purple red (Spartan), brown red (Fiesta)
- pattern of over colour, evaluated visually and classified as only solid blush, solid blush with weakly defined stripes, solid blush with strongly defined stripes, weakly defined blush with strongly defined stripes, only stripes (no blush), blushed and mottled, blushed, striped and mottled.
- area of russet (absent or small (only around the stalk or calyx cavity), medium (less than 1 0% of the surface), large (more than 1 0% of the surface)).
- number of lenticels (few, medium, many)
- size of lenticels (small, medium, large)
- length of stalk (very short, short, medium, long, very long)
- colour of flesh (white, cream, yellowish, greenish, pinkish, reddish).

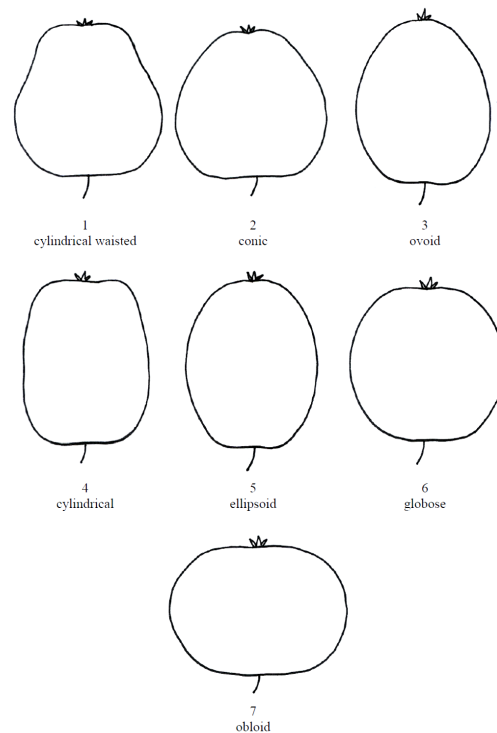


Fig. 2. Apple fruit shape types.

Following apple tree characters were assessed:

- vigour (very weak, weak, medium, strong),
- growth habit (upright, spreading, dropping, weeping) (fig.3),
- type of bearing (on spurs only, on spurs and long, on long shoots only) (fig.4).

Data was analysed by general analysis of variance (ANOVA) using the statistical program Minitab® 16 statistical software (Minitab Ltd., UK). All main phenological data, yield and fruit quality parameters are presented as an average of two years.

3 Results and Discussions

Phenology of flowering and fruit ripening.

Flowering time. Apple flowering time in Norway greatly depends on the weather conditions in a particular season and could vary till three - four weeks what was reported in our previous apple cultivar trials (Frøynes et al., 2020; 2021). Flowering window is important not only for optimal pollination and subsequent fruit set, but also to avoid risks of late spring frost damages in the regions where they occur.

In two years of this study variation of full flowering time between tested cultivars planted at Ulvik was 10 days: May 15-25 in 2018 and May 10-20 in 2019 (Table 2). Apple flowering time at Njøs was later by 5-6 days and varied between May 21 and June-1 in 2020 and between May 08-20 in 2019.

Early flowering was recorded for cvs. Aagoteple, Franskar, Jordbæreple, Raud Sävstaholm and Rosvolleple in both years and was similar to flowering time of cv. Summerred.

Flowering time of Edholm, Vintergul, Vågaepel, Signe Tillisch, Hindals dronning, Ingrid Marie, Strutar, Lord Lambourne, Sitroneple, Skredsvigepel, Søgneple, Nordfolk Royal, Bananepel, Haugeepel, Ribston, Øysteineple, and Cox's Orange cultivars was late or medium late and was comparable to cv. Aroma and Elstar.

All other tested cultivars belong to medium flowering cultivar group.

Flower morphology is provided in Table S1.

Fruit maturity. Fruit maturation and harvest time is very important at Norwegian climatic conditions. Cultivars that harvest time is after the middle of October due to possible temperature drop could not reach proper fruit quality every year. Based on two years of observations, heritage cultivars can be grouped according to their harvest time to following groups (Table 2):

Very early: Beauty of Bath, Early Red Bird, Ekely, Geneva Early, Grønt Laupsaeple, Jordbæreple, Oster and Quinte.

Early: Rossvolleple, Sukkereple, Fristeren, Garborg, Grindeepel, Haugeepel, Knuteple, Laveple, Transparente Blanche, Gyllenkroks Astrakan, Petrineepel, Raud Sävstaholm and Sävstaholm.

Mid-season: Aagoteple, Apalsetepel, Bananepel, Charlamovsky, Cox's Pomona, Edholm, Enestående, Gul Granat, Håkonseple, Hjartneseple, Fillippa, Franskar, Lavoll, Laxton's Exquisite, Leiknes, Leriseple, Lærdalseple, Løeple, Øskaug, Rondestveit, Stor Granat, Storesteinseple, Brureple, Fuhr, Gloppestadeple, Gullspir, Høyneple, Kaupanger, Kjerringholm, Kviteple, Maglemer, MarteMoster, Nansenepel, Nordfolk Royal, Paradiseple, Raud Gravenstein, Raudt Laupsaeple, Raud Sommerkavill, Riskedal, Sitroneple, Strutar, Summerred, Sysekavill, Teigeple, Tolleivseple, Tokheimseple, Tormod, Tveiteple, Ulgenes, Vinterrosenstrips and Worcester Pearmain.

Late: Antonovka, Borsdorfer, Bøtuneple, Elraud Pigeon, Gul Granat, Grågylling, Herrasaleple, Hindals dronning, Husmor, James Grieve, Lord Lambourne, Nordfjordeple, Raud Granat, Signe Tillisch, Silkeple, Skredsvigepel, Stor Torstein, Sureple Grønn, Vintergul, Aroma, Ingrid Marie, Ribston, Rubinstep, Vågaepel, Torstein and Elstar Boerekamp Excellent-Star®.

Very late: Belle de Boskoop, Bramley's Seedling and Cox's Orange.

Only three of tested cultivars had very late harvest time and cultivation of them in Norway could be risky, but majority of heritage cultivars are well adapted to local growing conditions.

Table 2. Tree vigour, habitus, bearing type and phenology, average 2018-2019

Cultivar	Tree vigour	Tree habitus	Type of bearing	Full flower ing date	Fruit harvest time
Aagoteple	weak	spreading	on spurs and long shoots	May-15	moderate
Antonovka	medium	spreading	on spurs		late
Apalseteple	medium	spreading	on spurs and long shoots	May-22	moderate
Aroma	medium	spreading	on spurs	May-24	late
Bananeple	strong	drooping	on spurs and long shoots	May-21	moderate
Beauty of Bath	medium	upright	on spurs and long shoots	May-19	very early
Belle de Boskoop	strong	spreading	on spurs and long shoots	May-19	very late
Borsdorfer	strong	spreading	on spurs	May-20	late
Bøtuneple	medium	spreading	on spurs and long shoots	late	
Bramley's Seedling	weak	spreading	on spurs and long shoots	May-19	very late
Brureple	weak	upright	on spurs and long shoots	May-18	moderate
Charlamovsky	medium	spreading	on spurs and long shoots	May-18	moderate
Cox's Orange	medium	spreading	on spurs	May-22	very late
Cox's Pomona	weak	spreading	on long shoots	May-21	moderate
Early Red Bird	medium	spreading	on spurs and long shoots	May-16	very early
Edholm	medium	upright	on spurs and long shoots	May-26	moderate
Ekely	medium	drooping	on spurs and long shoots	very early	
Eldraud Pigeon	medium	spreading	on spurs and long shoots	May-17	late
Elstar	medium	weeping	on spurs	May-24	late
Enestående	weak	drooping	on spurs and long shoots	May-22	moderate
Fillippa	medium	upright	on spurs and long shoots	May-24	moderate
Franskar	weak	spreading	on spurs	May-15	moderate
Fristeren	medium	spreading	on long shoots	May-20	early
Fuhr	medium	upright	on spurs and long shoots	May-18	moderate
Furuholm	medium	spreading	on spurs	May-18	moderate
Garborg	medium	spreading	on spurs and long shoots	May-18	early
Geneva Early	medium	spreading	on spurs and long shoots	May-19	very early
Gloppestadeple	medium	upright	on spurs and long shoots	May-22	moderate
Grågylling	medium	spreading	on spurs	May-22	late
Grindeple	medium	spreading	on spurs and long shoots	May-22	early
Grønt Laupsaeple	medium	spreading	on spurs and long shoots	May-17	very early
Gul Granat	weak	spreading/upright	on spurs and long shoots	May-20	late
Gullspir	weak	spreading	on spurs	May-20	moderate
Gyllenkroks Astrakan	medium	spreading	on spurs and long shoots	May-16	early
Håkonseple	medium	spreading/weeping	on spurs and long shoots	May-20	moderate
Haugeeple	strong	spreading	on spurs and long shoots	May-21	early
Herreasaeple	medium	spreading	on long shoots	May-18	late
Hindals drønning	medium	spreading	on spurs and long shoots	May-27	late
Hjartneseple	weak	spreading	on spurs and long shoots	May-16	moderate
Høyneseple	strong	upright	on spurs and long shoots	May-18	moderate
Husmor	medium	spreading	on spurs	May-20	late
Ingrid Marie	medium	spreading	on spurs	May-21	late

Table 2. (continued)

Cultivar	Tree vigour	Tree habitus	Type of bearing	Full flowering date	Fruit harvest time
James Grieve	weak	spreading	on spurs and long shoots	May-24	late
Jordbæreple	medium	spreading	on spurs	May-13	very early
Kaupanger	medium	spreading	on spurs and long shoots	May-20	moderate
Kavill	weak	spreading	on spurs and long shoots	May-16	moderate
Kjerringholm	medium	spreading	on spurs	May-24	moderate
Knuteple	strong	upright	on spurs and long shoots	May-19	early
Kviteple	medium	spreading	on spurs and long shoots	May-16	moderate
Lærdalseple	strong	spreading	on spurs and long shoots	May-24	moderate
Langballe	medium	spreading	on long shoots	May-16	moderate
Laveple	strong	spreading	on spurs and long shoots	May-21	early
Lavoll	medium	spreading	on spurs and long shoots	May-24	moderate
Laxton's Exquisite	medium	spreading	on spurs	May-19	moderate
Leiknes	medium	dropping	on spurs and long shoots	May-17	moderate
Leriseple	weak	spreading	on spurs and long shoots	May-22	moderate
Løeple	medium	spreading	on spurs	May-19	moderate
Lord Lambourne	weak	spreading/weeping	on spurs and long shoots	May-21	late
Maglemer	medium	spreading	on spurs and long shoots	May-19	moderate
Marte-Moster	very weak	spreading	on spurs and long shoots	May-16	moderate
Nansenepile	medium	spreading	on spurs and long shoots	May-24	moderate
Nordfjordeple	weak	spreading	on spurs and long shoots	May-19	late
Nordfolk Royal	medium	spreading	on spurs and long shoots	May-21	moderate
Ölands Kungseple	medium	spreading	on spurs and long shoots	May-16	moderate
Olinaeple	medium	upright	on spurs and long shoots	May-22	
Ørekrok	medium	spreading	on spurs and long shoots	May-24	late
Øskaug	strong	spreading/upright	on spurs	May-17	moderate
Oster	medium	spreading	on spurs and long shoots	May-18	very early
Øysteineple	weak	spreading	on spurs and long shoots	May-26	late
Paradiseple	medium	dropping/weeping	on long shoots	May-16	moderate
Petrineeple	weak	spreading	on spurs and long shoots	May-22	early
Quinte	medium	spreading	on spurs and long shoots	May-16	very early
Raud Granat	strong	upright	on spurs and long shoots	May-20	late
Raud Gravenstein	strong	spreading	on spurs	May-16	moderate
Raud Sävstaholm	medium	spreading	on spurs and long shoots	May-15	early
Raud Sommerkavill	medium	spreading	on spurs and long shoots	May-16	moderate
Raudt Laupsaeple	medium	spreading	on spurs and long shoots	May-16	moderate
Ribston	medium	spreading/dropping	on spurs and long shoots	May-21	late
Riskedal	weak	spreading	on spurs and long shoots	May-22	moderate
Rondestveit	weak	upright	on spurs and long shoots	May-16	moderate
Rosenrød	medium	drooping	on spurs	May-19	
Rosvolleple	strong	spreading/dropping	on spurs and long shoots	May-14	early
Rubinstep	weak	spreading	on spurs	May-16	late
Sävstaholm	strong	spreading	on spurs and long shoots	May-16	early

Table 2. (continued)

Cultivar	Tree vigour	Tree habitus	Type of bearing	Full flowering date	Fruit harvest time
Signe Tillisch	medium	spreading	on spurs and long shoots	May-21	late
Silkeple	medium	spreading	on spurs and long shoots	May-20	late
Sitroneple	medium	spreading	on spurs and long shoots	May-21	moderate
Skredsvigepel	medium	upright	on spurs	May-27	late
Søgneple	medium	spreading	on spurs and long shoots	May-27	
Søteple	medium	spreading	on spurs	May-18	moderate
Stor Granat	strong	upright	on spurs	May-18	moderate
Stor Torstein	medium	upright	on spurs and long shoots	May-20	late
Storesteineple	medium	spreading/upright	on spurs and long shoots	May-19	moderate
Strutar	strong	spreading/weeping	on spurs and long shoots	May-21	moderate
Sukkereple	medium	upright	on spurs and long shoots	May-19	early
Summerred	medium	spreading	on spurs	May-13	moderate
Sureple grønn	weak	spreading	on spurs	May-16	late
Sylfestepel	medium	spreading	on spurs and long shoots	May-22	
Sysekavill	medium	spreading	on spurs and long shoots	May-17	moderate
Teigepel	very strong	upright	on spurs and long shoots	May-22	moderate
Tolleivseple	weak	spreading/dropping	on spurs and long shoots	May-16	moderate
Tokheimseple	strong	spreading	on spurs and long shoots	May-16	moderate
Tormod	weak	spreading/dropping	on spurs and long shoots	May-20	moderate
Transparente Blanche	medium	spreading	on long shoots	May-19	early
Tveiteple	strong	spreading/upright	on spurs and long shoots	May-16	moderate
Ulgenes	strong	spreading	on spurs and long shoots	May-16	moderate
Vågaepel	medium	upright	on long shoots	May-29	late
Prins	medium	spreading/dropping	on spurs and long shoots	May-20	moderate
Torstein	strong	upright	on spurs	May-20	late
Vintergul	weak	spreading	on spurs and long shoots	May-21	late
Vinterrosenstrips	medium	spreading/upright	on spurs and long shoots	May-16	moderate
Worcester Pearmain	strong	upright/spreading	on spurs and long shoots	May-19	moderate

Apple tree growth and bearing type

Tree growth. Apple tree cultivars due to their genetics exhibit different growth vigour. Cultivation of weak or strong growing apple cultivars requires additional attention therefore optimal rootstock/scion combinations should be chosen combining strong growing cultivars with more dwarfing apple rootstocks and weak growing cultivars with more vigorous ones. In this study, most of tested cultivars exhibited medium vigorous growth (Table 2). Cv. Marte-Moster was the only very weak growing cultivar. According to assessed tree vigour rest of heritage cultivars felt to two groups:

Weak growing: Aagoteple, Bramley's Seedling, Brureple, Cox's Pomona, Franskar, Gul Granat, Gullspir, Enestående, Hjartneseple, James Grieve, Kavill, Leriseple, Lord Lambourne, Nordfjordeple, Petrineseple, Riskedal, Rondestveit, Rubinstep, Sureple grønn, Tolleivseple, Tormod, Øysteineple and Vintergul.

Strong growing: Bananeple, Belle de Boskoop, Borsdorfer, Haugeple, Høyneple, Knuteple,

Lærdalseple, Laveple, Øskaug, Raud Granat, Raud Gravenstein, Rosvolleple, Sävstaholm, Stor Granat, Strutar, Teigeple, Tokheimseple, Tveiteple, Ulgenes, Torstein and Worcester Pearmain.

Leaf characteristics. Data on leaf blade length, width, their ratio and incisions of upper half of leaf blade margin is provided in Table S2.

Tree habitus. Tree canopy of the most tested cultivars had spreading growth habitus. But there were cultivars with another pattern of canopy growth (Table 2, Fig.3):

Upright: Beauty of Bath, Brureple, Edholm, Gloppestadeple, Fillippa, Fuhr, Høyneseple, Knuteple, Olinaeple, Raud Granat, Rondestveit, Skredsvigeple, Stor Granat, Stor Torstein, Sukkereple, Teigeple, Torstein, Vågaeple.

Upright – spreading: Gul Granat, Øskaug, Storesteineple, Tveiteple, Vinterrosenstrips and Worcester Pearmain.

Weeping: Elstar.

Weeping – spreading: Håkonseple, Lord Lambourne and Strutar.

Weeping – dropping: Paradiseple

Dropping: Bananeple, Ekely, Enestående, Leiknes and Rosenrød.

Dropping – spreading: Ribston, Rosvolleple, Tolleivseple, Tormod and Prins.

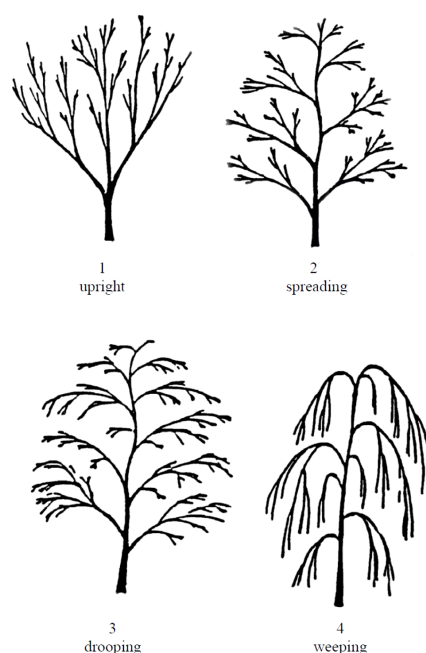


Fig.3. Apple tree growth habit

Bearing habit. Lespinasse (1977) proposed to divide apple cultivars into groups concerning the age of the fruiting wood: Type I ('Starkrimson') – fruiting is predominantly on 2- and 3-year old wood, Type II ('Reine des Reinettes') – fruiting is mainly on 3- and 4-year-old wood, Type III ('Golden Delicious') – fruiting predominantly on 1-, 2- and 3- year wood and Type IV ('Granny Smith') – fruiting mainly on 1- and 2-year-old wood. UPOV guidelines grouped apple cultivars into three groups according to type of bearing: on spurs only (reference cultivar Starkrimson Delicious); on spurs and long shoots (reference cultivar Jonagold) and on long shoots only (reference cultivars Cortland and Rome Beauty) (Fig.4). Both classifications are important for the establishment of right pruning strategy.

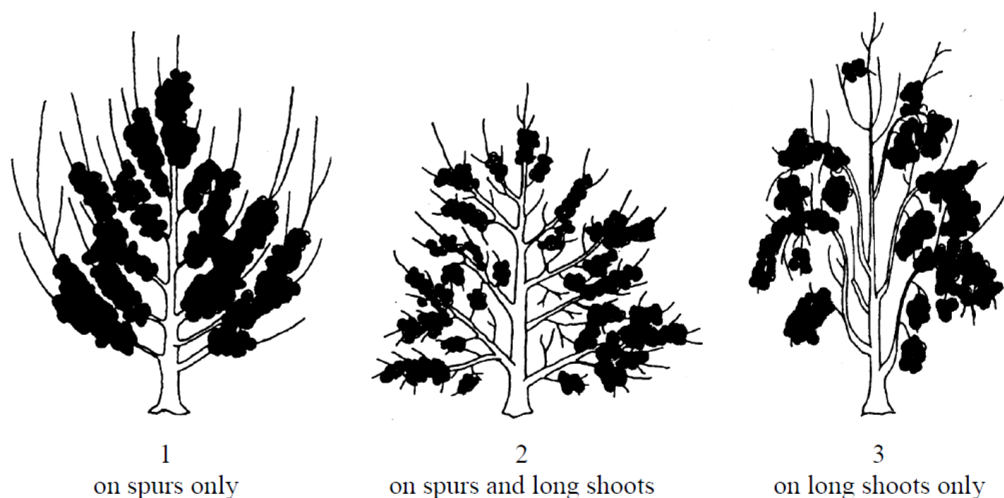


Fig.4. Apple tree bearing type

In our study, along with commercial cultivars Aroma, Summerred and Rubinstep following heritage cultivars as Antonovka, Borsdorfer, Cox's Orange, Gullspir, Grågylling, Furuholm, Franskar, Husmor, Ingrid Marie, Jordbæreple, Kjerringholm, Laxton's Exquisite, Løeple, Øskaug, Raud Gravenstein, Rosenrød, Søteple, Stor Granat, Skredsvigep, Sureple grønn and Torstein set fruits only on spurs (Table 2). The study conducted in Bulgaria (Dzhuvinov and Gandev, 2016) showed that apple cultivars produced the highest percentage of fruits on spurs. It is known that the spur-type cultivars are characterized by a biennial-bearing habit, but on long-branching cultivars leaf-bearing shoots appeared to be able to balance vegetative and reproductive growth (Lauri and Lespinnasse, 1993).

Only six cultivars were typical tip bearers - Cox's Pomona, Fristeren, Herreasaleple, Langballe, Paradiseple, Transparente Blanche and Vågaep, meanwhile the largest part of cultivars were fruiting both on spurs and long shoots.

Fruit quality.

Fruit diameter. It is obvious that testing of a large number of cultivars reveals significant variation in fruit size (Table 3). Cvs. Apalsetep, Bramley's seedling, Cox's Pomona, Husmor, Filippa, Rossvolleple, Leiknes, Skredsvigep, Sysekavill, Storesteineple Ørekrok and Øysteineple had the largest fruits with the average diameter over 80 mm. Only one of commercial cultivars Aroma has reached such size. On the other hand, there were 15 cultivars which average fruit diameter was less than 65 mm, and fruit diameter of Paradiseple and Sureple Grøn even did not overcome 50 mm.

Fruit weight. The average weight of tested cultivars depended on the crop load in particular year, but mostly was determined by genotype and varied from 36-38 g till 222 g. Cultivars Leiknes, Bramley Seedling, Hindals droning, Husmor, Filippa, Skredsvigep, Storesteineple, Signe Tillisch, Rossvolleple, Sysekavill, Øysteineple, Ørekrok and commercial cultivar Aroma had the biggest fruit weight around or over 200 g.

Average fruit weight of 18 cultivars was lower than 100 g. Cultivars Leriseple, Søteple, Eldraud Pigeon, Sureple grønn and Paradiseple had especially small fruits.

Fruit yield and fruit number of most of cultivars was higher in 2019. Therefore, in general, the average fruit weight was lower in that year. The highest variation of fruit weight (31 – 45%) due to differences of crop load was recorded for Marte-Moster, Oster, Fristeren, Husmor, Nordfolk Royal, Garborg and

Early Red Bird. Despite of that differences of fruit weight were very low almost for the half of tested cultivars (0-15%).

Fruit colour. Heritage cultivars Raud Sävstaholm, Ingrid Marie, Ölands Kungseple, Raudt Laupsaeple, Raud Gravenstein, Garborg, Early Red Bird, Eldraud Pigeon and Rondestveit the same as commercial Summerred and Elstar had extensively coloured fruits (Table 3). Their blush (over colour) covered 60-80 % of the fruit surface. Over colour of these cultivars varied from red to pink/violet - red and the blush pattern was mainly solid blush or solid blush with strongly defined stripes (Table S1). Several cultivars as Bananeple, Belle de Boskoop, Fristeren, Grønt Laupsaeple, Gul Granat, Gullspir, Hjartneseple, Rossvolleple, Sitroneple and Transparente Blanche had fruits without any blush and their ground colour was mostly white - green or green, and only Hjartneseple had yellow green fruits. Very little or no blush was found on fruits of cvs. Håkonseple, Haugeeple, Husmor, Kavill, Knuteple, Kviteple, Langballe, Signe Tillisch, Silkeple, Søteple and Tokheimseple.

Area of russetting. Most of tested cultivars were not affected by fruit russetting (Table S2). Only cv. Belle de Boskoop and cv. Ribston fruits had large russeted areas of fruit surface. Some other cultivars as Fristeren, Kavill, Knuteple, Langballe, Maglemer, Søteple and Vinterrosenstrips show some tendency to have more pronounced russetting.

Fruit shape and other external fruit characters as fruits skin greasiness and bloom, fruit ribbing, number and size of lenticels, length of stalk, are provided in Table 2, Table S3, Table S4 and Table S5.

Table 3. Fruit external characters, average 2018-2019.

Cultivar	Weight, g	Diameter (mm)	Length (mm)	Shape	Area of overcolour (1-9)
Aagoteple	133	70	62.1	globose	
Antonovka	145	64.9	63.1	conic	
Apalseteple	148	88.5	75.8	ovoid	
Aroma	194	81	70	conic obloid	4.7
Bananeples	114	67	59	globose obloid	1.1
Beauty of Bath	87	65	51	obloid	5.7
Belle de Boskoop	178	76	69	conic obloid	1.4
Borsdorfer	136	70	62	globose	3
Bøtuneples	112	69.9	58.2	globose	
Bramley's Seedling	222	84	68	conic-globose-obloid	3.2
Brureples	86	65	52	obloid	5.3
Charlamovsky	145	77	68	globose obloid	1.7
Cox's Orange	87	62	51	conic-globose-obloid	4.4
Cox's Pomona	168	83	64	obloid	4.9
Early Red Bird	102	68	59	obloid	6.7
Edholm	144	75.6	76.1	ovoid	
Ekely	106	66.1	64.4	ovoid	
Eldraud Pigeon	69	75	65	globose obloid	6.9
Elstar	151	56	59	ovoid-cylindrical-globose	6.6
Enestående	133	72.1	60.5	globose	
Filippa	201	80.1	73.3	ovoid	
Franskar	143	76	72	globose obloid	3.6
Fristeren	128	71	71	conic obloid	1.7
Fuhr	124	76	59	globose obloid	4.7
Furuholm	88	62	58	conic obloid	2
Garborg	88	63	60	conic obloid	6.8
Geneva Early	138	74	64	globose obloid	5.3
Gloppestadeple	103	69.1	70.1	conic	
Grågylling	147	69.1	61.4	conic	
Grindeples	114	69.3	59	globose	
Grønt Laupsæples	111	69	60	conic obloid	1
Gul Granat	120	69	63	globose obloid	1.4
Gullspir	110	67	75	conic-ovoid-cylindrical	1
Gyllenkroks Astrakan	111	71	62	conic-globose-obloid	2.9
Håkonseples	105	66	59	cylindrical-globose-obloid	1.4
Haugeples	169	74	80	cylindrical waisted	2.4
Herreasæples	151	73	62	globose obloid	5.1
Hindals drønning	199	75.8	73.7	conic	
Hjartnesæples	91	68	58	conic-globose-obloid	1.1
Høynesæples	105	70	55	obloid	4.8
Husmor	211	81	66	conic-globose-obloid	2.3
Ingrid Marie	137	71	56	globose obloid	7.7

Table 3. (continued)

Cultivar	Weight, g	Diameter (mm)	Length (mm)	Shape	Area of overcolour (1-9)
Jordbæreple	81	61.3	46.3	obloid	
Kaupanger	119	70	57	obloid	3.8
Kavill	129	69	66	cylindrical waisted conic	1.6
Kjerringholm	126	76.2	63.3	obloid	
Knuteple	96	62	52	obloid	2.5
Kviteple	124	69	65	conic obloid	1.3
Lærdalseple	143	82.4	94.0	conic	
Langballe	135	74	69	cylindrical waisted-conic	1.7
Laveple	86	75.4	62.4	conic	
Lavoll	169	76	67.9	globose	
Laxton's Exquisite	135	71	61	globose	5.3
Leiknes	222	81	71	globose obloid	2.2
Leriseple	63	58.3	45.3	obloid	
Løeple	172	79	67	globose obloid	4.3
Lord Lambourne	145	70	63	globose	5.2
Maglemer	129	74	59	obloid	4.4
Marte-Moster	85	62	48	globose obloid	2.3
Nanseneple	147	77.4	75.7	cylindrical waisted	
Nordfjordeple	191				
Nordfolk Royal	123	66	60	globose obloid	5.3
Ölands Kungseple	109	69	65	conic obloid	7.3
Ørekrok	253	86.5	73.2	ovoid	
Øskaug	86	61	57	conic obloid	5.5
Oster	180	75	81	conic-globose	5.4
Øysteineple	234	83.9	65.5	obloid	
Paradisepile	36	42	39	globose obloid	4
Petrineepile	121	69.6	56.5	globose	
Quinte	118	66	68	conic	5.8
Raud Granat	103	65	49	obloid	6
Raud Gravenstein	161	76	70	misc.	6.8
Raud Sävstaholm	102	67	66	misc.	7.8
Raud Sommerkavill	101	65	61	conic obloid	5.6
Raudt Laupsaeple	113	70	61	globose obloid	7.1
Ribston	116	68	60	conic-globose	1.9
Rondestveit	115	73	55	obloid	6.5
Rosvolleple	193	81	69	misc.	1.1
Rubinstep	150	71	60	conic-globose-obloid	6.2
Sävstaholm	113	67	67	conic-cylindrical- ellipsoid	3.7
Signe Tillisch	200	79	64	conic-globose-obloid	1.9
Silkeple	116	69	57	conic-globose-obloid	1.3
Sitroneple	143	74	85	cylindrical waisted-ovoid	1
Skredsvigepile	225	87.9	81.5	conic	
Søteple	78	68	57	obloid	2.3

Table 3. (continued)

Cultivar	Weight, g	Diameter (mm)	Length (mm)	Shape	Area of overcolour (1-9)
Stor Granat	182	75	64	conic obloid	2.4
Stor Torstein	160	75.1	61.4	globose	
Storesteineple	200	80	67	conic-globose-obloid	5.7
Strutar	150	75	72	conic	3.1
Sukkereple	83	84.7	71.5	conic	
Summerred	144	75	71	conic-globose-obloid	7.6
Sureple grønn	38	48	41	globose	5.8
Sysekavill	192	80	71	conic-globose-obloid	4.1
Teigeple	108				
Tolleivseple	99	67	56	conic-globose-obloid	1.8
Tokheimseple	126	73	62	misc.	1.8
Tormod	149	78	55	obloid	5.3
Transparente Blanche	139	72	72	misc.	1
Tveiteple	121	72	58	conic-globose-obloid	5.4
Ulgenes	115	67	58	conic-globose-obloid	4.2
Vågaeple	131	78.3	69.4	globose	
Prins	118	72	65	obloid	2
Torstein	125	70	58	globose obloid	6
Vintergul	115	61	54	conic-globose	2.6
Vinterrosenstrips	104	65	49	obloid	4.7
Worcester Pearmain	114	69	63	conic	5.4

Fruit biochemical content.

Soluble solid content (SSC). Different sugars mostly determined fruit soluble solid content (SSC) in fruits e.g. more sugars higher SSC. On the average SSC varied among cultivars from 9.85 to 14.0 (from 9.6 to 14.2 in 2018 and from 9.4 to 15 in 2019). More than 13% of SSC was found in cvs. Antonovka, Karin Schneider, Fosseple, Åkerø, Caroll, Rubin, Gravenstein, Ribston, Raud Sommerkavill, and Paradiseple fruits (Table 4). Very low SSC (less than 10%) was recorded for cvs. Alice, Haugeple, Garborg, Leinestrand and Øskaug. Endrizzi et al. (2015) stated that overall liking of apple fruits was positively influenced by high levels of sweetness. In our study it was true in the case of cv. Rubinstep and Raud Sommerkavill which high SSC correlated with high taste scores, while Ribston got lower than average taste score and Paradiseple was rated as uneatable. Low SSC of cvs. Haugeple, Franskar and Garborg also correlated with low taste score, only Øskaug got higher than average score.

Fruit acid content (TA). Very distinctive differences among tested cultivars were recorded for the acid content - from 0.18 to 2.55%. Titratable acidity of cvs. Leriseple, Haugeple, Tokheimseple, Knuteple, Gullspir, Sureple Grønn, Teigeple, Early Red Bird, Leinestrand and Fristeren fruits was over 1.5%. Only one commercial cultivar Geneva Early was on the same range. Cultivars with the high TA could be used for processing purposes (e.g. concentrated juice) where high acidity is a preference.

Low average fruit acid content of cvs. Laveple, Marte-Moster, Strutar, Sukkereple, Raudt Laupsaeple, Søteple, Herreasaeple and Hjartneseple cultivars was 0.52% and less.

SSC/TA ratio. Based on sugar and acid content Wang et al. (2010) separated heritage apple cultivars into 3 groups: cultivars for 'fresh eat', for 'industry use' and for 'contract industry use'. In our study thirty-five tested cultivars had very acid fruits. Their SSC/TA ratio was less than 10 and equalled to a ratio of sour wild apples (Jakobek et al., 2020). Interesting that two commercial cultivars Quinte and Geneva Early also fell in this group. Due to very low TA level extremely high SSC/TA ratio (over 40) was recorded for cvs. Laveple, Hjartneseple, Herreasaeple, Sukkereple and Søteple. The fruit flavour of cvs. Raudt Laupsaeple, Åkerø, Caroll, Marte-Moster, Worcester Pearmain and Strutar had also prevailing sweet character, though their SSC/TA ratio was twice lower than previously mentioned cultivars. Despite of these findings there should be stated that the most of heritage cultivars have mild sour or sour fruits.

Fruit firmness. Most of heritage cultivars had fruits with very high fruit firmness. Fruit firmness of Ribston, Belle de Boskoop, Raud Granat, Gul Granat, Eldraud Pigeon, Borsdorfer, Bananeple and Silkeple was over 11 kg/cm². Fruit firmness of commercial cultivar Rubinstep was 9.6 kg/cm² but all other commercial cultivars according fruit firmness were in the lower part of the list. Only very few of heritage cultivars had firmness comparable to Aroma or lower, but among them there were cvs. Rossvolleple and Sävstaholm which were rated as the tastiest cultivars.

Vitamine C content. Fruits are very important source of natural vitamine C. However, apples compared to other fruits, have a rather low amount of vitamin C. Its content in commercial cultivars equals around 10 mg/100 g. Recent studies revealed that vitamin C variation in apple fruits of different cultivars can be more than 10-fold (Bassi et al., 2018; Fang et al., 2017; Lemens et al. 2020, Pissard et al., 2013). In our study established 7.2-fold variation. This genetic variation can be used for the improvement of the vitamin C content in apple fruits. The highest vitamine C content (over 19 mg/100 g) was recorded in fruits of Riskedal, Øskaug, Bøtuneple and Hindals drønning, while cultivars Vintergul and Kavill accumulated only 3 or less mg/100 g. Similar vitamin C diversity in apple fruits was shown in a study of 79 cultivars in Belgium (26.7 – 2.3 mg/100 g) (Lemens et al. 2020). On the average in our study, very high (> 15 mg/100 g) or very low (< 5 mg/100 g) C content was found in 12.5%, average (5-10 mg/100 g) content in 41% and high vitamin C content in 34% of studied cultivars.

Table 4. Fruit biochemical content and antioxidant activity (FRAP), average 2018-2020

Cultivar	SSC %*	Starch (1-9)	Firmness kg cm²	TA %	SSC/TA	Vit C mg/100 g	TPC mg GAE/ 100g	FRAP μmol/ g
Aagoteple	11.6	-	-	0.97	12.1	9.57	146.0	11.3
Åkerø	13.6	2.7	8.67	0.6	23.4	7.97	277.8	23.3
Alice	9.5	4.0	6.62	1.0	9.3		104.1	8.2
Antonovka	14.0	-	-	1.18	11.9	12.52	315.0	24.4
Apalseteple	12.6	-	-	1.12	11.2	16.13	214.1	16.1
Aroma	12.7	6	5.95	0.82	15.6	6.7	199.7	15.0
Astrakan	11.8	4.1	7.42	1.1	10.8	7.82	225.2	18.4
Bananepple	10.4	3.7	11.12	0.87	11.9	13.5	169.4	12.6
Beauty of Bath	10.8	2.1	7.53	1.22	8.8	13.17	306.1	26.7
Belle de Boskoop	12.5	3.7	11.33	1.09	11.5	8.41	306.2	23.3
Borsdorfer	10.1	3.7	11.16	0.97	10.5	12.1	-	-
Bøtuneple	13.2	-	-	0.84	13.2	19.62	229.5	17.3
Bramley's seedling	11.8	5.4	9.52	1.20	9.8	10.37	333.8	27.8
Brureple	11.3	4.8	7.66	0.93	12.2	12.1	249.2	22.3
Caroll	13.6	6.0	6.36	0.6	22.2		170.4	12.6
Charlamovsky	11	3.1	8.24	1.30	8.4	14.43	218.1	17.9
Cox's Orange	12.8	3.3	9.43	0.89	14.5	6.18	228.0	18.1
Cox's Pomona	10.6	1	7.05	0.69	15.4	7.57	252.3	23.2
Discovery	12.6	4.9	7.15	0.8	15.9	3.97	227.3	19.0
Early Red Bird	11.4	3.7	5.87	1.5	7.6	5.19	130.5	11.0
Edholm	11.9	-	-	1.11	10.7	12.73	279.2	23.1
Eir	11.3	3.1	6.10	1.0	11.4	9.13	177.4	14.0
Ekely	12.9	-	-	0.74	17.9	13.77	159.1	12.6
Eldraud Pigeon	11.4	4.7	11.19	1.12	10.1	12.57	323.9	26.2
Elstar	12.4	2.4	7.87	0.73	17	7.73	200.3	15.1
Enestående	11.9	4.9	8.78	1.16	11.3	12.75	213.2	16.4
Filippa	13.2	-	-	1.16	11.7	15.52	177.6	14.2
Fosseple	13.2	5.5	9.47	1.2	10.7	3.6	128.4	9.9
Franskar	10.9	3.5	9.03	1.01	10.7	9.29	189.1	15.1
Fristeren	10.3	3.3	8.16	1.5	6.9	10.89	-	-
Fuhr	12.4	4	9.23	0.96	15.6	17.46	216.2	16.0
Furuholm	11.6	3.8	7.07	1.04	11.2	4.42	243.6	19.5
Garborg	10	2.3	7.14	1.31	7.6	4.03	226.6	19.1
Geneva Early	11.6	3.6	6.49	1.5	7.8	7.87	209.6	17.8
Gloppestadeple	12.8	-	-	0.88	11.8	15.35	237.8	17.3
Grågylling	11.6	-	-	0.87	13.3	10.7	196.7	14.5
Gravenstein	13.8	4.0	6.21	0.9	15.8	11.01	174.6	13.8
Grindeeple	12.1	-	-	1.04	11.2	17.48	204.3	16.2
Grønt Laupsaeple	11.1	1.3	9.93	1.4	7.9	7.07	507.6	48.1
Gul Granat	11.1	2.9	12.89	0.71	17.5	7.81	194.7	16.3
Gul Richard	12.2	3.0	7.92	0.9	12.9	9.01	168.7	12.5
Gullspir	10.9	3.9	8.42	1.59	6.9	10.31	278.7	25.5

Table 4. (continued)

Cultivar	SSC %*	Starch (1-9)	Firmness kg cm²	TA %	SSC/TA	Vit C mg/100 g	TPC mg GAE/ 100g	FRAP μmol/ g
Gyllenkroks Astrakan	10.6	5.9	4.44	0.71	14.9	13.31	205.6	17.9
Håkonseple	10.9	2.2	8.11	0.63	17.2	6.17	268.0	19.9
Haugeeple	10	4.1	8.51	1.98	5	9.57	258.8	19.2
Haugmann	12.0	2.0	9.52	0.9	13.9	7.89	246.5	21.1
Herreasaleple	12.4	6.6	9.97	0.27	45.6	6.85	296.6	21.2
Hindals dronning	12.85	-	-	0.83	15.5	18.99	228.4	17.1
Hjartneseple	11.3	4.3	7.7	0.24	46.4	8.67	306.7	26.4
Høynes	10.8	2.3	9.03	1.24	8.7	7.92	350.5	31.5
Husmor	11.1	4.1	9.13	0.82	13.5	6.53	260.0	20.0
Idunn Kaja	11.1	7.1	4.80	0.9	13.5	15.25	188.4	14.4
Ingrid Marie	11.6	1.1	9.26	0.75	15.5	12.52	202.6	15.0
James Grieve	10.6	-	-	0.88	12.1	8.61	110.2	9.0
Jordbæreple	11.1	-	-	0.87	13.1	13.18	124.4	9.2
Julyred	11.3	5.9	6.52	1.1	10.4	8.06	218.7	17.8
Karin Schneider	13.1	1.3	9.10	1.2	10.8		167.0	14.4
Katja	12.1	4.5	6.09	0.9	14.0	11.24	191.5	16.2
Kaupanger	11.1	1	10.32	0.73	15.2	7.33	152.5	14.9
Kavill	10.4	6.4	7.16	0.91	11.4	2.83	234.7	18.6
Kjerringholm	12.7	-	-	1.00	12.7	15.78	214.0	15.5
Knuteple	11	1.8	9.01	1.74	6.3		180.8	14.2
Kviteple	11.1	4.1	9.35	1.23	9	6.53	220.4	16.4
Lærdalseple	11.8	-	-	0.71	16.6	8.75	228.0	17.4
Langballe	10.4	8.2	6.09	0.92	11.2	6.45	190.2	14.3
Laveple	13.0	-	-	0.23	57.5	13.29	206.3	14.7
Lavoll	12.3	-	-	1.42	8.9	14.48	203.0	15.4
Laxton's Exquisite	12.4	5.3	9.61	0.72	17	9.24	222.0	19.1
Leiknes	12.8	5	7.94	0.79	16.2	4.35	232.6	16.3
Leinestrand	10.0	1.1	8.44	1.5	6.8	10.16	255.3	22.1
Leriseple	12.3	-	-	2.55	4.8	12.88	382.6	32.8
Lobo	12.0	5.4	6.55	0.6	18.4	14.11	125.7	9.7
Løeple	11.6	3.6	7.52	0.91	12.6	6.18	183.1	16.1
Lord Lambourne	12.9	4.4	8.01	0.76	17	10.27	204.6	14.6
Maglemer	11.7	6.5	6.59	0.71	16.5	4.34	264.4	23.8
Marte-Moster	11.2	3.3	9.82	0.52	21.6	11.25	160.2	13.1
Nanna	11.4	2.1	6.20	1.0	12.1		204.6	16.3
Nansenepile	12.8	-	-	1.25	10.24	15.71	218.1	16.4
Nordfjordeple	12.6	-	-	0.92	13.7	14.43	141.6	11.1
Nordfolk royal	10.8	2.5	7.5	0.66	16.3	7.19	283.0	23.9
Ölands Kungseple	11.1	6.7	4.98	0.74	15.1	10.74	232.5	17.8
Ørekrok	11.9	-	-	0.76	15.7	16.89	149.7	11.6
Øskaug	9.9	1.7	7.38	0.7	14.2	19.69	203.4	15.9
Oster	11.9	3.7	6.39	1.46	8.1	4.71	170.4	14.3

Table 4. (continued)

Cultivar	SSC %*	Starch (1-9)	Firmness kg cm²	TA %	SSC/TA	Vit C mg/100 g	TPC mg GAE/ 100g	FRAP μmol/ g
Øysteineple	12.0	-	-	0.62	19.3	17.42	195.7	15.2
Paradiseppe	13.1	5.1	8.7	1.47	9	6.48	544.4	49.3
Petrineeppe	12.5	-	-	0.77	16.6	9.84	162.1	11.5
Petter Heyerdahl	11.7	3.1	7.30	1.1	11.0	9.29	190.6	15.3
Quinte	11.7	2.9	6.4	1.31	8.9	10.71	229.2	20.1
Raud Granat	11.1	6.6	11.22	1.11	10	14.75	202.9	15.6
Raud Gravenstein	11.1	3.6	7.97	0.8	13.8	5.12	175.3	14.7
Raud Sävstaholm	11.2	5.5	5.75	0.82	13.6	5.94	233.9	17.2
Raud Sommerkavill	13.6	4.8	6.87	0.97	14	5.48	269.5	22.4
Raud Torstein	12.7	4.8	9.40	0.9	13.7	8.92	185.0	15.5
Raudt Laupsaeple	11.1	2	9.18	0.41	26.9	3.72	328.9	31.6
Ribston	13.7	4.4	11.37	0.87	15.8	14.65	273.2	21.9
Riskedal	11.9	-	-	1.03	11.5	20.52	211.9	17.3
Raud Prins	12.3	3.7	8.28	0.8	16.1		161.2	12.4
Rondestveit	11.1	2.8	8.87	0.92	12.1	10.7	178.0	13.9
Rossvolleple	10.7	6.8	5.67	1.45	7.3		180.7	12.0
Rubin	13.3	3.0	7.25	0.8	17.0	13.23	136.8	10.7
Rubinstep	13	8.4	9.59	0.78	16.6	14.77	188.3	13.7
Sävstaholm	11.1	5.9	6.06	0.91	12.2	4.36	199.8	14.5
Signe Tillisch	12	3.5	7.8	0.65	18.5	6.73	352.5	28.7
Silkeeppe	10.7	3.3	11.09	0.87	12.3	4.78	240.0	21.4
Sitroneple	10.9	5.3	8.79	1.13	9.6	8.26	340.1	25.8
Siv	12.6	5.4	5.13	0.9	15.1	7.97	194.8	15.1
Skredsvigeppe	13.2	-	-	0.71	19.0	15.93	234.0	17.8
Søteple	12.5	4.3	9.98	0.31	40.4	3.45	273.9	25.3
Stokkeeppe	11.2	2.0	8.82	1.2	9.6		185.3	15.0
Stor Granat	10.5	2.3	9.79	0.78	13.3	3.88	155.2	12.3
Stor Torstein	12.7	-	-	0.61	20.8	12.79	174.2	13.6
Storesteinseple	10.7	3.4	9.3	1.18	9.1	13.5	272.7	24.7
Strutar	10.3	5.4	6.81	0.52	19.9	7.65	233.6	18.3
Sukkereple	13.0	-	-	0.18	72.2	14.34	241.0	17.0
Summerred	11.6	5.2	7.38	1.04	11.1	8.49	148.7	14.4
Sunrise	12.2	6.1	6.00	0.7	17.4	11.62	152.4	12.8
Sureple Grønn	11.6	7	8.79	1.53	7.6		514.9	45.3
Sylvia	12.2	2.4	8.03	1.1	10.7	6.43	224.2	18.1
Sysekavill	11.4	6.1	7	1.09	10.4	13.11	279.9	20.6
Teigeppe	12.8	-	-	1.57	8.1	17.24	173.0	14.4
Tolleivseple	11.8	4.1	8.19	0.78	15.1	4.9	223.2	15.8
Tohoku 2	12.9	5.8	6.76	0.7	18.5	6.47	180.0	14.2
Tokheimseple	11.3	5.1	8.26	1.81	6.2	6.74	182.9	13.6
Tormod	10.9	4.6	10.69	1.25	8.7	9.15	203.8	17.7
Transparente Blanche	10.7	2.2	6.85	0.94	11.4	12.79	200.5	15.7

Table 4. (continued)

Cultivar	SSC %*	Starch (1-9)	Firmness kg cm²	TA %	SSC/TA	Vit C mg/100 g	TPC mg GAE/ 100g	FRAP μmol/ g
Tveiteple	12.2	5.6	6.69	0.79	15.4	13.98	175.8	15.4
Ulgenes	11.6	6.8	8.46	1.07	10.8	5.66	234.5	17.6
Ullerneple	11.4	3.3	5.53	0.8	13.6	11.5	153.2	11.9
Vågaepel	12.52	-	-	1.15	10.89	9.79	183.8	14.1
Gravenstein	11.4	2.7	8.42	0.8	14.3	7.39	256.0	25.4
Prins	10.8	1.1	10.27	1.12	9.6	10.59	207.8	15.9
Torstein	11.4	5.7	10.67	0.81	14.1	6.82	199.6	15.5
Vintergul	11.4	3.9	8.86	0.75	15.2	3.07	363.6	28.2
Vinterrosenstrips	10.4	1.1	7.99	1	10.4	7.7	301.7	22.5
Vista Bella	10.7	6.1	6.40	1.2	9.0	3.35	169.6	13.4
Wealthy	12.6	-	-	1.15	11.0	10.28	190.5	14.6
Worcester Pearmain	12.6	3.3	6.87	0.60	20.8	5.89	235.8	20.9

* SSC – soluble solid content, TA – titrateable acidity, DM – dry matter content, TPC – total phenol content.

Phenol content and antioxidant activity. Besides genetic characterization research of heritage or local apple cultivars is focused on fruit bioactive compounds and especially extensively phenolic profiles have been evaluated in different studies performed in various countries (Butkeviciute et al., 2020; Gökse and Keles, 2020; Lončarić et al., 2020; Oszmiański et al., 2020).

Extremely high total phenol content was recorded in fruits of cvs. Grønt Laupsaeple, Sureple Grønn, Paradiseple (more than 500 mg GAE/100 g) (Table 4). These cultivars distinguished significantly from all other tested cultivars. Highest phenol content determined the highest antioxidant reducing capacity of these cultivars. Such correlation was described in other studies too (Kschonsek et al., 2018). Interesting that all three cultivars were small-fruited (especially Paradiseple and Sureple grønn which had fruits with weight less than 40 g.) and had fruits with relatively high acid content and low SSC/TA ratio. Anastasiadi et al. (2017) found relation between fruit size and phenol content. Since higher content of phenolic compounds is found in the apple peel than in the flesh, so phenolic content in large fruited dessert apples was mainly influenced by the presence of the flesh, while small fruited cider and ornamental cultivars the peel had a greater influence.

Relatively high total phenol content (330 – 360 mg GAE/100 g) was also found in fruits of cvs. Vintergul, Signe Tillisch, Høyneple, Sitroneple and Bramley Seedling. If cvs. Vintergul and Sitroneple were again small fruited cultivars, so cv. Signe Tillisch and cv. Bramley's Seedling had one of the biggest fruits among tested group. It could be stated that not only fruit size, but also genotype have crucial influence on total phenol content.

Studies conducted in UK showed that dessert cultivars had a lower phenolic content than cider or culinary apples (Marks et al., 2007; Anastasiadi et al., 2017). Studies performed in Croatia also support evidence that old apple cultivars have higher levels of polyphenolic compounds and antioxidant capacity as compared to commercial cultivars (Duralija et al., 2021). All tested commercial cultivars Aroma, Rubinstep, Rubin, James Grieve, Lobo, Elstar and Summerred had lowest total phenol contents (<200 mg GAE/100 g or 2,5 time less than three top cvs.) in the whole group and low Frap (3-4 times) as well. Along with them following heritage cultivars had the same low total phenol content: Jordbæreple, Nordfjordeple, Aagoteple, Fosseple, Early Red Bird, and some others.

Fruit taste. Test panel evaluation indicated cultivars with the best tasting fruits (Table 5). Along with the commercial cultivars as Aroma, Elstar, Quinte, Rubinstep and Summerred, on the average of both years the highest taste scores were given to Rondestveit, Ulgenes, Gul Granat, Laxton's Exquisite, Løeple, Maglemer, Raud Gravenstein, Raud Sommerkavill, Rossvolleple and Sävstaholm.

The taste of 32 cultivars was evaluated lower than 3 points and was rated as poor. Cultivars Antonovka, Garborg, Teigeple, Nansenple, Knuteple, Vågaeple, Grønt Laupsaeple, Herreasaleple, Søteple, Storesteinseple, Strutar, Borsdorfer, Bramley seedling, Paradiseple and Sureple Grønn received extremely low scores for fruit taste (0.5 - 1.5).

Fruit sell appearance. Test panel evaluation distinguished cultivars with the best sell appearance. Along with the commercial cultivars as Elstar, Quinte, Rubinstep, Geneva Early and Summerred, on the average of both years the highest scores were given to Løeple, Raud Gravenstein, Fuhr, Rondestveit, Sävstaholm, Raud Sävstaholm, Transparente Blanche, Raudt Laupsaeple and Ölands Kungseple. Fifteen cultivars were rated as not suitable for sale and among them there were cultivars Marte-Moster, Vinterrosenstrips, Knuteple, Belle de Boskoop and Sureple grønn that received score lower than 1.

Table 5. List of cultivars sorted by total sensory evaluation score in descending order, points

Cultivar	Taste (0-6)	Sell appearance (0-6)	Aroma (0-4)	Total (0-16)
Rondestveit	5.5	4.5	3.5	13.5
Aroma	5	4	3.5	12.5
Quinte	5	4.5	3	12.5
Rubinstep	5	5	2.5	12.5
Summerred	5	5.5	2	12.5
Elstar	5	4.5	2.5	12
Løeple	4.5	5.5	2	12
Raud Gravenstein	4.5	5	2	11.5
Gyllenkroks Astrakan	4	4	3.5	11.5
Sävsstaholm	4.5	4.5	2.5	11.5
Fuhr	2.5	5	3.5	11
Raud Sävsstaholm	4	4.5	2.5	11
Transparente Blanche	3.5	4.5	2.5	10.5
Worcester Pearmain	4	4	2.5	10.5
Edholm	3	5	2	10
Early Red Bird	4	4	2	10
Øskaug	4	3	3	10
Ulgenes	5	3	1.5	9.5
Tolleivseple	4	3.5	2	9.5
Geneva Early	3	5	1.5	9.5
Furuholm	3	3.5	3	9.5
Maglemer	4.5	4	1	9.5
Raud Sommerkavill	4.5	3	2	9.5
Rosvolleple	4.5	2	2.5	9
Gul Granat	4.5	2.5	2	9
Tveiteple	4	2.5	2.5	9
Fristeren	3.5	2.5	3	9
Ölands Kungseple	2.5	4.5	2	9
Oster	3	4	2	9
Høyneseple	2.5	3.5	2.5	8.5
Laxton's Exquisite	4.5	2.5	1.5	8.5
Raudt Laupsaeple	3	4.5	1	8.5
Beauty of Bath	2	4	2.5	8.5
Nordfolk Royal	2	4	2.5	8.5
Filippa	3	1	4	8
Franskar	2.5	3.5	2	8
Teigeple	1	4	3	8
Charlamovsky	3	3	2	8
Cox's Orange	4	2.5	1.5	8
Raud Granat	2	4	2	8
Garborg	1.5	4	2.5	8
Håkonseple	4	2	1.5	7.5
Ingrid Marie	3	3.5	1	7.5

Table 5. (continued)

Cultivar	Taste (o-6)	Sell appearance (o-6)	Aroma (o-4)	Total (o-16)
Stor Granat	2.5	2	3	7.5
Bøtuneple	3	3	1	7
Kavill	3	3	1	7
Tokheimseple	4	2	1	7
Kviteple	2.5	2.5	2	7
Signe Tillisch	3.5	2.5	1	7
Sitroneple	3	3	1	7
Eldraud Pigeon	2	3.5	1.5	7
Vågaeple	1	4	2	7
Torstein	2.5	3.5	1	7
Bananeple	3.5	1	2	6.5
Tormod	2	3.5	1	6.5
Cox's Pomona	2.5	3	1	6.5
Storesteineple	1	4	1.5	6.5
Vintergul	3	2	1.5	6.5
Langballe	2	3	1.5	6.5
Riskedal	2	2	2	6
Silkeple	3.5	1.5	1	6
Kaupanger	4	1.5	0.5	6
Husmor	3	2.5	0.5	6
Leiknes	2	1.5	2.5	6
Sysekavill	2.5	3	0.5	6
Marte-Moster	3.5	0.5	1.5	5.5
Ribston	3	1	1.5	5.5
Brureple	3.5	2	0	5.5
Gullspir	3.5	1	1	5.5
Lord Lambourne	3.5	1	1	5.5
Hjartneseple	2	1.5	2	5.5
Antonovka	1	3	1	5
Nansenepile	1	2	2	5
Sukkereple	2	2	1	5
Grønt Laupsaeple	1	3	1	5
Vinterrosenstrips	2.5	0.5	2	5
Haugeeple	2	1	1.5	4.5
Strutar	1	2	1.5	4.5
Prins	2.5	1	0.5	4
Herreasaleple	1	2.5	0	3.5
Knuteple	1.5	0.5	1	3
Bramley's Seedling	0.5	1	1.5	3
Borsdorfer	0.5	1.5	1	3
Søteple	1	1	1	3
Paradisepile	0.5	2	0	2.5
Belle de Boskoop	2	0	0	2
Sureple grønn	0.5	0	0	0.5

Fruit aroma. The most aromatic fruits were harvested from cvs. Fuhr, Gyllenkroks Astrakan and Rondestveit trees (Table 5). Their flesh aroma was rated as high as cv. Aroma. Fruits of cvs. Fristeren, Furuholm, Øskaug, Quinte and Stor Granat also received high scores. Studies performed in Denmark distinguished couple of heritage cultivars which juices were characterized by very peculiar odors and flavors such as apricot and peach (Iaccarino et al., 2019). That gives idea to try our selected aromatic cultivars for single juice production.

On the other hand, cvs. Belle de Boskoop, Brureple, Herreasaleple, Paradiseple, Sureple grønn, Husmor, Kaupanger, Sysekavill and Prins fruits had no or very little aroma.

Overall fruit quality. Combining both taste and sell appearance characters following best heritage cultivars were defined: Rondestveit, Løeple, Raud Gravenstein, Sävstaholm, Raud Sävstaholm and Maglemer (Table 5, Fig. 5). The overall quality of these heritage cultivars was rated as high as a fruit quality of commercial cultivars Summerred, Aroma, Rubinstep and Elstar Boerekamp Excellent-Star®. Cultivars Early Red Bird, Gyllenkroks Astrakan and Worcester Pearmain on average were rated as high as previously mentioned heritage cultivars, but the taste of their fruits and/or sell appearance of cv. Worcester Pearmain was not consistent in different years.

Adding aroma component to the taste and sell appearance characters, only some changes appear in the best cultivar list: Rondestveit, Løeple, Raud Gravenstein, Gyllenkroks Astrakan and Sävstaholm.

4 Conclusions

Comprehensive phenological, pomological, agronomical, and biochemical studies of one hundred thirty-nine heritage apple cultivars were performed in 2018 – 2020. During the studies heritage cultivars that have never been documented were identified and pomological descriptions of sixteen heritage cultivars - Bananeple, Fristeren, Grønt Laupsaeple, Herreasaeple, Hjartneseple, Kviteple, Marte-Moster, Raudt Laupsaeple, Rossvolleple, Sitroneple, Søteple, Storesteinseple, Strutar, Sureple Grønn, Sysekavill and Tokheimseple were prepared.

Most of the investigated heritage apple cultivars have significantly higher content of biologically active compounds compared to the tested commercial cultivars.

Based on overall fruit quality, heritage cultivars for fresh consumption are selected: Rondestveit, Løeeple, Raud Gravenstein, Sävstaholm, Raud Sävstaholm and Maglemer. Limitation for the last three cultivars could be a short consumption window after that the fruit quality drops fast, moderate productivity of Sävstaholm and Raud Sävstaholm and biennial bearing habit of Maglemer.

Based on individual investigations of various fruit quality characters, cultivar groups with special properties are selected:

- Cultivars Leriseple, Lavoll, Haugeeple, Tokheimseple, Knuteple, Gullspir, Sureple Grønn, Teigeple, Early Red Bird and Fristeren have very high acid content and could be valuable for processing into concentrated juice or as additives to products where higher acidity is required.
- Cultivars Worcester Pearmain, Lord Lambourne and Leiknes along with high SSC have a good SSC/TA ratio and could be potential source for fresh juice production.
- Cultivars Paradiseple, Sureple grønn, Grønt Laupsaeple have extremely high phenol content and could be used for medical purposes.
- Comprehensive investigations of fruit biochemical profile and gathered data on all possible combinations of phenolic, acid and sugar content in fruits allow selection of cultivars to produce different types of cider.

Selected cultivars with special features that could serve as genetic sources in breeding programs:

- soluble solid content: Antonovka, Gravenstein, Ribston, Raud Sommerkavill, Åkerø, Fosseple, Karin Schneider, Paradiseple, Vågaeple;
- very high sweetness index (SSC/TA): Laveple, Hjartneseple, Herreasaeple, Sukkereple, Søteple;
- acid content: Leriseple, Haugeeple, Tokheimseple, Knuteple;
- phenolic compounds: Paradiseple, Sureple Grønn, Grønt Laupsaeple;
- fruit size: Ørekrok, Øysteineple, Skredsvigeple, Leiknes, Bramley Seedling, Husmor, Filippa, Storesteineple, Signe Tillisch;
- aroma: Fuhr, Gyllenkroks Astrakan, Rondestveit.



Løeple



Maglemer



Raud Gravenstein



Raud Sävstaholm



Rondestveit



Sävstaholm

Fig. 5. Selected heritage cultivars for fresh consumption.

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Photos - Oddmund Frøynes : Bananeple, Beauty of Bath, Belle de Boskoop, Borsdorfer, Bramley's Seedling, Brureple, Charlamovsky, Cox's Orange, Cox 's Pomona, Early Red Bird, Elraud Pigeon, Franskar, Fristeren, Fuhr, Furuholm, Garborg, Grønt Laupsaeple, Gul Granat, Gullspir, Gyllenkroks Astrakan, Håkonseple, Haugeeple, Herrasaleple, Hjartneseple, Høyneseple, Husmoreple, Kaupanger, Kavill, Knuteple, Kviteple, Langballe, Laxton's Exquisite, Leiknes, Løeeple, Lord Lambourne, Maglemer, Marte-Moster, Norfolk Royal, Ölands Kungseple, Øskaug, Oster, Paradiseple, Raud Granat, Raud Gravenstein, Raud Sävstaholm, Raud Sommerkavill, Raudt Laupsaeple, Ribston, Rondestveit, Rosvolleple, Sävstaholm, Signe Tillisch, Silkeple, Sitroneple, Søteple, Stor Granat, Storesteinseple, Strutar, Sureple grønn, Sysekavill, Tolleivseple, Tokheimseple, Tormod, Transparente Blanche, Tveiteple, Ulgenes, Prins, Torstein, Vintergul, Vinterrosenstrips, Worcester Pearmain.

Rest of the photos: www.fruktsorter.no

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7 Supplements

Appendix 1 – Flower, leaf and fruit characteristics

Table S1. Flower morphology

Cultivar	Flower diameter (mm)	Position of stigmas relative to anthers
Aroma	40.0	below
Bananepple	41.5	above
Beauty of Bath	43.5	same level/below
Belle de Boskoop	59.0	same level/above
Borsdorfer	46.5	misc.
Bramley Seedling	55.0	misc.
Brureple	47.0	above
Charlamovsky	53.0	above
Cox's Orange	51.5	same level/above
Cox's Pomona	46.0	same level
Early Red Bird	54.0	same level/above
Elstar	30.0	above
Eldraud Pigeon	47.0	same level/above
Franskar	44.0	above
Fristeren	42.0	above
Fuhr	45.5	above
Furuholm	48.5	above
Garborg	58.0	misc.
Geneva Early	56.5	same level/below
Grønt Laupsaeple	51.5	above
Gul Granat	51.5	above
Gullspir	45.0	below
Gyllenkroks Astrakan	45.5	same level/above
Håkonseple	54.0	same level
Haugeeple	65.0	above
Herreasaleple	48.5	above
Hjartneseple	48.0	same level
Høyneseple	43.5	misc.
Husmor	47.0	same level
Ingrid Marie	50.0	same level
Kaupanger	51.5	above
Kavill	43.5	misc.
Knutepple	40.0	same level
Kviteple	49.0	above
Langballe	52.5	above
Laxton's Exquisite	56.5	same level
Leiknes	50.5	same level
Løeeple	52.5	below
Lord Lambourne	45.0	above

Table S1. (continued)

Cultivar	Flower diameter (mm)	Position of stigmas relative to anthers
Maglemer	53.5	above
Nordfolk Royal	53.0	above
Ölands Kungseple	52.0	above
Øskaug	33.0	above
Oster	59.0	same level/above
Paradisepile	56.5	above
Quinte	54.0	below
Raud Granat	48.5	same level/above
Raud Gravenstein	63.5	above
Raud Sävstaholm	55.0	above
Raud Sommerkavill	46.5	same level/below
Raudt Laupsaeple	50.0	misc.
Ribston	50.5	same level/above
Rondestveit	57.0	above
Rosvolleple	53.5	above
Rubinstep	56.0	same level
Sävstaholm	55.5	above
Signe Tillisch	50.5	above
Silkeeple	45.7	above
Sitroneple	59.0	above
Søteple	38.0	same level
Stor Granat	51.5	above
Storesteineple	45.0	above
Strutar	50.0	misc.
Summerred	43.0	above
Sureple grøn	54.0	same level
Sysekavill	65.0	same level/above
Tolleivseple	51.0	same level/above
Tokheimseple	61.0	above
Tormod	56.5	above
Transparente Blanche	59.5	above
Tveiteple	48.0	above
Ulgenes	55.0	above
Prins	53.0	above
Torstein	44.0	above
Vintergul	45.5	above
Vinterrosenstrips	51.0	same level/above
Worcester Pearmain	49.0	same level/below

Table S2. Leaf blade characters

Cultivar	Length (mm)	Width (mm)	Length/ width ratio	Incisions of margin
Aagoteple	7.86	5.70	1.4	crenate/biserrate
Antonovka	8.70	5.42	1.6	serrate type 1 or 2
Apalseteple	8.38	5.76	1.5	biserrate
Aroma	7.8	5.8	1.3	serrate type 1
Bananepile	8.23	6.1	1.4	serrate type 1
Beauty of Bath	9.4	5.74	1.6	biserrate /serrate type 1
Belle de Boskoop	9.71	7.62	1.3	serrate type 2
Borsdorfer	7.86	5.66	1.4	serrate type 1/ biserrate
Bøtuneple	8.35	5.70	1.5	serrate type 1/bicrenate
Bramley's Seedling	9.26	7.41	1.3	serrate type 2
Brureple	7.87	6.33	1.2	serrate type 1
Charlamovsky	9.77	7.31	1.3	serrate type 1
Cox's Orange	7.86	4.42	1.8	serrate type 1/ bicrenate
Cox's Pomona	8.27	6.33	1.3	serrate type 1/ bicrenate
Early Red Bird	8.54	6.45	1.3	crenate
Edholm	8.58	5.81	1.5	serrate type 1
Ekely	8.29	6.39	1.3	serrate type 1
Elstar	9.6	5.4	1.8	serrate type 1
Eldraud Pigeon	9.3	5.47	1.7	serrate type 1 or 2
Enestående	7.02	4.96	1.4	serrate type 2 /biserrate
Filippa	7.98	6.01	1.3	bicrenate
Franskar	8.96	5.8	1.6	serrate type 2
Fristeren	8.94	7.11	1.3	serrate type 1 or 2
Fuhr	8.77	6.62	1.3	biserrate
Furuholm	8.54	6.15	1.4	serrate type 1
Garborg	7.05	5.67	1.3	crenate
Geneva Early	10.24	7.71	1.3	serrate type 1/ crenate
Gloppetadeple	7.85	5.06	1.5	serrate type 1
Grågylling	8.09	5.66	1.4	serrate type 1 /biserrate
Grindeeple	8.70	6.76	1.3	bicrenate
Grønt Laupsaeple	8.08	6.25	1.3	biserrate
Gul Granat	7.48	5.58	1.3	bicrenate
Gullspir	8.76	5.05	1.7	serrate type 1/ biserrate
Gyllenkroks Astrakan	7.77	5.31	1.5	bicrenate/ serrate type 2
Håkonseple	9	5.6	1.6	serrate type 1
Haugeeple	10.1	7.8	1.3	serrate type 1
Herreasaeple	7.16	4.95	1.5	serrate type 2
Hindals Dronning	9.83	5.98	1.6	bicrenate / biserrate
Hjartneseple	7.57	5.73	1.3	serrate type 1/ bicrenate
Høyneseple	6.35	5.83	1.1	crenate
Husmor	8.88	7.03	1.3	misc.
Ingrid Marie	8.64	5.08	1.7	serrate type 1/ bicrenate
James Grieve	8.40	5.43	1.6	serrate type 1/bicrenate

Table S2. (continued)

Cultivar	Length (mm)	Width (mm)	Length/ width ratio	Incisions of margin
Jordbæreple	8.39	5.08	1.7	crenate/ bicrenate
Kaupanger	9.4	5.93	1.6	serrate type 1
Kavill	8.47	5.56	1.5	serrate type 1/ crenate
Kjerringholm	8.34	6.20	1.3	serrate type 1 /crenate
Knuteple	8.99	5.64	1.6	serrate type 1
Kviteple	9.23	6.36	1.5	serrate type 1
Lærdalseple	8.21	4.81	1.7	serrate type 1
Langballe	9	6	1.5	serrate type 1/ bicrenate
Laveple	7.63	5.60	1.4	crenate/ bicrenate
Lavoll	8.14	5.82	1.4	serrate type 1 /biserrate
Laxton's Exquisite	8.39	5.15	1.6	crenate
Leiknes	9.51	7.13	1.3	biserrate/ bicrenate
Leriseple	7.42	5.79	1.3	serrate type 1/bicrenate
Løeple	8.41	6.16	1.4	serrate type 1/ crenate
Lord Lambourne	8.5	5.2	1.6	serrate type 1 or 2
Maglemer	8.67	6.6	1.3	serrate type 1or 2
Nansenepale	9.21	5.95	1.6	serrate type 1 or 2
Nordfjordeple	7.84	6.30	1.2	serrate type 1/bicrenate
Nordfolk Royal	8.3	5.87	1.4	misc.
Ölands Kungseple	8.41	5.47	1.5	serrate type 1/ crenate
Olinaeple	9.16	6.33	1.4	serrate type 1 /biserrate
Ørekrok	10.05	6.53	1.5	bicrenate
Øskaug	7.8	6.2	1.3	biserrate
Oster	8.71	6.98	1.3	serrate type 2
Øysteineple	8.87	5.42	1.6	bicrenate
Paradiseple	11.16	6.68	1.7	serrate type 2/ biserrate
Petrineeple	7.18	5.72	1.3	serrate type 1 /biserrate
Quinte	10.1	6.73	1.5	serrate type 1
Raud Granat	8	6.32	1.3	bicrenate / biserrate
Raud Gravenstein	9.56	6.11	1.6	serrate type 1 or 2
Raud Sävstaholm	8.74	5.94	1.5	biserrate/ crenate
Raud Sommerkavill	8.62	5.75	1.5	serrate type 1/ crenate
Raudt Laupsaeple	7.03	5.54	1.3	bicrenate
Ribston	8.5	5.8	1.5	serrate type 1 or 2
Riskedal	7.76	6.88	1.1	serrate type 2 /biserrate
Rondestveit	8.67	6.45	1.4	biserrate
Rosenrød	7.13	5.25	1.4	serrate type 1/bicrenate
Rosvolleple	9.7	7.7	1.3	serrate type 2
Rubinstep	10.4	6.5	1.6	serrate type 1
Sävstaholm	8.58	5.76	1.5	serrate type 1
Signe Tillisch	9.6	6.4	1.5	serrate type 1
Silkeeple	7.94	5.8	1.4	biserrate/ serrate type 1
Sitroneple	10.45	7.13	1.5	serrate type 1/ biserrate
Skredsvigeple	10.44	6.93	1.5	serrate type 1

Table S2. (continued)

Cultivar	Length (mm)	Width (mm)	Length/ width ratio	Incisions of margin
Søteple	9.58	6.64	1.5	serrate type 1/ bicrenate
Stor Granat	7	4.82	1.5	serrate type 1
Stor Torstein	7.59	4.80	1.6	serrate type 1 /biserrate
Storesteineple	8.4	5.2	1.6	serrate type 1/ bicrenate
Strutar	9.42	5.35	1.8	serrate type 1/ crenate
Sukkereple	8.19	6.36	1.3	serrate type 1 /biserrate
Summerred	10.7	6.2	1.7	crenate
Sureple grøn	7.15	5.84	1.2	serrate type 1 or 2
Sysekavill	8.78	6.24	1.4	crenate
Teigeple	8.37	6.34	1.3	serrate type 1 /crenate
Tolleivseple	8.3	5.66	1.5	serrate type 1/ biserrate
Tokheimseple	9.53	6.43	1.5	serrate type 2/ bicrenate
Tormod	9.17	6.05	1.5	bicrenate/ serrate type 1
Transparente Blanche	10.08	6.81	1.5	crenate/ bicrenate
Tveiteple	7.68	5.39	1.4	crenate
Ulgenes	7.82	5.93	1.3	crenate/ serrate type 1
Vågaeple	8.51	6.00	1.4	serrate type 1 /biserrate
Prins	8.4	6.4	1.3	serrate type 1 or 2
Torstein	8.49	5.65	1.5	biserrate
Vintergul	7.57	4.9	1.5	serrate type 1/ crenate
Vinterrosenstrips	7.72	6.01	1.3	serrate type 1 or 2
Worcester Pearmain	9.41	5.64	1.7	biserrate/ serrate type 2

Table S3. Fruit colour characters

Cultivar	Background colour	Over colour	Pattern of over colour	Colour of flesh
Aagoteple	yellow green	pink red	solid blush	white
Antonovka	white yellow			cream
Apalseteple	white yellow	red	striped and mottled	cream
Aroma	white green/ green	red	solid blush with weakly defined stripes	cream
Bananeple	white green/ green	-	-	white greenish
Beauty of Bath	white yellow/ white green	pink red/red	striped and mottled	white pinkish
Belle de Boskoop	green	-	-	white
Borsdorfer	green	red	solid blush with strongly defined stripes	white
Bøtuneple	white yellow	red	striped and mottled	greenish
Bramley's Seedling	green	red/ orange-red	weakly defined blush with strongly defined stripes	white cream
Brureple	green	red/violet-red	solid blush	greenish pinkish
Charlamovsky	white green	pink red	only stripes (no blush)	white
Cox's Orange	yellow/ yellow green	red/ orange-red	blushed and mottled	greenish cream
Cox's Pomona	yellow green/green	red	blushed	white greenish
Early Red Bird	white yellow/ yellow/green	red/violet-red	solid blush with strongly defined stripes	pinkish
Edholm	white yellow	red	striped and mottled	cream
Ekely	white yellow	red	striped and mottled	white
Elraud Pigeon	yellow/ yellow green	red/violet-red	solid blush	white
Elstar	yellow/ yellow green	red	solid blush	white
Enestående	white yellow	red	striped and mottled	white
Filippa	white yellow	pink red	solid blush	cream
Franskar	white green/ green	violet red/ orange red	striped and mottled	white
Fristeren	white green/green	-	-	white greenish
Fuhr	white green/ yellow green/ green	red/violet-red	solid blush with weakly/strongly defined stripes	greenish
Furuholm	white green/ yellow green	pink red	only stripes (no blush)	white
Garborg	yellow/ yellow green	red	solid blush with strongly defined stripes	white greenish
Geneva Early	white green	pink red/ red	striped and mottled	pinkish
Gloppetadeple	white yellow	red	solid blush with strongly defined stripes	cream
Grågylling	white green	red	striped and mottled	cream
Grindeeple		red	solid blush	cream
Grønt Laupsaeple	white green/ yellow green/ green	-	-	white cream
Gul Granat	white green/ yellow green/ green	-	-	white
Gullspir	white green/ green	-	-	white

Table S3. (continued)

Cultivar	Background colour	Over colour	Pattern of over colour	Colour of flesh
Gyllenkroks Astrakan	white yellow/ white green	orange-red	blushed	white cream
Håkonseple	white green/ green	pink red	blushed	white greenish
Haugeeple	white green/ green	pink red	striped and mottled	white
Herreasaleple	yellow/ yellow green	pink red/red	solid blush/striped and mottled	white
Hindals dronning	white yellow	red	striped and mottled	white
Hjartneseple	yellow green	-	-	white cream
Høyne-seple	white green/ green	red/orange- red	blushed and mottled	greenish cream
Husmor	green	pink -orange- red	blushed	cream
Ingrid Marie	yellow	red	solid blush/blushed and mottled	white
Jordbæreple	white green	pink red	striped and mottled	white
Kaupanger	white green/green	red	striped and mottled	white
Kavill	white green/ yellow green/ green	pink red	blushed	white cream
Kjerringholm	white green	pink red	striped and mottled	white
Knuteple		red/ orange- red	striped and mottled	greenish
Kviteple	white green/ green	pink red	striped and mottled	white
Lærdalseple	white green	red	solid blush with weakly defined stripes	greenish
Langballe	white green/ green	orange-red	striped and mottled	greenish cream
Laveple	white yellow	orange-red	striped and mottled	white
Lavoll	white yellow	red	striped and mottled	cream
Laxton's Exquisite	misc	red/ brown- red	solid blush with weakly/strongly defined stripes	white cream
Leiknes	yellow white/ white green/ green	red/ orange- red	striped and mottled/only stripes (no blush)	cream
Leriseple		red	striped and mottled	white
Løeple	white yellow/ yellow green	pink red/ red	striped and mottled/solid blush with weakly defined stripes	white
Lord Lambourne	green	pink red/ red	blushed and mottled/blushed	white cream
Maglemer	white green	red/ orange- red	only stripes (no blush)	white cream
Marte- Moster	white green/yellow green/green	orange-red	weakly defined blush with strongly defined stripes/only stripes	cream
Nansenep-le	white yellow	pink red	striped and mottled	cream
Nordfolk Royal	white yellow/ white green	red/ violet-red	blushed and mottled	greenish pinkish
Ölands Kungseple	green	red	solid blush with weakly/strongly defined stripes	white greenish
Ørekrok	white yellow	red	solid blush with weakly defined stripes	white
Øskaug	white green/ green	red	solid blush with weakly defined stripes	pinkish cream
Oster	white green/ yellow green	pink red	striped and mottled	white
Øysteineple	white yellow	orange-red	striped and mottled	cream

Table S3. (continued)

Cultivar	Background colour	Over colour	Pattern of over colour	Colour of flesh
Paradisepple	yellow/yellow green	red	solid blush with weakly defined stripes	yellowish cream
Petrineepple	yellow	orange-red	solid blush	white
Quinte	white green/ yellow green/ green	pink red	solid blush with weakly/strongly defined stripes	white greenish
Raud Granat	yellow	red	solid blush/solid blush with weakly defined stripes	white
Raud Gravenstein	yellow green/ green white	red	striped and mottled	white
Raud Sävstaholm	green/yellow green/green white	pink red/ red	blushed	white pinkish
Raud Sommerkavill	green/yellow green/green	red	blushed and mottled/solid blush with strongly defined stripes	white cream
Raudt Laupsaeple	misc	red/ violet-red	solid blush/solid blush with weakly defined stripes	greenish cream
Ribston	green	red/ orange-red	only stripes (no blush)	greenish cream
Rondestveit	misc	red	solid blush with weakly defined stripes	white cream
Rossvolleple	white green	-	-	white greenish
Rubinstep	yellow	orange-red	solid blush with weakly defined stripes	white greenish
Sävstaholm	white green/green white	pink red/ orange red	striped and mottled	white
Signe Tillisch	green/yellow green/green	red	solid blush with strongly defined stripes	greenish cream
Silkeepple	misc	orange-red	striped and mottled	white greenish
Sitroneple	white green/green	-	-	white cream
Skredsvigepple	yellow	brown red	striped and mottled	cream
Søteple	white green	orange-red	solid blush with weakly defined stripes	white
Stor Granat	white yellow/ white green	pink red	misc	white cream
Stor Torstein	white yellow	brown red	striped and mottled	white
Storesteinseple	yellow green/green	red/ violet-red	striped and mottled/solid blush with strongly defined stripes	greenish pinkish
Strutar	yellow/yellow green/ green	orange-red	striped and mottled	white cream
Sukkereple	white yellow	pink red	mottled	cream
Summerred	yellow green/ green	red/ violet-red	solid blush	greenish pinkish
Sureple Grønn	green	red	solid blush with strongly defined stripes	white
Sysekavill	white green/ green	pink red/ red	solid blush with strongly defined stripes	white greenish
Tolleivseple	white yellow/ yellow green	orange-red	blushed	white cream
Tokheimseple	white green/ green	pink red	striped and mottled/blushed	white
Tormod	misc	pink red/red	solid blush with strongly defined stripes	white
Transparente Blanche	white green/green	-	-	white greenish
Tveiteple	yellow green/green	red/violet-red	solid blush with weakly defined stripes	white cream

Table S3. (continued)

Cultivar	Background colour	Over colour	Pattern of over colour	Colour of flesh
Ulgenes	yellow green/green	red	striped and mottled/solid blush with strongly defined stripes	cream
Vågaeple	white yellow	pink red	solid blush	greenish
Gravenstein	white green/green	orange-red	solid blush with weakly defined stripes	white cream
Prins	white green/green	pink red/ red	striped and mottled	white
Torstein	yellow/white green/green	red/ brown-red	solid blush with weakly/strongly defined stripes	white
Vintergul	yellow green/green	red/ orange red	only stripes (no blush)/weakly defined blush with strongly defined stripes	white cream
Vinterrosenstrips	green	red	solid blush with strongly defined stripes	white greenish
Worcester Pearmain	misc	violet/ pink-red	solid blush with weakly defined stripes	white cream

Table S4. Fruit skin bloom, greasiness and fruit ribbing

Cultivar	Bloom of skin	Greasiness of skin	Fruit ribbing
Aroma	moderate	absent or weak	weak-moderate
Bananepile	absent or weak	absent or weak	weak-moderate
Beauty of Bath	weak	absent or weak	weak
Belle de Boskoop	weak	absent or weak	moderate
Borsdorfer	weak	absent or weak	moderate
Bramley's Seedling	absent or weak	absent or weak	moderate
Brureple	absent or weak	absent or weak	weak
Charlamovsky	absent or weak	absent or weak	weak-moderate
Cox's Orange	absent or weak	absent or weak	absent or weak
Cox's Pomona	absent or weak	absent or weak	weak-moderate
Early Red Bird	strong	absent or weak	weak-moderate
Elraud Pigeon	weak	absent or weak	weak
Elstar	absent or weak	absent or weak	weak-moderate
Franskar	absent or weak	absent or weak	absent or weak
Fristeren	weak	absent or weak	weak-moderate
Fuhr	weak	absent or weak	weak-moderate
Furuholm	weak	absent or weak	absent or weak
Garborg	absent or weak	weak	weak
Geneva Early	weak	absent or weak	weak
Grønt Laupsaeple	absent or weak	absent or weak	moderate
Gul Granat	absent or weak	absent or weak	absent or weak
Gullspir	absent or weak	absent or weak	moderate
Gyllenkroks Astrakan	absent or weak	weak	weak-moderate
Håkonseple	absent or weak	absent or weak	weak-moderate
Haugeple	absent or weak	absent or weak	weak-moderate
Herreasaeple	strong	absent or weak	weak-moderate
Hjartneseple	absent or weak	absent or weak	moderate
Høyneseple	weak	absent or weak	weak-moderate
Husmor	absent or weak	absent or weak	weak-moderate
Ingrid Marie	absent or weak	absent or weak	absent or weak
Kaupanger	absent or weak	absent or weak	weak-moderate
Kavill	weak	absent or weak	moderate
Knuteple	weak	absent or weak	absent or weak
Kviteple	absent or weak	absent or weak	weak-moderate
Langballe	weak	absent or weak	moderate
Laxton's Exquisite	absent or weak	absent or weak	absent or weak
Leiknes	absent or weak	absent or weak	weak-moderate
Løeeple	absent or weak	absent or weak	absent or weak
Lord Lambourne	absent or weak	absent or weak	weak
Maglemer	absent or weak	weak	moderate
Marte-Moster	weak	weak	weak
Nordfolk Royal	absent or weak	weak	weak-moderate
Ölands Kungseple	absent or weak	absent or weak	absent or weak
Øskaug	weak	absent or weak	weak-moderate

Table S4. (continued)

Cultivar	Bloom of skin	Greasiness of skin	Fruit ribbing
Oster	weak	absent or weak	weak
Paradisepile	absent or weak	absent or weak	weak-moderate
Quinte	absent or weak	absent or weak	weak
Raud Granat	absent or weak	absent or weak	absent or weak
Raud Gravenstein	weak	absent or weak	moderate
Raud Sävstaholm	absent or weak	weak	weak
Raud Sommerkavill	strong	absent or weak	moderate
Raudt Laupsaeple	weak	absent or weak	weak-moderate
Ribston	absent or weak	absent or weak	weak
Rondestveit	weak	absent or weak	absent or weak
Rossvolleple	absent or weak	absent or weak	weak-moderate
Rubinstep	absent or weak	absent or weak	moderate
Sävstaholm	absent or weak	weak	weak
Signe Tillisch	absent or weak	absent or weak	weak-moderate
Silkeepile	absent or weak	absent or weak	weak
Sitronepile	absent or weak	absent or weak	weak-moderate
Søteple	absent or weak	absent or weak	absent or weak
Stor Granat	weak	absent or weak	weak-moderate
Storesteinseple	moderate	absent or weak	moderate
Strutar	weak	weak	moderate
Summerred	moderate	absent or weak	weak-moderate
Sureple grønn	absent or weak	absent or weak	absent or weak
Sysekavill	weak	absent or weak	weak-moderate
Tolleivseple	weak	absent or weak	weak-moderate
Tokheimseple	moderate	absent or weak	weak-moderate
Tormod	weak	absent or weak	weak-moderate
Transparente Blanche	absent or weak	absent or weak	weak-moderate
Tveiteple	absent or weak	weak	weak-moderate
Ulgenes	moderate	weak	absent or weak
Gravenstein	weak	absent or weak	moderate
Prins	absent or weak	absent or weak	weak-moderate
Torstein	weak	absent or weak	weak-moderate
Vintergul	weak	weak	weak-moderate
Vinterrosenstrips	moderate	weak	absent or weak
Worcester Pearmain	moderate	weak	absent or weak

Table S5. Fruit russetting, lenticels and stalk length

Cultivar	Area of russetting	Number of lenticels	Size of lenticels	Length of stalk
Aagoteple	small	many	medium	short
Antonovka	absent or small	2	medium	short
Apalseteple	absent or small	many	large	very short
Aroma	absent or small	medium	medium	very short/short
Bananepile	absent or small	few/medium	small/medium	misc
Beauty of Bath	absent or small	medium	large	misc
Belle de Boskoop	large	many	small/medium	very short
Borsdorfer	absent or small	medium	small	very short
Bøtuneple	small	medium	small	medium
Bramley's Seedling	absent or small	few	medium	very short
Brureple	absent or small	few/medium	misc	very short/short
Charlamovsky	absent or small	many	medium	misc
Cox's Orange	absent or small	few/medium	small	very short/short
Cox's Pomona	absent or small	misc	misc	very short/short
Early Red Bird	absent or small	medium	small/medium	misc
Edholm	absent or small	many	small	medium
Ekely	absent or small	medium	medium	short
Elraud Pigeon	absent or small	medium	small/medium	misc
Elstar	absent or small	few	small/medium	medium/short
Enestående	small	many	small	short
Filippa	small	medium	large	short
Franskar	absent or small	medium/many	misc	very short
Fristeren	small	many	small/medium	very short/short
Fuhr	absent or small	many	small	short
Furuholm	absent or small	few	small	very short
Garborg	absent or small	few/medium	small/medium	medium/short
Geneva Early	absent or small	many	small/medium	medium/short
Gloppestadeple	small	many	small	short
Grågylling	absent or small	many	small	medium
Grindeple	small	medium	medium	medium
Grønt Laupsaeple	absent or small	few/medium	medium/large	very short/short
Gul Granat	absent or small	misc	misc	very short/short
Gullspir	absent or small	medium/many	medium/large	very short/short
Gyllenkroks Astrakan	absent or small	medium	large	medium
Håkonseple	absent or small	medium/many	small/medium	very short/short
Haugeple	absent or small	medium	medium	very short/short
Herreasaleple	absent or small	few/medium	misc	misc
Hindals dronning	small	many	medium	short
Hjartneseple	absent or small	medium	large	medium/short
Høyneseple	absent or small	medium/many	small/medium	very short
Husmor	absent or small	medium	medium/large	very short
Ingrid Marie	absent or small	few/medium	small/medium	very short/short
Jordbæreple	small	many	small	short

Table S5. (continued)

Cultivar	Area of russetting	Number of lenticels	Size of lenticels	Length of stalk
Kaupanger	absent or small	few/medium	small/medium	very short/short
Kavill	small	medium	small/medium	very short
Kjerringholm	absent or small	many	small	long
Knuteple	small	few/medium	small/medium	short
Kviteple	absent or small	medium	medium/large	medium/short
Lærdalseple	absent or small	many	small	medium
Langballe	small	medium/many	misc	very short
Laveple	small	many	small	very short
Lavoll	absent or small	many	small	very short
Laxton's Exquisite	absent or small	few/medium	misc	misc
Leiknes	absent or small	misc	small/medium	very short
Leriseple	absent or small	many	small	short
Løeple	absent or small	few/medium	large	very short/short
Lord Lambourne	absent or small	few/medium	small/medium	very short/short
Maglemer	small	medium	misc	medium/short
Marte-Moster	absent or small	few	medium	short
Nansenepale	absent or small	medium	medium	medium
Nordfolk Royal	absent or small	few/medium	small	very short/short
Ölands Kungseple	absent or small	medium/many	small/medium	very short/short
Ørekrok	small	many	small	very short
Øskaug	absent or small	few	small/medium	very short/short
Oster	absent or small	medium	medium/large	misc
Øysteineple	large	medium	small	short
Paradiseple	absent or small	few/medium	small/medium	very long
Petrineepale	small	medium	small	short
Quinte	absent or small	many	medium/large	short
Raud Granat	absent or small	medium	medium/large	very short
Raud Gravenstein	absent or small	many	small/medium	very short/short
Raud Sävstaholm	absent or small	medium	medium/large	medium
Raud Sommerkavill	absent or small	many	medium/large	very short/short
Raudt Laupsaeple	absent or small	few	misc	very short
Ribston	large	medium	small/medium	very short
Rondestveit	absent or small	few	small/medium	very short
Rossvolleple	absent or small	medium	medium/large	very short
Rubinstep	absent or small	few	small	medium/long
Sävstaholm	absent or small	few	small/medium	medium/short
Signe Tillisch	absent or small	many	medium	misc
Silkeepale	absent or small	many	large	medium/short
Sitroneple	absent or small	many	medium	medium/short
Skredsvigepale	absent or small	many	large	short
Søteple	small	medium	small	very short
Stor Granat	absent or small	many/medium	small/misc	misc
Stor Torstein	absent or small	medium	medium	short
Storesteinseple	absent or small	few/medium	misc	very short/short

Table S5. (continued)

Cultivar	Area of russetting	Number of lenticels	Size of lenticels	Length of stalk
Strutar	absent or small	medium/many	<i>misc</i>	<i>misc</i>
Sukkereple	absent or small	many	medium	very short
Summerred	absent or small	many	small/medium	medium/long
Sureple Grønn	absent or small	many	large	medium
Sysekavill	absent or small	medium/many	medium/large	very short
Tolleivseple	absent or small	medium	<i>misc</i>	very short/short
Tokheimseple	absent or small	mange	medium/large	short
Tormod	<i>misc</i>	few	small/medium	very short/short
Transparente Blanche	absent or small	medium/many	medium/large	<i>misc</i>
Tveiteple	absent or small	medium/many	<i>misc</i>	very short
Ulgenes	absent or small	few/medium	small/medium	very short
Vågaepile	small	medium	medium	very short
Gravenstein	absent or small	medium	medium	very short
Prins	absent or small	few	small/medium	very short/short
Torstein	absent or small	medium/many	small	very short
Vintergul	absent or small	medium/many	small	short
Vinterrosenstrips	small	medium	small/medium	<i>misc</i>
Worcester Pearmain	<i>misc</i>	medium/many	small/medium	very short

Appendix 2 - Pomological descriptions of heritage cultivars

AAGOTEPLE



Tree vigour	weak
Tree habitus	spreading
Type of bearing	on spurs and long shoots
Flowering time	early
Flower diameter (mm)	large
Position of stigmas relative to anthers	above
Leaf length (mm)	7.86
Leaf width (mm)	5.70
Leaf length/width ratio	1.4
Incisions of leaf blade margin	crenate/biserrate

Fruit harvest time	Mid-season
Fruit weight, g	133
Shape	globose
Over colour	pink red
Pattern of over colour	solid blush
Background colour	Yellow green
Colour of flesh	white
Area of russetting	small
Number of lenticels	many
Size of lenticels	medium
Length of stalk	short
SSC %*	11.6
Firmness	medium
TA %	0.97
Vitamin C, mg/100 g	9.57
Taste (0-6)	1

ANTONOVKA



Tree vigour	medium
Tree habitus	spreading
Type of bearing	on spurs
Flowering time	medium
Flower diameter (mm)	medium
Position of stigmas relative to anthers	same level
Leaf length (mm)	8.70
Leaf width (mm)	5.42
Leaf length/width ratio	1.6
Incisions of leaf blade margin	serrate type 1 or 2

Fruit harvest time	late
Fruit weight, g	145
Shape	conic
Area of overcolour (1-9)	-
Over colour	-
Pattern of over colour	-
Background colour	yellow green
Colour of flesh	cream
Fruit ribbing	strong
Area of russeting	Absent or small
Number of lenticels	medium
Size of lenticels	medium
Length of stalk	short
SSC %*	14.0
Firmness	medium
TA %	1.18
Vitamin C, mg/100 g	12.52
Taste (0-6)	1
Sell appearance (0-6)	3
Aroma (0-4)	1

APALSETEPLE



Tree vigour	medium
Tree habitus	spreading
Type of bearing	On spurs and long shoots
Flowering time	medium
Leaf length (mm)	8.38
Leaf width (mm)	5.76
Leaf length/width ratio	1.5
Incisions of leaf blade margin	biserrate

Fruit harvest time	mid-season
Fruit weight, g	148
Shape	ovoid
Over colour	red
Pattern of over colour	striped and mottled
Background colour	white yellow
Colour of flesh	cream
Area of russetting	absent or small
Number of lenticels	Many
Size of lenticels	Large
Length of stalk	very short
SSC %	12.6
TA %	1.12
Vitamin C, mg/100 g	16.13

BANANEPL



Tree vigour	strong
Tree habitus	dropping
Type of bearing	on spurs and long shoots
Flowering time	May-21 (late/medium late)
Flower diameter (mm)	41.5
Position of stigmas relative to anthers	above
Leaf length (mm)	8.23
Leaf width (mm)	6.10
Leaf length/width ratio	1.4
Incisions of leaf blade margin	serrate type 1

Fruit harvest time	Mid-season
Fruit weight, g	114
Shape	globose obloid
Area of overcolour (1-9)	1.1
Over colour	-
Pattern of over colour	-
Background colour	white green/ green
Colour of flesh	white greenish
Bloom of skin	absent or weak
Greasiness of skin	absent or weak
Fruit ribbing	weak-moderate
Area of russeting	absent or small
Number of lenticels	few/medium
Size of lenticels	small/medium
Length of stalk	misc.
SSC %*	10.4
Firmness kg cm ²	11.12
TA %	0.87
Vitamin C, mg/100 g	13.5
Taste (0-6)	3.5
Sell appearance (0-6)	1
Aroma (0-4)	2

BEAUTY OF BATH



Tree vigour	medium
Tree habitus	upright
Type of bearing	on spurs and long shoots
Flowering time	medium
Flower diameter (mm)	43.5
Position of stigmas relative to anthers	same level/below
Leaf length (mm)	9.4
Leaf width (mm)	5.74
Leaf length/width ratio	1.6
Incisions of leaf blade margin	biserrate/serrate type 1

Fruit harvest time	very early
Fruit weight, g	87
Shape	obloid
Area of overcolour (1-9)	5.7
Over colour	pink red/red
Pattern of over colour	striped and mottled
Background colour	white yellow/ white green
Colour of flesh	white pinkish
Bloom of skin	weak
Greasiness of skin	absent or weak
Fruit ribbing	weak
Area of russeting	absent or small
Number of lenticels	medium
Size of lenticels	large
Length of stalk	misc.
SSC %*	10.8
Firmness kg cm ²	7.53
TA %	1.22
Vitamin C, mg/100 g	13.17
Taste (0-6)	2
Sell appearance (0-6)	4
Aroma (0-4)	2.5

BELLE DE BOSKOOP



Tree vigour	strong
Tree habitus	spreading
Type of bearing	on spurs and long shoots
Flowering time	medium
Flower diameter (mm)	59.0
Position of stigmas relative to anthers	same level/above
Leaf length (mm)	9.71
Leaf width (mm)	7.62
Leaf length/width ratio	1.3
Incisions of leaf blade margin	serrate type 2

Fruit harvest time	very late
Fruit weight, g	178
Shape	conic obloid
Area of overcolour (1-9)	1.4
Over colour	-
Pattern of over colour	-
Background colour	green
Colour of flesh	white pinkish
Bloom of skin	weak
Greasiness of skin	absent or weak
Fruit ribbing	moderate
Area of russeting	large
Number of lenticels	many
Size of lenticels	small/medium
Length of stalk	very short
SSC %*	12.5
Firmness kg cm ²	11.3
TA %	1.09
Vitamin C, mg/100 g	8.41
Taste (0-6)	2
Sell appearance (0-6)	0
Aroma (0-4)	0

BORSDORFER



Tree vigour	strong
Tree habitus	spreading
Type of bearing	On spurs
Flowering time	medium
Flower diameter (mm)	46.5
Position of stigmas relative to anthers	misc.
Leaf length (mm)	7.86
Leaf width (mm)	5.66
Leaf length/width ratio	1.4
Incisions of leaf blade margin	serrate type 1/ biserrate

Fruit harvest time	late
Fruit weight, g	136
Shape	globose
Area of overcolour (1-9)	3
Over colour	red
Pattern of over colour	solid blush with strongly defined stripes
Background colour	green
Colour of flesh	white
Bloom of skin	weak
Greasiness of skin	absent or weak
Fruit ribbing	moderate
Area of russetting	absent or small
Number of lenticels	medium
Size of lenticels	small
Length of stalk	very short
SSC %*	10.1
Firmness kg cm ²	11.16
TA %	0.97
Vitamin C, mg/100 g	12.10
Taste (0-6)	0.5
Sell appearance (0-6)	1.5
Aroma (0-4)	1.0

BØTUNEPLE



Tree vigour	medium
Tree habitus	spreading
Type of bearing	on spurs and long shoots
Flowering time	late
Flower diameter (mm)	medium
Position of stigmas relative to anthers	above
Leaf length (mm)	8.35
Leaf width (mm)	5.70
Leaf length/width ratio	1.5
Incisions of leaf blade margin	serrate type 1/bicrenate

Fruit weight, g	112
Shape	globose
Over colour	red
Pattern of over colour	striped and mottled
Background colour	white yellow
Colour of flesh	greenish
Fruit ribbing	absent or weak
Area of russeting	small
Number of lenticels	medium
Size of lenticels	small
Length of stalk	medium
SSC %*	13.2
Firmness	firm
TA %	0.84
Vitamin C, mg/100 g	19.62
Taste (0-6)	3
Sell appearance (0-6)	3
Aroma (0-4)	1

BRAMLEY'S SEEDLING



Tree vigour	weak
Tree habitus	spreading
Type of bearing	on spurs and long shoots
Flowering time	medium
Flower diameter (mm)	55.0
Position of stigmas relative to anthers	misc.
Leaf length (mm)	9.26
Leaf width (mm)	7.41
Leaf length/width ratio	1.3
Incisions of leaf blade margin	serrate type 2

Fruit harvest time	very late
Fruit weight, g	222
Shape	conic-globose-obloid
Area of overcolour (1-9)	3.2
Over colour	red/ orange-red
Pattern of over colour	weakly defined blush with strongly defined stripes
Background colour	green
Colour of flesh	white cream
Bloom of skin	absent or weak
Greasiness of skin	absent or weak
Fruit ribbing	moderate
Area of russeting	absent or small
Number of lenticels	few
Size of lenticels	medium
Length of stalk	very short
SSC %*	11.8
Firmness kg cm ²	9.52
TA %	1.2
Vitamin C, mg/100 g	10.37
Taste (0-6)	0.5
Sell appearance (0-6)	1
Aroma (0-4)	1.5

BRUREPLE



Tree vigour	weak
Tree habitus	upright
Type of bearing	on spurs and long shoots
Flowering time	medium
Flower diameter (mm)	47.0
Position of stigmas relative to anthers	above
Leaf length (mm)	7.87
Leaf width (mm)	6.33
Leaf length/width ratio	1.2
Incisions of leaf blade margin	serrate type 1

Fruit harvest time	mid-season
Fruit weight, g	86
Shape	obloid
Area of overcolour (1-9)	5.3
Over colour	red/violet-red
Pattern of over colour	solid blush
Background colour	green
Colour of flesh	greenish pinkish
Bloom of skin	absent or weak
Greasiness of skin	absent or weak
Fruit ribbing	weak
Area of russeting	absent or small
Number of lenticels	few/medium
Size of lenticels	misc.
Length of stalk	very short/short
SSC %*	11.3
Firmness kg cm ²	7.66
TA %	0.93
Vitamin C, mg/100 g	12.1
Taste (0-6)	3.5
Sell appearance (0-6)	2
Aroma (0-4)	0

CHARLAMOVSKY



Tree vigour	medium
Tree habitus	spreading
Type of bearing	on spurs and long shoots
Flowering time	medium
Flower diameter (mm)	53.0
Position of stigmas relative to anthers	above
Leaf length (mm)	9.77
Leaf width (mm)	7.31
Leaf length/width ratio	1.3
Incisions of leaf blade margin	serrate type 1

Fruit harvest time	mid-season
Fruit weight, g	145
Shape	globose obloid
Area of overcolour (1-9)	1.7
Over colour	pink red
Pattern of over colour	only stripes (no blush)
Background colour	white green
Colour of flesh	white
Bloom of skin	absent or weak
Greasiness of skin	absent or weak
Fruit ribbing	weak-moderate
Area of russeting	absent or small
Number of lenticels	many
Size of lenticels	medium
Length of stalk	misc.
SSC %*	11.3
Firmness kg cm ²	7.66
TA %	0.93
Vitamin C, mg/100 g	14.43
Taste (0-6)	3
Sell appearance (0-6)	3
Aroma (0-4)	2

COX'S ORANGE



Tree vigour	medium
Tree habitus	spreading
Type of bearing	on spurs
Flowering time	late
Flower diameter (mm)	51.5
Position of stigmas relative to anthers	same level/above
Leaf length (mm)	7.86
Leaf width (mm)	4.42
Leaf length/width ratio	1.8
Incisions of leaf blade margin	serrate type 1/ bicrenate

Fruit harvest time	very late
Fruit weight, g	87
Shape	conic-globose-obloid
Area of overcolour (1-9)	4.4
Over colour	red/ orange-red
Pattern of over colour	blushed and mottled
Background colour	yellow/ yellow green
Colour of flesh	greenish cream
Bloom of skin	absent or weak
Greasiness of skin	absent or weak
Fruit ribbing	absent or weak
Area of russetting	absent or small
Number of lenticels	few/medium
Size of lenticels	small
Length of stalk	very short/short
SSC %*	12.8
Firmness kg cm ²	9.43
TA %	0.89
Vitamin C, mg/100 g	6.18
Taste (0-6)	4
Sell appearance (0-6)	2.5
Aroma (0-4)	1.5

COX'S POMONA



Tree vigour	weak
Tree habitus	spreading
Type of bearing	On long shoots
Flowering time	late
Flower diameter (mm)	46.0
Position of stigmas relative to anthers	same level
Leaf length (mm)	8.27
Leaf width (mm)	6.33
Leaf length/width ratio	1.3
Incisions of leaf blade margin	serrate type 1/ bicrenate

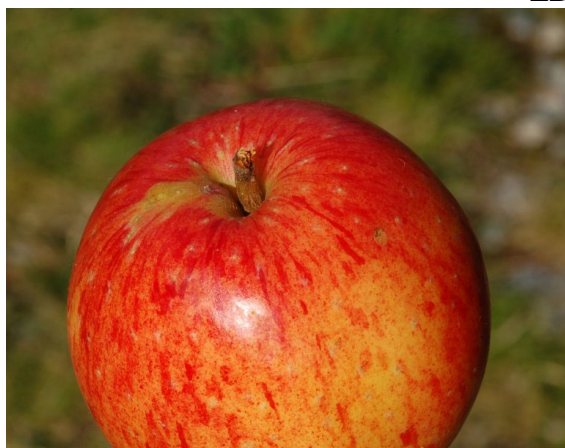
Fruit harvest time	mid-season
Fruit weight, g	168
Shape	obloid
Area of overcolour (1-9)	4.9
Over colour	red
Pattern of over colour	blushed
Background colour	yellow green/green
Colour of flesh	white greenish
Bloom of skin	absent or weak
Greasiness of skin	absent or weak
Fruit ribbing	weak- moderate
Area of russeting	absent or small
Number of lenticels	misc.
Size of lenticels	misc.
Length of stalk	very short / short
SSC %*	10.6
Firmness kg cm ²	7.05
TA %	0.69
Vitamin C, mg/100 g	7.57
Taste (0-6)	2.5
Sell appearance (0-6)	3
Aroma (0-4)	1

EARLY RED BIRD



Tree vigour	medium
Tree habitus	spreading
Type of bearing	on spurs and long shoots
Flowering time	medium
Flower diameter (mm)	54.0
Position of stigmas relative to anthers	same level/above
Leaf length (mm)	8.54
Leaf width (mm)	6.45
Leaf length/width ratio	1.3
Incisions of leaf blade margin	crenate

Fruit harvest time	very early
Fruit weight, g	102
Shape	obloid
Area of overcolour (1-9)	6.7
Over colour	red/violet-red
Pattern of over colour	solid blush with strongly defined stripes
Background colour	white yellow/ yellow/green
Colour of flesh	pinkish
Bloom of skin	strong
Greasiness of skin	absent or weak
Fruit ribbing	weak-moderate
Area of russeting	absent or small
Number of lenticels	medium
Size of lenticels	small/medium
Length of stalk	misc.
SSC %*	11.4
Firmness kg cm ²	5.87
TA %	1.5
Vitamin C, mg/100 g	5.19
Taste (0-6)	4
Sell appearance (0-6)	4
Aroma (0-4)	2

EDHOLM

Tree vigour	medium
Tree habitus	upright
Type of bearing	on spurs and long shoots
Flowering time	late
Flower diameter (mm)	medium
Position of stigmas relative to anthers	same level
Leaf length (mm)	8.58
Leaf width (mm)	5.81
Leaf length/width ratio	1.5
Incisions of leaf blade margin	serrate type 1

Fruit harvest time	mid-season
Fruit weight, g	144
Shape	ovoid
Over colour	red
Pattern of over colour	striped and mottled
Background colour	white yellow
Colour of flesh	cream
Fruit ribbing	weak
Area of russeting	absent or small
Number of lenticels	many
Size of lenticels	small
Length of stalk	medium
SSC %*	11.9
Firmness	firm
TA %	1.11
Vitamin C, mg/100 g	12.73
Taste (0-6)	3
Sell appearance (0-6)	5
Aroma (0-4)	2

EKELY

Tree vigour	medium
Tree habitus	drooping
Type of bearing	on spurs and long shoots
Flowering time	very early
Flower diameter (mm)	medium
Position of stigmas relative to anthers	above
Leaf length (mm)	8.29
Leaf width (mm)	6.39
Leaf length/width ratio	1.3
Incisions of leaf blade margin	serrate type 1

Fruit weight, g	106
Shape	ovoid
Over colour	red
Pattern of over colour	striped and mottled
Background colour	white yellow
Colour of flesh	white
Fruit ribbing	weak
Area of russeting	absent or small
Number of lenticels	medium
Size of lenticels	medium
Length of stalk	short
SSC %*	12.9
Firmness	medium
TA %	0.74
Vitamin C, mg/100 g	13.77
Taste (0-6)	2
Sell appearance (0-6)	3

ELRAUD PIGEON



Tree vigour	medium
Tree habitus	spreading
Type of bearing	on spurs and long shoots
Flowering time	medium
Flower diameter (mm)	47.0
Position of stigmas relative to anthers	same level/above
Leaf length (mm)	9.3
Leaf width (mm)	5.47
Leaf length/width ratio	1.7
Incisions of leaf blade margin	serrate type 1 or 2

Fruit harvest time	late
Fruit weight, g	69
Shape	globose obloid
Area of overcolour (1-9)	6.9
Over colour	red/violet-red
Pattern of over colour	solid blush
Background colour	yellow/ yellow green
Colour of flesh	white
Bloom of skin	weak
Greasiness of skin	absent or weak
Fruit ribbing	weak
Area of russeting	absent or small
Number of lenticels	medium
Size of lenticels	small/medium
Length of stalk	misc.
SSC %*	11.4
Firmness kg cm ²	11.19
TA %	1.12
Vitamin C, mg/100 g	12.57
Taste (0-6)	2
Sell appearance (0-6)	3.5
Aroma (0-4)	1.5

ENESTÅENDE



Tree vigour	weak
Tree habitus	drooping
Type of bearing	on spurs and long shoots
Flowering time	moderate
Leaf length (mm)	7.02
Leaf width (mm)	4.96
Leaf length/width ratio	1.4
Incisions of leaf blade margin	serrate type 2/ biserrate

Fruit harvest time	mid-season
Fruit weight, g	133
Shape	globose
Area of overcolour (1-9)	
Over colour	red
Pattern of over colour	striped and mottled
Background colour	white yellow
Colour of flesh	white
Area of russetting	small
Number of lenticels	many
Size of lenticels	small
Length of stalk	short
SSC %*	11.9
Firmness	firm
TA %	1.16
Vitamin C, mg/100 g	12.75
Taste (0-6)	3

FILIPPA

Tree vigour	medium
Tree habitus	upright
Type of bearing	on spurs and long shoots
Flowering time	medium
Flower diameter (mm)	large
Position of stigmas relative to anthers	above
Leaf length (mm)	7.98
Leaf width (mm)	6.01
Leaf length/width ratio	1.3
Incisions of leaf blade margin	bicrenate

Fruit harvest time	mid-season
Fruit weight, g	201
Shape	ovoid
Area of overcolour (1-9)	
Over colour	pink red
Pattern of over colour	solid blush
Background colour	white yellow
Colour of flesh	cream
Fruit ribbing	strong
Area of russetting	small
Number of lenticels	medium
Size of lenticels	large
Length of stalk	short
SSC %*	13.2
Firmness	medium
TA %	1.16
Vitamin C, mg/100 g	15.52
Taste (0-6)	3
Sell appearance (0-6)	1
Aroma (0-4)	4

FRANSKAR



Tree vigour	weak
Tree habitus	spreading
Type of bearing	on spurs
Flowering time	early
Flower diameter (mm)	44.0
Position of stigmas relative to anthers	above
Leaf length (mm)	8.96
Leaf width (mm)	5.8
Leaf length/width ratio	1.6
Incisions of leaf blade margin	serrate type 2

Fruit harvest time	mid-season
Fruit weight, g	143
Shape	globose obloid
Area of overcolour (1-9)	3.6
Over colour	violet red/ orange red
Pattern of over colour	striped and mottled
Background colour	white green/ green
Colour of flesh	white
Bloom of skin	absent or weak
Greasiness of skin	absent or weak
Fruit ribbing	absent or weak
Area of russetting	absent or small
m	medium/many
Size of lenticels	misc.
Length of stalk	very short
SSC %*	10.9
Firmness kg cm ²	9.03
TA %	1.01
Vitamin C, mg/100 g	9.29
Taste (0-6)	2.5
Sell appearance (0-6)	3.5
Aroma (0-4)	2

FRISTEREN



Tree vigour	moderate
Tree habitus	spreading
Type of bearing	on long shoots
Flowering time	May-20 (medium)
Flower diameter (mm)	42
Position of stigmas relative to anthers	above
Leaf length (mm)	8.9
Leaf width (mm)	7.1
Leaf length/width ratio	1.3
Incisions of leaf blade margin	serrate type 1 or 2

Fruit harvest time	early
Fruit weight, g	128
Shape	conic obloid
Area of overcolour (1-9)	1.7
Over colour	-
Pattern of over colour	-
Background colour	white green/green
Colour of flesh	white greenish
Bloom of skin	weak
Greasiness of skin	absent or weak
Fruit ribbing	weak-moderate
Area of russetting	small
Number of lenticels	many
Size of lenticels	small/medium
Length of stalk	very short/short
SSC %*	10.3
Firmness kg cm ²	8.16
TA %	1.50
Vitamin C, mg/100 g	10.89
Taste (0-6)	3.5
Sell appearance (0-6)	2.5
Aroma (0-4)	3

FUHR

Tree vigour	medium
Tree habitus	upright
Type of bearing	on spurs and long shoots
Flowering time	medium
Flower diameter (mm)	45.5
Position of stigmas relative to anthers	above
Leaf length (mm)	8.77
Leaf width (mm)	6.62
Leaf length/width ratio	1.3
Incisions of leaf blade margin	biserrate

Fruit harvest time	mid-season
Fruit weight, g	124
Shape	globose obloid
Area of overcolour (1-9)	4.7
Over colour	red/violet-red
Pattern of over colour	solid blush with weakly/strongly defined stripes
Background colour	white green/ yellow green/ green
Colour of flesh	greenish
Bloom of skin	weak
Greasiness of skin	absent or weak
Fruit ribbing	weak-moderate
Area of russeting	absent or small
Number of lenticels	many
Size of lenticels	small
Length of stalk	short
SSC %*	12.4
Firmness kg cm ²	9.23
TA %	0.96
Vitamin C, mg/100 g	17.46
Taste (0-6)	2.5
Sell appearance (0-6)	5
Aroma (0-4)	3.5

FURUHOLM



Tree vigour	medium
Tree habitus	spreading
Type of bearing	on spurs
Flowering time	medium
Flower diameter (mm)	48.5
Position of stigmas relative to anthers	above
Leaf length (mm)	8.54
Leaf width (mm)	6.15
Leaf length/width ratio	1.4
Incisions of leaf blade margin	serrate type 1

Fruit harvest time	mid-season
Fruit weight, g	88
Shape	conic obloid
Area of overcolour (1-9)	2
Over colour	pink red
Pattern of over colour	only stripes (no blush)
Background colour	white green/ yellow green
Colour of flesh	white
Bloom of skin	weak
Greasiness of skin	absent or weak
Fruit ribbing	absent or weak
Area of russetting	absent or small
Number of lenticels	few
Size of lenticels	small
Length of stalk	very short
SSC %*	11.6
Firmness kg cm ²	7.07
TA %	1.04
Vitamin C, mg/100 g	4.42
Taste (0-6)	3
Sell appearance (0-6)	3.5
Aroma (0-4)	3

GARBORG

Tree vigour	medium
Tree habitus	spreading
Type of bearing	on spurs and long shoots
Flowering time	medium
Flower diameter (mm)	58.0
Position of stigmas relative to anthers	misc.
Leaf length (mm)	7.05
Leaf width (mm)	5.67
Leaf length/width ratio	1.3
Incisions of leaf blade margin	crenate

Fruit harvest time	early
Fruit weight, g	88
Shape	conic obloid
Area of overcolour (1-9)	6.8
Over colour	red
Pattern of over colour	solid blush with strongly defined stripes
Background colour	yellow/ yellow green
Colour of flesh	white greenish
Bloom of skin	absent or weak
Greasiness of skin	weak
Fruit ribbing	weak
Area of russetting	absent or small
Number of lenticels	few/medium
Size of lenticels	small/medium
Length of stalk	medium/short
SSC %*	10.0
Firmness kg cm ²	7.14
TA %	1.31
Vitamin C, mg/100 g	4.03
Taste (0-6)	1.5
Sell appearance (0-6)	4
Aroma (0-4)	2.5

GLOPPESTADEPLE



Tree vigour	medium
Tree habitus	upright
Type of bearing	on spurs and long shoots
Flowering time	moderate
Flower diameter (mm)	medium
Position of stigmas relative to anthers	above
Leaf length (mm)	7.85
Leaf width (mm)	5.06
Leaf length/width ratio	1.5
Incisions of leaf blade margin	serrate type 1

Fruit harvest time	mid-season
Fruit weight, g	103
Shape	conic
Over colour	red
Pattern of over colour	solid blush with strongly defined stripes
Background colour	white yellow
Colour of flesh	cream
Area of russetting	small
Number of lenticels	many
Size of lenticels	small
Length of stalk	short
SSC %*	12.8
Firmness	firm
TA %	0.88
Vitamin C, mg/100 g	15.35
Taste (0-6)	3

GRÅGYLLING

Tree vigour	medium
Tree habitus	spreading
Type of bearing	on spurs
Flowering time	moderate
Flower diameter (mm)	small
Position of stigmas relative to anthers	above
Leaf length (mm)	8.09
Leaf width (mm)	5.66
Leaf length/width ratio	1.4
Incisions of leaf blade margin	serrate type 1 /biserrate

Fruit harvest time	late
Fruit weight, g	147
Shape	conic
Over colour	red
Pattern of over colour	striped and mottled
Background colour	white green
Colour of flesh	cream
Area of russetting	Absent or small
Number of lenticels	many
Size of lenticels	small
Length of stalk	medium
SSC %*	11.6
TA %	0.87
Vitamin C, mg/100 g	10.7

GRINDEEPL



Tree vigour	medium
Tree habitus	spreading
Type of bearing	on spurs and long shoots
Flowering time	moderate
Flower diameter (mm)	medium
Position of stigmas relative to anthers	same level
Leaf length (mm)	8.70
Leaf width (mm)	6.76
Leaf length/width ratio	1.3
Incisions of leaf blade margin	bicrenate

Fruit harvest time	early
Fruit weight, g	114
Shape	globose
Over colour	red
Pattern of over colour	solid blush
Background colour	yellow
Colour of flesh	cream
Fruit ribbing	strong
Area of russeting	small
Number of lenticels	medium
Size of lenticels	medium
Length of stalk	medium
SSC %*	12.1
Firmness	soft
TA %	1.04
Vitamin C, mg/100 g	17.48
Taste (0-6)	2
Sell appearance (0-6)	4

GRØNT LAUPSAEPLE



Tree vigour	medium
Tree habitus	Spreading
Type of bearing	On spurs and long shoots
Flowering time	(May-17) (medium)
Flower diameter (mm)	51.5
Position of stigmas relative to anthers	above
Leaf length (mm)	8.08
Leaf width (mm)	6.25
Leaf length/width ratio	1.3
Incisions of leaf blade margin	biserrate

Fruit harvest time	very early
Fruit weight, g	111
Shape	conic obloid
Area of overcolour (1-9)	1
Over colour	-
Pattern of over colour	-
Background colour	white green/ yellow green/ green
Colour of flesh	white cream
Bloom of skin	absent or weak
Greasiness of skin	absent or weak
Fruit ribbing	moderate
Area of russetting	absent or small
Number of lenticels	few/medium
Size of lenticels	medium/large
Length of stalk	very short/short
SSC %*	11.1
Firmness kg cm ²	9.93
TA %	1.4
Vitamin C, mg/100 g	7.07
Taste (0-6)	1
Sell appearance (0-6)	3
Aroma (0-4)	1

GUL GRANAT



Tree vigour	weak
Tree habitus	spreading/ upright
Type of bearing	On spurs and long shoots
Flowering time	medium
Flower diameter (mm)	51.5
Position of stigmas relative to anthers	above
Leaf length (mm)	7.48
Leaf width (mm)	5.58
Leaf length/width ratio	1.3
Incisions of leaf blade margin	bicrenate

Fruit harvest time	late
Fruit weight, g	120
Shape	globose obloid
Area of overcolour (1-9)	1.4
Over colour	-
Pattern of over colour	-
Background colour	white green/ yellow green
Colour of flesh	white
Bloom of skin	absent or weak
Greasiness of skin	absent or weak
Fruit ribbing	absent or weak
Area of russetting	absent or small
Number of lenticels	misc.
Size of lenticels	misc.
Length of stalk	very short/short
SSC %*	11.1
Firmness kg cm ²	12.89
TA %	0.71
Vitamin C, mg/100 g	7.81
Taste (0-6)	4.5
Sell appearance (0-6)	2.5
Aroma (0-4)	2.5

GULLSPIR



Tree vigour	weak
Tree habitus	Spreading
Type of bearing	on spurs
Flowering time	medium
Flower diameter (mm)	45.0
Position of stigmas relative to anthers	below
Leaf length (mm)	8.78
Leaf width (mm)	5.05
Leaf length/width ratio	1.7
Incisions of leaf blade margin	serrate type 1/ biserrate

Fruit harvest time	mid-season
Fruit weight, g	110
Shape	conic-ovoid-cylindrical
Area of overcolour (1-9)	1
Over colour	-
Pattern of over colour	-
Background colour	white green/green
Colour of flesh	white
Bloom of skin	absent or weak
Greasiness of skin	absent or weak
Fruit ribbing	moderate
Area of russetting	absent or small
Number of lenticels	medium/ many
Size of lenticels	medium/large
Length of stalk	very short/short
SSC %*	10.9
Firmness kg cm ²	8.42
TA %	1.59
Vitamin C, mg/100 g	10.31
Taste (0-6)	3.5
Sell appearance (0-6)	1
Aroma (0-4)	1

GYLLENKROKS ASTRAKAN



Tree vigour	medium
Tree habitus	spreading
Type of bearing	on spurs and long shoots
Flowering time	medium
Flower diameter (mm)	45.5
Position of stigmas relative to anthers	same level/above
Leaf length (mm)	7.77
Leaf width (mm)	5.31
Leaf length/width ratio	1.5
Incisions of leaf blade margin	bicrenate/ serrate type 2

Fruit harvest time	early
Fruit weight, g	111
Shape	conic -globose- obloid
Area of overcolour (1-9)	2.9
Over colour	orange-red
Pattern of over colour	blushed
Background colour	white green/ white yellow
Colour of flesh	white cream
Bloom of skin	absent or weak
Greasiness of skin	weak
Fruit ribbing	weak-moderate
Area of russetting	absent or small
Number of lenticels	medium
Size of lenticels	large
Length of stalk	medium
SSC %*	10.6
Firmness kg cm ²	4.44
TA %	0.71
Vitamin C, mg/100 g	13.31
Taste (0-6)	4
Sell appearance (0-6)	4
Aroma (0-4)	3.5

HÅKONSEPLE



Tree vigour	medium
Tree habitus	spreading/weeping
Type of bearing	on spurs and long shoots
Flowering time	medium
Flower diameter (mm)	54.0
Position of stigmas relative to anthers	same level
Leaf length (mm)	9.0
Leaf width (mm)	5.6
Leaf length/width ratio	1.6
Incisions of leaf blade margin	serrate type 1

Fruit harvest time	mid-season
Fruit weight, g	105
Shape	cylindrical-globose-obloid
Area of overcolour (1-9)	1.4
Over colour	pink red
Pattern of over colour	blushed
Background colour	white green/green
Colour of flesh	white greenish
Bloom of skin	absent or weak
Greasiness of skin	absent or weak
Fruit ribbing	weak-moderate
Area of russetting	absent or small
Number of lenticels	small/medium
Size of lenticels	medium/large
Length of stalk	very short/short
SSC %*	10.9
Firmness kg cm ²	8.11
TA %	0.63
Vitamin C, mg/100 g	6.17
Taste (0-6)	4
Sell appearance (0-6)	2
Aroma (0-4)	1.5

HAUGEEPLE



Tree vigour	strong
Tree habitus	spreading
Type of bearing	on spurs and long shoots
Flowering time	medium late
Flower diameter (mm)	65.0
Position of stigmas relative to anthers	above
Leaf length (mm)	10.1
Leaf width (mm)	7.8
Leaf length/width ratio	1.3
Incisions of leaf blade margin	serrate type 1

Fruit harvest time	early
Fruit weight, g	169
Shape	cylindrical waisted
Area of overcolour (1-9)	2.4
Over colour	pink red
Pattern of over colour	striped and mottled
Background colour	white green/green
Colour of flesh	white
Bloom of skin	absent or weak
Greasiness of skin	absent or weak
Fruit ribbing	weak /moderate
Area of russeting	absent or small
Number of lenticels	medium
Size of lenticels	medium
Length of stalk	very short/short
SSC %*	10.0
Firmness kg cm ²	8.51
TA %	1.98
Vitamin C, mg/100 g	9.57
Taste (0-6)	2
Sell appearance (0-6)	1
Aroma (0-4)	1.5

HERREASALEPLE



Tree vigour	medium
Tree habitus	spreading
Type of bearing	on long shoots
Flowering time	May-18 (medium)
Flower diameter (mm)	48.5
Position of stigmas relative to anthers	above
Leaf length (mm)	7.16
Leaf width (mm)	4.95
Leaf length/width ratio	1.5
Incisions of leaf blade margin	serrate type 2

Fruit harvest time	late
Fruit weight, g	151
Shape	globose obloid
Area of overcolour (1-9)	5.1
Over colour	pink red/red
Pattern of over colour	solid blush/striped and mottled
Background colour	yellow/ yellow green
Colour of flesh	white
Bloom of skin	strong
Greasiness of skin	absent or weak
Fruit ribbing	weak-moderate
Area of russeting	absent or small
Number of lenticels	few/medium
Size of lenticels	misc
Length of stalk	misc
SSC %*	12.4
Firmness kg cm ²	9.97
TA %	0.27
Vitamin C, mg/100 g	6.85
Taste (0-6)	1
Sell appearance (0-6)	2.5
Aroma (0-4)	0

HINDALS DRONNING



Tree vigour	medium
Tree habitus	spreading
Type of bearing	on spurs and long shoots
Flowering time	late
Leaf length (mm)	9.83
Leaf width (mm)	5.98
Leaf length/width ratio	1.6
Incisions of leaf blade margin	bicrenate/biserrate

Fruit harvest time	late
Fruit weight, g	199
Shape	conic
Over colour	red
Pattern of over colour	striped and mottled
Background colour	white-yellow
Colour of flesh	white
Area of russetting	small
Number of lenticels	many
Size of lenticels	medium
Length of stalk	short
SSC %*	12.85
TA %	0.83
Vitamin C, mg/100 g	18.99

HJARTNESEPLE



Tree vigour	weak
Tree habitus	spreading
Type of bearing	on spurs and long shoots
Flowering time	May-16 (medium)
Flower diameter (mm)	48.0
Position of stigmas relative to anthers	same level
Leaf length (mm)	7.57
Leaf width (mm)	5.73
Leaf length/width ratio	1.3
Incisions of leaf blade margin	serrate type 1/ bicrenate

Fruit harvest time	mid - season
Fruit weight, g	91
Shape	conic-globose-obloid
Area of overcolour (1-9)	1.1
Over colour	-
Pattern of over colour	-
Background colour	yellow green
Colour of flesh	white cream
Bloom of skin	absent or weak
Greasiness of skin	absent or weak
Fruit ribbing	moderate
Area of russeting	absent or small
Number of lenticels	medium
Size of lenticels	large
Length of stalk	medium/short
SSC %*	11.3
Firmness kg cm ²	7.7
TA %	0.24
Vitamin C, mg/100 g	8.67
Taste (0-6)	2
Sell appearance (0-6)	1.5
Aroma (0-4)	2

HØYNESEPLE



Tree vigour	strong
Tree habitus	upright
Type of bearing	on spurs and long shoots
Flowering time	medium
Flower diameter (mm)	43.5
Position of stigmas relative to anthers	misc.
Leaf length (mm)	6.35
Leaf width (mm)	5.83
Leaf length/width ratio	1.1
Incisions of leaf blade margin	crenate

Fruit harvest time	mid-season
Fruit weight, g	105
Shape	obloid
Area of overcolour (1-9)	4.8
Over colour	red/orange-red
Pattern of over colour	blushed and mottled
Background colour	white green/green
Colour of flesh	greenish cream
Bloom of skin	weak
Greasiness of skin	absent or weak
Fruit ribbing	weak- moderate
Area of russeting	absent or small
Number of lenticels	medium/ many
Size of lenticels	small/medium
Length of stalk	very short
SSC %*	10.8
Firmness kg cm ²	9.03
TA %	1.24
Vitamin C, mg/100 g	7.92
Taste (0-6)	2.5
Sell appearance (0-6)	3.5
Aroma (0-4)	2.5

HUSMOREPLE



Tree vigour	medium
Tree habitus	spreading
Type of bearing	on spurs
Flowering time	medium
Flower diameter (mm)	47.0
Position of stigmas relative to anthers	same level
Leaf length (mm)	8.88
Leaf width (mm)	7.03
Leaf length/width ratio	1.3
Incisions of leaf blade margin	misc.

Fruit harvest time	late
Fruit weight, g	211
Shape	conic-globose-obloid
Area of overcolour (1-9)	2.3
Over colour	pink -orange-red
Pattern of over colour	blushed
Background colour	green
Colour of flesh	cream
Bloom of skin	absent or weak
Greasiness of skin	absent or weak
Fruit ribbing	weak-moderate
Area of russeting	absent or small
Number of lenticels	medium
Size of lenticels	medium/large
Length of stalk	very short
SSC %*	11.1
Firmness kg cm ²	9.13
TA %	0.82
Vitamin C, mg/100 g	6.53
Taste (0-6)	3
Sell appearance (0-6)	2.5
Aroma (0-4)	0.5

JORDBÆREPLE



Tree vigour	medium
Tree habitus	spreading
Type of bearing	on spurs
Flowering time	early
Leaf width (mm)	5.08
Leaf length/width ratio	1.7
Incisions of leaf blade margin	crenate/bicrenate

Fruit harvest time	very early
Fruit weight, g	81
Shape	obloid
Area of overcolour (1-9)	5.7
Over colour	pink red
Pattern of over colour	striped and mottled
Background colour	white green
Colour of flesh	white
Fruit ribbing	strong
Area of russeting	small
Number of lenticels	few/medium
Size of lenticels	small
Length of stalk	short
SSC %*	11.1
TA %	0.87
Vitamin C, mg/100 g	13.18
Sell appearance (0-6)	2
Aroma (0-4)	2

KAUPANGER



Tree vigour	medium
Tree habitus	spreading
Type of bearing	on spurs and long shoots
Flowering time	medium
Flower diameter (mm)	51.5
Position of stigmas relative to anthers	above
Leaf length (mm)	9.40
Leaf width (mm)	5.93
Leaf length/width ratio	1.6
Incisions of leaf blade margin	serrate type 1

Fruit harvest time	mid-season
Fruit weight, g	119
Shape	obloid
Area of overcolour (1-9)	3.8
Over colour	red
Pattern of over colour	striped and mottled
Background colour	white green/green
Colour of flesh	white
Bloom of skin	absent or weak
Greasiness of skin	absent or weak
Fruit ribbing	weak-moderate
Area of russeting	absent or small
Number of lenticels	few/medium
Size of lenticels	small/medium
Length of stalk	very short/ short
SSC %*	11.1
Firmness kg cm ²	10.32
TA %	0.73
Vitamin C, mg/100 g	7.33
Taste (0-6)	4
Sell appearance (0-6)	1.5
Aroma (0-4)	0.5

KAVILL



Tree vigour	weak
Tree habitus	spreading
Type of bearing	on spurs and long shoots
Flowering time	medium
Flower diameter (mm)	43.5
Position of stigmas relative to anthers	misc.
Leaf length (mm)	8.47
Leaf width (mm)	5.56
Leaf length/width ratio	1.5
Incisions of leaf blade margin	serrate type 1/ crenate

Fruit harvest time	mid-season
Fruit weight, g	129
Shape	cylindrical waisted conic
Area of overcolour (1-9)	1.6
Over colour	pink -red
Pattern of over colour	blushed
Background colour	white green/ yellow green/ green
Colour of flesh	white cream
Bloom of skin	weak
Greasiness of skin	absent or weak
Fruit ribbing	moderate
Area of russeting	small
Number of lenticels	medium
Size of lenticels	small/medium
Length of stalk	very short
SSC %*	10.4
Firmness kg cm ²	7.16
TA %	0.91
Vitamin C, mg/100 g	2.83
Taste (0-6)	3
Sell appearance (0-6)	3
Aroma (0-4)	1

KJERRINGHOLM



Tree vigour	medium
Tree habitus	spreading
Type of bearing	on spurs
Flowering time	medium
Flower diameter (mm)	large
Position of stigmas relative to anthers	above
Leaf length (mm)	8.34
Leaf width (mm)	6.20
Leaf length/width ratio	1.3
Incisions of leaf blade margin	serrate type 1/ crenate

Fruit harvest time	mid-season
Fruit weight, g	126
Shape	obloid
Over colour	pink-red
Pattern of over colour	striped and mottled
Background colour	white-green
Colour of flesh	white
Fruit ribbing	strong
Area of russetting	absent or small
Number of lenticels	many
Size of lenticels	small
Length of stalk	long
SSC %*	12.7
Firmness	firm
TA %	1.00
Vitamin C, mg/100 g	15.78
Taste (0-6)	2
Sell appearance (0-6)	2

KNUTEPLE



Tree vigour	strong
Tree habitus	upright
Type of bearing	on spurs and long shoots
Flowering time	medium
Flower diameter (mm)	40.0
Position of stigmas relative to anthers	same level
Leaf length (mm)	8.99
Leaf width (mm)	5.64
Leaf length/width ratio	1.6
Incisions of leaf blade margin	serrate type 1

Fruit harvest time	early
Fruit weight, g	96
Shape	obloid
Area of overcolour (1-9)	2.5
Over colour	red /orange-red
Pattern of over colour	striped and mottled
Background colour	green
Colour of flesh	greenish
Bloom of skin	weak
Greasiness of skin	absent or weak
Fruit ribbing	absent or weak
Area of russetting	small
Number of lenticels	few/medium
Size of lenticels	small/medium
Length of stalk	short
SSC %*	11.0
Firmness kg cm ²	9.01
TA %	1.74
Taste (0-6)	1.5
Sell appearance (0-6)	0.5
Aroma (0-4)	1

KVITEPLE



Tree vigour	medium
Tree habitus	spreading
Type of bearing	on spurs and long shoots
Flowering time	May-16 (medium)
Flower diameter (mm)	49
Position of stigmas relative to anthers	above
Leaf length (mm)	9.23
Leaf width (mm)	6.36
Leaf length/width ratio	1.5
Incisions of leaf blade margin	serrate type 1

Fruit harvest time	mid-season
Fruit weight, g	124
Shape	conic obloid
Area of overcolour (1-9)	1.3
Over colour	pink red
Pattern of over colour	striped and mottled
Background colour	white green/ green
Colour of flesh	white
Bloom of skin	absent or weak
Greasiness of skin	absent or weak
Fruit ribbing	Weak moderate
Area of russetting	absent or small
Number of lenticels	medium
Size of lenticels	medium/large
Length of stalk	medium/short
SSC %*	11.1
Firmness kg cm ²	9.35
TA %	1.23
Vitamin C, mg/100 g	6.53
Taste (0-6)	2.5
Sell appearance (0-6)	2.5
Aroma (0-4)	2

LÆRDALSEPLE



Tree vigour	strong
Tree habitus	spreading
Type of bearing	on spurs and long shoots
Flowering time	medium
Flower diameter (mm)	medium
Position of stigmas relative to anthers	above
Leaf length (mm)	8.21
Leaf width (mm)	4.81
Leaf length/width ratio	1.7
Incisions of leaf blade margin	serrate type 1

Fruit harvest time	mid-season
Fruit weight, g	143
Shape	conic
Over colour	red
Pattern of over colour	solid blush with weakly defined stripes
Background colour	white-green
Colour of flesh	greenish
Fruit ribbing	strong
Area of russeting	absent or small
Number of lenticels	many
Size of lenticels	small
Length of stalk	medium
SSC %*	11.8
Firmness	medium
TA %	0.71
Vitamin C, mg/100 g	8.75
Taste (0-6)	2
Sell appearance (0-6)	1
Aroma (0-4)	1

LANGBALLE



Tree vigour	medium
Tree habitus	spreading
Type of bearing	on long shoots
Flowering time	medium
Flower diameter (mm)	52.5
Position of stigmas relative to anthers	above
Leaf length (mm)	9.00
Leaf width (mm)	6.00
Leaf length/width ratio	1.5
Incisions of leaf blade margin	serrate type 1/ bicrenate

Fruit harvest time	mid-season
Fruit weight, g	135
Shape	cylindrical waisted-conic
Area of overcolour (1-9)	1.7
Over colour	orange-red
Pattern of over colour	striped and mottled
Background colour	white green/ green
Colour of flesh	greenish cream
Bloom of skin	weak
Greasiness of skin	absent or weak
Fruit ribbing	moderate
Area of russetting	small
Number of lenticels	medium/many
Size of lenticels	misc.
Length of stalk	very short
SSC %*	10.4
Firmness kg cm ²	6.09
TA %	0.92
Vitamin C, mg/100 g	6.45
Taste (0-6)	2
Sell appearance (0-6)	3
Aroma (0-4)	1.5

LAVEPLE



Tree vigour	medium
Tree habitus	spreading
Type of bearing	on spurs and long shoots
Flowering time	medium
Flower diameter (mm)	small
Position of stigmas relative to anthers	above
Leaf length (mm)	7.63
Leaf width (mm)	5.60
Leaf length/width ratio	1.4
Incisions of leaf blade margin	crenate/ bicrenate

Fruit harvest time	early
Fruit weight, g	86
Shape	conic
Over colour	orange-red
Pattern of over colour	striped and mottled
Background colour	white-yellow
Colour of flesh	white
Fruit ribbing	weak
Area of russetting	small
Number of lenticels	many
Size of lenticels	small
Length of stalk	very short
SSC %*	13.0
TA %	0.23
Vitamin C, mg/100 g	13.29
Sell appearance (0-6)	3

LAXTON'S EXQUISITE



Tree vigour	medium
Tree habitus	spreading
Type of bearing	on spurs
Flowering time	medium
Flower diameter (mm)	56.5
Position of stigmas relative to anthers	same level
Leaf length (mm)	8.39
Leaf width (mm)	5.15
Leaf length/width ratio	1.6
Incisions of leaf blade margin	crenate

Fruit harvest time	mid-season
Fruit weight, g	135
Shape	globose
Area of overcolour (1-9)	5.3
Over colour	red/ brown-red
Pattern of over colour	solid blush with weakly/strongly defined stripes
Background colour	misc.
Colour of flesh	white cream
Bloom of skin	absent or weak
Greasiness of skin	absent or weak
Fruit ribbing	absent or weak
Area of russeting	absent or small
Number of lenticels	few/medium
Size of lenticels	misc.
Length of stalk	misc.
SSC %*	12.4
Firmness kg cm ²	9.61
TA %	0.72
Vitamin C, mg/100 g	9.24
Taste (0-6)	4.5
Sell appearance (0-6)	2.5
Aroma (0-4)	1.5

LEIKNES



Tree vigour	medium
Tree habitus	drooping
Type of bearing	on spurs and long shoots
Flowering time	medium
Flower diameter (mm)	50.5
Position of stigmas relative to anthers	same level
Leaf length (mm)	9.51
Leaf width (mm)	7.13
Leaf length/width ratio	1.5
Incisions of leaf blade margin	biserrate/ bicrenate

Fruit harvest time	mid-season
Fruit weight, g	222
Shape	globose obloid
Area of overcolour (1-9)	2.2
Over colour	red/ orange-red
Pattern of over colour	striped and mottled/only stripes (no blush)
Background colour	yellow white/ white green/ green
Colour of flesh	cream
Bloom of skin	absent or weak
Greasiness of skin	absent or weak
Fruit ribbing	weak-moderate
Area of russeting	absent or small
Number of lenticels	misc.
Size of lenticels	small/medium
Length of stalk	very short
SSC %*	12.8
Firmness kg cm ²	7.49
TA %	0.79
Vitamin C, mg/100 g	4.35
Taste (0-6)	2
Sell appearance (0-6)	1.5
Aroma (0-4)	2.5

LØEEPLE



Tree vigour	medium
Tree habitus	spreading
Type of bearing	on spurs
Flowering time	medium
Flower diameter (mm)	52.5
Position of stigmas relative to anthers	below
Leaf length (mm)	8.41
Leaf width (mm)	6.16
Leaf length/width ratio	1.4
Incisions of leaf blade margin	serrate type 1/ crenate

Fruit harvest time	mid-season
Fruit weight, g	172
Shape	globose obloid
Area of overcolour (1-9)	4.3
Over colour	pink red/ red
Pattern of over colour	striped and mottled/solid blush with weakly defined stripes
Background colour	white yellow/ yellow green
Colour of flesh	white
Bloom of skin	absent or weak
Greasiness of skin	absent or weak
Fruit ribbing	absent or weak
Area of russeting	absent or small
Number of lenticels	few/medium
Size of lenticels	large
Length of stalk	very short/short
SSC %*	11.6
Firmness kg cm ²	7.52
TA %	0.91
Vitamin C, mg/100 g	6.18
Taste (0-6)	4.5
Sell appearance (0-6)	5.5
Aroma (0-4)	2

LORD LAMBOURNE



Tree vigour	weak
Tree habitus	spreading/weeping
Type of bearing	on spurs and long shoots
Flowering time	late
Flower diameter (mm)	45.0
Position of stigmas relative to anthers	above
Leaf length (mm)	8.5
Leaf width (mm)	5.2
Leaf length/width ratio	1.6
Incisions of leaf blade margin	serrate type 1 or 2

Fruit harvest time	late
Fruit weight, g	145
Shape	globose
Area of overcolour (1-9)	5.2
Over colour	pink red/ red
Pattern of over colour	blushed and mottled/blushed
Background colour	green
Colour of flesh	white cream
Bloom of skin	absent or weak
Greasiness of skin	absent or weak
Fruit ribbing	weak
Area of russeting	absent or small
Number of lenticels	few/medium
Size of lenticels	small/medium
Length of stalk	very short/short
SSC %*	12.9
Firmness kg cm ²	8.01
TA %	0.76
Vitamin C, mg/100 g	10.27
Taste (0-6)	3.5
Sell appearance (0-6)	1
Aroma (0-4)	1

MAGLEMER



Tree vigour	medium
Tree habitus	spreading
Type of bearing	on spurs and long shoots
Flowering time	medium
Flower diameter (mm)	53.5
Position of stigmas relative to anthers	above
Leaf length (mm)	8.67
Leaf width (mm)	6.60
Leaf length/width ratio	1.3
Incisions of leaf blade margin	serrate type 1 or 2

Fruit harvest time	mid-season
Fruit weight, g	129
Shape	obloid
Area of overcolour (1-9)	4.4
Over colour	red/ orange-red
Pattern of over colour	only stripes (no blush)
Background colour	white green
Colour of flesh	white cream
Bloom of skin	absent or weak
Greasiness of skin	weak
Fruit ribbing	moderate
Area of russeting	small
Number of lenticels	medium
Size of lenticels	misc.
Length of stalk	medium/ short
SSC %*	11.7
Firmness kg cm ²	6.59
TA %	0.71
Vitamin C, mg/100 g	4.34
Taste (0-6)	4.5
Sell appearance (0-6)	4
Aroma (0-4)	1

MARTE-MOSTER



Tree vigour	very weak
Tree habitus	spreading
Type of bearing	on spurs and long shoots
Flowering time	May-16 (medium)
Flower diameter (mm)	58
Position of stigmas relative to anthers	above
Leaf length (mm)	7.8
Leaf width (mm)	6.0
Leaf length/width ratio	1.3
Incisions of leaf blade margin	serrate type 2

Fruit harvest time	Mid-season
Fruit weight, g	85
Shape	globose obloid
Area of overcolour (1-9)	2.3
Over colour	orange-red
Pattern of over colour	weakly defined blush with strongly defined stripes/only stripes
Background colour	white green/yellow green/green
Colour of flesh	cream
Bloom of skin	weak
Greasiness of skin	weak
Fruit ribbing	weak
Area of russeting	absent or small
Number of lenticels	few
Size of lenticels	medium
Length of stalk	short
SSC %*	11.2
Firmness kg cm ²	9.82
TA %	0.52
Vitamin C, mg/100 g	11.25
Taste (0-6)	3.5
Sell appearance (0-6)	0.5
Aroma (0-4)	1.5

NANSENEPLE



Tree vigour	medium
Tree habitus	spreading
Type of bearing	on spurs and long shoots
Flowering time	medium
Flower diameter (mm)	large
Position of stigmas relative to anthers	above
Leaf length (mm)	9.21
Leaf width (mm)	5.95
Leaf length/width ratio	1.6
Incisions of leaf blade margin	serrate type 1 or 2

Fruit harvest time	mid-season
Fruit weight, g	147
Shape	cylindrical waisted
Over colour	pink red
Pattern of over colour	striped and mottled
Background colour	white yellow
Colour of flesh	cream
Fruit ribbing	moderate
Area of russetting	absent or small
Number of lenticels	medium
Size of lenticels	medium
Length of stalk	medium
SSC %*	12.8
Firmness	firm
TA %	1.25
Vitamin C, mg/100 g	15.71
Taste (0-6)	1
Sell appearance (0-6)	2
Aroma (0-4)	2

NORDFOLK ROYAL



Tree vigour	medium
Tree habitus	spreading
Type of bearing	on spurs and long shoots
Flowering time	late
Flower diameter (mm)	53.0
Position of stigmas relative to anthers	above
Leaf length (mm)	8.3
Leaf width (mm)	5.887
Leaf length/width ratio	1.4
Incisions of leaf blade margin	misc.

Fruit harvest time	mid-season
Fruit weight, g	123
Shape	globose
Area of overcolour (1-9)	5.3
Over colour	red/ violet-red
Pattern of over colour	blushed and mottled
Background colour	white yellow/ white green
Colour of flesh	greenish pinkish
Bloom of skin	absent or weak
Greasiness of skin	weak
Fruit ribbing	weak- moderate
Area of russeting	absent or small
Number of lenticels	few/medium
Size of lenticels	small
Length of stalk	very short/short
SSC %*	10.8
Firmness kg cm ²	7.05
TA %	0.66
Vitamin C, mg/100 g	7.19
Taste (0-6)	2
Sell appearance (0-6)	4
Aroma (0-4)	2.5

ÖLANDS KUNGSEPLE



Tree vigour	medium
Tree habitus	spreading
Type of bearing	on spurs and long shoots
Flowering time	medium
Flower diameter (mm)	52.0
Position of stigmas relative to anthers	above
Leaf length (mm)	8.41
Leaf width (mm)	5.47
Leaf length/width ratio	1.6
Incisions of leaf blade margin	serrate type 1/ crenate

Fruit harvest time	mid-season
Fruit weight, g	109
Shape	conic obloid
Area of overcolour (1-9)	7.3
Over colour	red
Pattern of over colour	solid blush with weakly/strongly defined stripes
Background colour	green
Colour of flesh	white greenish
Bloom of skin	absent or weak
Greasiness of skin	absent or weak
Fruit ribbing	absent or weak
Area of russeting	absent or small
Number of lenticels	medium/many
Size of lenticels	small/medium
Length of stalk	very short/short
SSC %*	11.1
Firmness kg cm ²	4.98
TA %	0.74
Vitamin C, mg/100 g	10.74
Taste (0-6)	2.5
Sell appearance (0-6)	4.5
Aroma (0-4)	2

ØSKAUG



Tree vigour	medium
Tree habitus	spreading
Type of bearing	on spurs and long shoots
Flowering time	medium
Flower diameter (mm)	33.0
Position of stigmas relative to anthers	above
Leaf length (mm)	7.8
Leaf width (mm)	6.2
Leaf length/width ratio	1.3
Incisions of leaf blade margin	biserrate

Fruit harvest time	mid-season
Fruit weight, g	86
Shape	ovoid
Area of overcolour (1-9)	5.2
Over colour	red
Pattern of over colour	solid blush with weakly defined stripes
Background colour	white green/ green
Colour of flesh	pinkish cream
Bloom of skin	weak
Greasiness of skin	absent or weak
Fruit ribbing	weak- moderate
Area of russeting	absent or small
Number of lenticels	few
Size of lenticels	small/medium
Length of stalk	very short/short
SSC %*	9.9
Firmness kg cm ²	7.38
TA %	0.70
Vitamin C, mg/100 g	19.69
Taste (0-6)	4
Sell appearance (0-6)	3
Aroma (0-4)	3

OSTER



Tree vigour	medium
Tree habitus	spreading
Type of bearing	on spurs and long shoots
Flowering time	medium
Flower diameter (mm)	59.0
Position of stigmas relative to anthers	same level/above
Leaf length (mm)	8.71
Leaf width (mm)	6.98
Leaf length/width ratio	1.3
Incisions of leaf blade margin	serrate type 2

Fruit harvest time	very-early
Fruit weight, g	180
Shape	conic-globose
Area of overcolour (1-9)	5.4
Over colour	pink red
Pattern of over colour	striped and mottled
Background colour	white green/ yellow green
Colour of flesh	white
Bloom of skin	weak
Greasiness of skin	absent or weak
Fruit ribbing	weak
Area of russeting	absent or small
Number of lenticels	medium
Size of lenticels	medium/large
Length of stalk	misc.
SSC %*	11.9
Firmness kg cm ²	6.39
TA %	1.46
Vitamin C, mg/100 g	4.71
Taste (0-6)	3
Sell appearance (0-6)	4
Aroma (0-4)	2

ØYSTEINEPLE



Tree vigour	weak
Tree habitus	spreading
Type of bearing	on spurs and long shoots
Flowering time	late
Flower diameter (mm)	large
Position of stigmas relative to anthers	above
Leaf length (mm)	8.87
Leaf width (mm)	5.42
Leaf length/width ratio	1.6
Incisions of leaf blade margin	bicrenate

Fruit harvest time	late
Fruit weight, g	234
Shape	obloid
Over colour	orange red
Pattern of over colour	striped and mottled
Background colour	white yellow
Colour of flesh	cream
Area of russeting	large
Number of lenticels	medium
Size of lenticels	small
Length of stalk	short
SSC %*	12.0
Firmness	firm
TA %	0.62
Vitamin C, mg/100 g	17.42
Taste (0-6)	3

PARADISEPLE



Tree vigour	medium
Tree habitus	dropping/weeping
Type of bearing	on long shoots
Flowering time	medium
Flower diameter (mm)	56.5
Position of stigmas relative to anthers	above
Leaf length (mm)	11.16
Leaf width (mm)	5.42
Leaf length/width ratio	1.6
Incisions of leaf blade margin	serrate type 2/ biserrate

Fruit harvest time	mid-season
Fruit weight, g	36
Shape	globose obloid
Area of overcolour (1-9)	4.0
Over colour	red
Pattern of over colour	solid blush with weakly defined stripes
Background colour	yellow/yellow green
Colour of flesh	yellowish cream
Bloom of skin	absent or weak
Greasiness of skin	absent or weak
Fruit ribbing	weak-moderate
Area of russeting	absent or small
Number of lenticels	few/medium
Size of lenticels	small/medium
Length of stalk	very long
SSC %*	13.1
Firmness kg cm ²	8.70
TA %	1.47
Vitamin C, mg/100 g	6.48
Taste (0-6)	0.5
Sell appearance (0-6)	2
Aroma (0-4)	0

RAUD GRANAT



Tree vigour	strong
Tree habitus	upright
Type of bearing	on spurs and long shoots
Flowering time	medium
Flower diameter (mm)	48.5
Position of stigmas relative to anthers	same level/above
Leaf length (mm)	8.0
Leaf width (mm)	6.32
Leaf length/width ratio	1.3
Incisions of leaf blade margin	bicrenate / biserrate

Fruit harvest time	late
Fruit weight, g	103
Shape	obloid
Area of overcolour (1-9)	6.0
Over colour	red
Pattern of over colour	solid blush/solid blush with weakly defined stripes
Background colour	yellow
Colour of flesh	white
Bloom of skin	absent or weak
Greasiness of skin	absent or weak
Fruit ribbing	absent or weak
Area of russeting	absent or small
Number of lenticels	medium
Size of lenticels	medium/large
Length of stalk	very short
SSC %*	11.1
Firmness kg cm ²	11.22
TA %	1.11
Vitamin C, mg/100 g	14.75
Taste (0-6)	2
Sell appearance (0-6)	4
Aroma (0-4)	2

RAUD GRAVENSTEIN



Tree vigour	strong
Tree habitus	spreading
Type of bearing	on spurs
Flowering time	medium
Flower diameter (mm)	63.5
Position of stigmas relative to anthers	above
Leaf length (mm)	9.56
Leaf width (mm)	6.11
Leaf length/width ratio	1.6
Incisions of leaf blade margin	serrate type 1 or 2

Fruit harvest time	mid-season
Fruit weight, g	161
Shape	misc.
Area of overcolour (1-9)	6.8
Over colour	red
Pattern of over colour	striped and mottled
Background colour	yellow green/ green
Colour of flesh	white
Bloom of skin	weak
Greasiness of skin	absent or weak
Fruit ribbing	moderate
Area of russetting	absent or small
Number of lenticels	many
Size of lenticels	small/medium
Length of stalk	very short/short
SSC %*	11.1
Firmness kg cm ²	7.97
TA %	0.80
Vitamin C, mg/100 g	5.12
Taste (0-6)	4.5
Sell appearance (0-6)	5
Aroma (0-4)	2

RAUD SÄVSTAHOLM



Tree vigour	medium
Tree habitus	spreading
Type of bearing	on spurs and long shoots
Flowering time	early
Flower diameter (mm)	55.0
Position of stigmas relative to anthers	above
Leaf length (mm)	8.74
Leaf width (mm)	5.94
Leaf length/width ratio	1.5
Incisions of leaf blade margin	biserrate/ crenate

Fruit harvest time	early
Fruit weight, g	102
Shape	misc.
Area of overcolour (1-9)	7.8
Over colour	pink red/ red
Pattern of over colour	blushed
Background colour	white green/yellow green/green
Colour of flesh	white pinkish
Bloom of skin	absent or weak
Greasiness of skin	weak
Fruit ribbing	weak
Area of russeting	absent or small
Number of lenticels	medium
Size of lenticels	medium/large
Length of stalk	medium
SSC %*	11.2
Firmness kg cm ²	5.75
TA %	0.82
Vitamin C, mg/100 g	5.94
Taste (0-6)	4
Sell appearance (0-6)	4.5
Aroma (0-4)	2.5

RAUD SOMMERKAVILL



Tree vigour	medium
Tree habitus	spreading
Type of bearing	on spurs and long shoots
Flowering time	medium
Flower diameter (mm)	46.5
Position of stigmas relative to anthers	same level/below
Leaf length (mm)	8.62
Leaf width (mm)	5.75
Leaf length/width ratio	1.5
Incisions of leaf blade margin	serrate type 1 / crenate

Fruit harvest time	mid-season
Fruit weight, g	101
Shape	conic obloid
Area of overcolour (1-9)	5.6
Over colour	red
Pattern of over colour	blushed and mottled/solid blush with strongly defined stripes
Background colour	white green/yellow green/green
Colour of flesh	white cream
Bloom of skin	strong
Greasiness of skin	absent or weak
Fruit ribbing	moderate
Area of russeting	absent or small
Number of lenticels	many
Size of lenticels	medium/large
Length of stalk	very short/short
SSC %*	13.6
Firmness kg cm ²	6.87
TA %	0.97
Vitamin C, mg/100 g	5.48
Taste (0-6)	4.5
Sell appearance (0-6)	3
Aroma (0-4)	2

RAUDT LAUPSAEPLE



Tree vigour	medium
Tree habitus	spreading
Type of bearing	on spurs and long shoots
Flowering time	May-16 (medium)
Flower diameter (mm)	50.0
Position of stigmas relative to anthers	misc
Leaf length (mm)	7.03
Leaf width (mm)	5.54
Leaf length/width ratio	1.3
Incisions of leaf blade margin	bicrenate

Fruit harvest time	mid-season
Fruit weight, g	113
Shape	globose obloid
Area of overcolour (1-9)	7.1
Over colour	red/ violet-red
Pattern of over colour	solid blush/solid blush with weakly defined stripes
Background colour	misc
Colour of flesh	greenish cream
Bloom of skin	weak
Greasiness of skin	absent or weak
Fruit ribbing	weak-moderate
Area of russeting	absent or small
Number of lenticels	few
Size of lenticels	misc
Length of stalk	very short
SSC %*	11.1
Firmness kg cm ²	9.18
TA %	0.41
Vitamin C, mg/100 g	3.72
Taste (0-6)	3
Sell appearance (0-6)	4.5
Aroma (0-4)	1

RIBSTON



Tree vigour	medium
Tree habitus	spreading/ dropping
Type of bearing	on spurs and long shoots
Flowering time	late
Flower diameter (mm)	50.5
Position of stigmas relative to anthers	same level/above
Leaf length (mm)	8.5
Leaf width (mm)	5.8
Leaf length/width ratio	1.5
Incisions of leaf blade margin	serrate type 1 or 2

Fruit harvest time	late
Fruit weight, g	116
Shape	conic- globose
Area of overcolour (1-9)	1.9
Over colour	red/ orange-red
Pattern of over colour	only stripes (no blush)
Background colour	green
Colour of flesh	greenish cream
Bloom of skin	absent or weak
Greasiness of skin	absent or weak
Fruit ribbing	weak
Area of russeting	large
Number of lenticels	medium
Size of lenticels	small/medium
Length of stalk	very short
SSC %*	13.7
Firmness kg cm ²	11.37
TA %	0.87
Vitamin C, mg/100 g	14.65
Taste (0-6)	3
Sell appearance (0-6)	1
Aroma (0-4)	1.5

RISKEDAL



Tree vigour	weak
Tree habitus	spreading
Type of bearing	on spurs and long shoots
Flowering time	medium
Flower diameter (mm)	medium
Position of stigmas relative to anthers	same level
Leaf length (mm)	7.76
Leaf width (mm)	6.88
Leaf length/width ratio	1.1
Incisions of leaf blade margin	serrate type 2 /biserrate

Fruit harvest time	mid-season
Fruit ribbing	weak
SSC %*	11.9
Firmness	medium
TA %	1.03
Vitamin C, mg/100 g	20.52
Taste (0-6)	2
Sell appearance (0-6)	2
Aroma (0-4)	2

RONDESTVEIT



Tree vigour	weak
Tree habitus	upright
Type of bearing	on spurs and long shoots
Flowering time	medium
Flower diameter (mm)	57.0
Position of stigmas relative to anthers	above
Leaf length (mm)	8.67
Leaf width (mm)	6.45
Leaf length/width ratio	1.4
Incisions of leaf blade margin	biserrate

Fruit harvest time	mid-season
Fruit weight, g	115
Shape	obloid
Area of overcolour (1-9)	6.5
Over colour	red
Pattern of over colour	solid blush with weakly defined stripes
Background colour	misc.
Colour of flesh	white cream
Bloom of skin	weak
Greasiness of skin	absent or weak
Fruit ribbing	absent or weak
Area of russeting	absent or small
Number of lenticels	few
Size of lenticels	small/medium
Length of stalk	very short
SSC %*	11.1
Firmness kg cm ²	8.87
TA %	0.92
Vitamin C, mg/100 g	10.7
Taste (0-6)	5.5
Sell appearance (0-6)	4.5
Aroma (0-4)	3.5

ROSSVOLLEPLE



Tree vigour	strong
Tree habitus	spreading/dropping
Type of bearing	on spurs and long shoots
Flowering time	May-14 (early)
Flower diameter (mm)	53.5
Position of stigmas relative to anthers	above
Leaf length (mm)	9.7
Leaf width (mm)	7.7
Leaf length/width ratio	1.3
Incisions of leaf blade margin	serrate type 2

Fruit harvest time	early
Fruit weight, g	193
Shape	misc.
Area of overcolour (1-9)	1.1
Over colour	-
Pattern of over colour	-
Background colour	white green
Colour of flesh	white greenish
Bloom of skin	absent or weak
Greasiness of skin	absent or weak
Fruit ribbing	weak-moderate
Area of russetting	absent or small
Number of lenticels	medium
Size of lenticels	medium/large
Length of stalk	very short
SSC %*	10.7
Firmness kg cm ²	5.67
TA %	1.45
Taste (0-6)	4.5
Sell appearance (0-6)	2
Aroma (0-4)	2.5

SÄVSTAHOLM



Tree vigour	strong
Tree habitus	spreading
Type of bearing	on spurs and long shoots
Flowering time	medium
Flower diameter (mm)	55.5
Position of stigmas relative to anthers	above
Leaf length (mm)	8.58
Leaf width (mm)	5.76
Leaf length/width ratio	1.5
Incisions of leaf blade margin	serrate type 1

Fruit harvest time	early
Fruit weight, g	113
Shape	conic-cylindrical-ellipsoid
Area of overcolour (1-9)	3.7
Over colour	pink red/ orange red
Pattern of over colour	striped and mottled
Background colour	white green/green
Colour of flesh	white
Bloom of skin	absent or weak
Greasiness of skin	weak
Fruit ribbing	weak
Area of russeting	absent or small
Number of lenticels	few
Size of lenticels	small/medium
Length of stalk	medium/short
SSC %*	11.1
Firmness kg cm ²	6.06
TA %	0.91
Vitamin C, mg/100 g	4.36
Taste (0-6)	4.5
Sell appearance (0-6)	4.5
Aroma (0-4)	2.5

SIGNE TILLISCH



Tree vigour	medium
Tree habitus	spreading
Type of bearing	on spurs and long shoots
Flowering time	late
Flower diameter (mm)	50.5
Position of stigmas relative to anthers	above
Leaf length (mm)	9.6
Leaf width (mm)	6.4
Leaf length/width ratio	1.5
Incisions of leaf blade margin	serrate type 1

Fruit harvest time	late
Fruit weight, g	200
Shape	conic-globose-obloid
Area of overcolour (1-9)	1.9
Over colour	red
Pattern of over colour	solid blush with strongly defined stripes
Background colour	white green/yellow green/green
Colour of flesh	greenish cream
Bloom of skin	absent or weak
Greasiness of skin	absent or weak
Fruit ribbing	weak-moderate
Area of russeting	absent or small
Number of lenticels	many
Size of lenticels	medium
Length of stalk	misc.
SSC %*	12.0
Firmness kg cm ²	7.8
TA %	0.65
Vitamin C, mg/100 g	6.73
Taste (0-6)	3.5
Sell appearance (0-6)	2.5
Aroma (0-4)	1

SILKEEPL



Tree vigour	medium
Tree habitus	spreading
Type of bearing	on spurs and long shoots
Flowering time	medium
Flower diameter (mm)	45.7
Position of stigmas relative to anthers	above
Leaf length (mm)	7.94
Leaf width (mm)	5.8
Leaf length/width ratio	1.4
Incisions of leaf blade margin	biserrate/ serrate type 1

Fruit harvest time	late
Fruit weight, g	116
Shape	conic-globose-obloid
Area of overcolour (1-9)	1.3
Over colour	orange-red
Pattern of over colour	striped and mottled
Background colour	misc.
Colour of flesh	white greenish
Bloom of skin	absent or weak
Greasiness of skin	absent or weak
Fruit ribbing	weak
Area of russeting	absent or small
Number of lenticels	many
Size of lenticels	large
Length of stalk	medium/short
SSC %*	10.7
Firmness kg cm ²	11.09
TA %	0.87
Vitamin C, mg/100 g	4.78
Taste (0-6)	3.5
Sell appearance (0-6)	1.5
Aroma (0-4)	1

SITRONEPLE



Tree vigour	medium
Tree habitus	spreading
Type of bearing	on spurs and long shoots
Flowering time	May-21 (late/medium late)
Flower diameter (mm)	59.0
Position of stigmas relative to anthers	above
Leaf length (mm)	10.45
Leaf width (mm)	7.13
Leaf length/width ratio	1.5
Incisions of leaf blade margin	serrate type 1/ biserrate

Fruit harvest time	mid-season
Fruit weight, g	143
Shape	cylindrical waisted-ovoid
Area of overcolour (1-9)	1
Over colour	-
Pattern of over colour	-
Background colour	white green/green
Colour of flesh	white cream
Bloom of skin	absent or weak
Greasiness of skin	absent or weak
Fruit ribbing	weak-moderate
Area of russetting	absent or small
Number of lenticels	many
Size of lenticels	medium
Length of stalk	medium/short
SSC %*	10.9
Firmness kg cm ²	8.79
TA %	1.13
Vitamin C, mg/100 g	8.26
Taste (0-6)	3
Sell appearance (0-6)	3
Aroma (0-4)	1

SKREDSVIGEPLE



Tree vigour	medium
Tree habitus	upright
Type of bearing	on spurs
Flowering time	late
Flower diameter (mm)	large
Position of stigmas relative to anthers	same level
Leaf length (mm)	10.44
Leaf width (mm)	6.93
Leaf length/width ratio	1.5
Incisions of leaf blade margin	serrate type 1

Fruit harvest time	late
Fruit weight, g	225
Shape	conic
Area of overcolour (1-9)	1.3
Over colour	brown-red
Pattern of over colour	striped and mottled
Background colour	yellow
Colour of flesh	cream
Area of russetting	absent or small
Number of lenticels	many
Size of lenticels	large
Length of stalk	short
SSC %*	13.2
Firmness	firm
TA %	0.71
Vitamin C, mg/100 g	15.93
Taste (0-6)	2

SØTEPLE



Tree vigour	medium
Tree habitus	spreading
Type of bearing	on spurs
Flowering time	May-18 (medium)
Flower diameter (mm)	38.0
Position of stigmas relative to anthers	same level
Leaf length (mm)	9.58
Leaf width (mm)	6.64
Leaf length/width ratio	1.5
Incisions of leaf blade margin	serrate type 1/ bicrenate

Fruit harvest time	mid-season
Fruit weight, g	78
Shape	obloid
Area of overcolour (1-9)	2.3
Over colour	orange-red
Pattern of over colour	solid blush with weakly defined stripes
Background colour	white green
Colour of flesh	white
Bloom of skin	absent or weak
Greasiness of skin	absent or weak
Fruit ribbing	absent or weak
Area of russeting	small
Number of lenticels	medium
Size of lenticels	small
Length of stalk	very short
SSC %*	12.5
Firmness kg cm ²	9.98
TA %	0.31
Vitamin C, mg/100 g	3.45
Taste (0-6)	1
Sell appearance (0-6)	1
Aroma (0-4)	1

STOR GRANAT



Tree vigour	strong
Tree habitus	upright
Type of bearing	on spurs
Flowering time	medium
Flower diameter (mm)	51.5
Position of stigmas relative to anthers	above
Leaf length (mm)	7.00
Leaf width (mm)	4.82
Leaf length/width ratio	1.5
Incisions of leaf blade margin	serrate type 1

Fruit harvest time	mid-season
Fruit weight, g	182
Shape	conic-obloid
Area of overcolour (1-9)	2.4
Over colour	pink-red
Pattern of over colour	misc.
Background colour	white yellow/ white green
Colour of flesh	white cream
Bloom of skin	weak
Greasiness of skin	absent or weak
Fruit ribbing	weak-moderate
Area of russeting	absent or small
Number of lenticels	many/medium
Size of lenticels	small
Length of stalk	misc.
SSC %*	10.5
Firmness kg cm ²	9.79
TA %	0.78
Vitamin C, mg/100 g	3.88
Taste (0-6)	2.5
Sell appearance (0-6)	2
Aroma (0-4)	3

STOR TORSTEIN



Tree vigour	medium
Tree habitus	upright
Type of bearing	on spurs and long shoots
Flowering time	medium
Leaf length (mm)	7.59
Leaf width (mm)	4.80
Leaf length/width ratio	1.6
Incisions of leaf blade margin	biserrate/ serrate type 1

Fruit harvest time	late
Fruit weight, g	160
Shape	globose
Over colour	brown-red
Pattern of over colour	striped and mottled
Background colour	white yellow
Colour of flesh	white
Area of russeting	absent or small
Number of lenticels	medium
Size of lenticels	medium
Length of stalk	short
SSC %*	12.7
TA %	0.61
Vitamin C, mg/100 g	12.79

STORESTEINSEPLE



Tree vigour	medium
Tree habitus	spreading/upright
Type of bearing	on spurs and long shoots
Flowering time	May-19 (medium)
Flower diameter (mm)	45.0
Position of stigmas relative to anthers	above
Leaf length (mm)	8.4
Leaf width (mm)	5.2
Leaf length/width ratio	1.6
Incisions of leaf blade margin	serrate type 1/ bicrenate

Fruit harvest time	mid-season
Fruit weight, g	200
Shape	conic-globose-obloid
Area of overcolour (1-9)	5.7
Over colour	red/ violet-red
Pattern of over colour	striped and mottled/solid blush with strongly defined stripes
Background colour	yellow green/green
Colour of flesh	greenish pinkish
Bloom of skin	moderate
Greasiness of skin	absent or weak
Fruit ribbing	moderate
Area of russeting	absent or small
Number of lenticels	few/medium
Size of lenticels	misc
Length of stalk	very short/short
SSC %*	10.7
Firmness kg cm ²	9.3
TA %	1.18
Vitamin C, mg/100 g	13.5
Taste (0-6)	1
Sell appearance (0-6)	4
Aroma (0-4)	1.5

STRUTAR



Tree vigour	strong
Tree habitus	spreading/weeping
Type of bearing	on spurs and long shoots
Flowering time	May-21 (late/medium late)
Flower diameter (mm)	50.0
Position of stigmas relative to anthers	misc
Leaf length (mm)	9.42
Leaf width (mm)	5.35
Leaf length/width ratio	1.8
Incisions of leaf blade margin	serrate type 1/ crenate

Fruit harvest time	mid-season
Fruit weight, g	150
Shape	conic
Area of overcolour (1-9)	3.1
Over colour	orange-red
Pattern of over colour	striped and mottled
Background colour	yellow/yellow green/ green
Colour of flesh	white cream
Bloom of skin	weak
Greasiness of skin	weak
Fruit ribbing	moderate
Area of russeting	absent or small
Number of lenticels	medium/many
Size of lenticels	misc.
Length of stalk	misc.
SSC %*	10.3
Firmness kg cm ²	6.81
TA %	0.52
Vitamin C, mg/100 g	7.65
Taste (0-6)	1
Sell appearance (0-6)	2
Aroma (0-4)	1.5

SUKKEREPLÉ



Tree vigour	medium
Tree habitus	upright
Type of bearing	on spurs and long shoots
Flowering time	medium
Flower diameter (mm)	large
Position of stigmas relative to anthers	above
Leaf length (mm)	8.19
Leaf width (mm)	6.36
Leaf length/width ratio	1.3
Incisions of leaf blade margin	biserrate/ serrate type 1

Fruit harvest time	early
Fruit weight, g	83
Shape	conic
Over colour	pink-red
Pattern of over colour	mottled
Background colour	white yellow
Colour of flesh	cream
Fruit ribbing	weak
Area of russetting	absent or small
Number of lenticels	many
Size of lenticels	medium
Length of stalk	very short
SSC %*	13.0
Firmness	firm
TA %	0.18
Vitamin C, mg/100 g	14.34
Taste (0-6)	2
Sell appearance (0-6)	2
Aroma (0-4)	1

SUREPLE GRØNN



Tree vigour	weak
Tree habitus	spreading
Type of bearing	on spurs
Flowering time	May-16 (medium)
Flower diameter (mm)	54.0
Position of stigmas relative to anthers	same level
Leaf length (mm)	7.15
Leaf width (mm)	5.84
Leaf length/width ratio	1.2
Incisions of leaf blade margin	serrate type 1 or 2

Fruit harvest time	late
Fruit weight, g	38
Shape	globose
Area of overcolour (1-9)	5.8
Over colour	red
Pattern of over colour	solid blush with strongly defined stripes
Background colour	green
Colour of flesh	white
Bloom of skin	absent or weak
Greasiness of skin	absent or weak
Fruit ribbing	absent or weak
Area of russeting	absent or small
Number of lenticels	many
Size of lenticels	large
Length of stalk	medium
SSC %*	11.6
Firmness kg cm ²	8.79
TA %	1.53
Vitamin C, mg/kg	
Taste (0-6)	0.5
Sell appearance (0-6)	0
Aroma (0-4)	0

SYSEKAVIL



Tree vigour	medium
Tree habitus	spreading
Type of bearing	on spurs and long shoots
Flowering time	May-17 (medium)
Flower diameter (mm)	65.0
Position of stigmas relative to anthers	same level/above
Leaf length (mm)	8.78
Leaf width (mm)	6.24
Leaf length/width ratio	1.4
Incisions of leaf blade margin	crenate

Fruit harvest time	mid-season
Fruit weight, g	192
Shape	conic-globose-obloid
Area of overcolour (1-9)	4.1
Over colour	pink red/ red
Pattern of over colour	solid blush with strongly defined stripes
Background colour	white green/ green
Colour of flesh	white greenish
Bloom of skin	weak
Greasiness of skin	absent or weak
Fruit ribbing	weak-moderate
Area of russeting	absent or small
Number of lenticels	medium/many
Size of lenticels	medium/large
Length of stalk	very short
SSC %*	11.4
Firmness kg cm ²	7.0
TA %	1.09
Vitamin C, mg/100 g	13.11
Taste (0-6)	2.5
Sell appearance (0-6)	3
Aroma (0-4)	1.5

TEIGEPL



Tree vigour	very strong
Tree habitus	upright
Type of bearing	on spurs and long shoots
Flowering time	medium
Flower diameter (mm)	large
Position of stigmas relative to anthers	above
Leaf length (mm)	8.37
Leaf width (mm)	6.34
Leaf length/width ratio	1.3
Incisions of leaf blade margin	crenate/ serrate type 1

Fruit harvest time	mid-season
Fruit weight, g	108
Over colour	pink-red
Pattern of over colour	mottled
Background colour	white yellow
Colour of flesh	cream
Fruit ribbing	absent or weak
Area of russeting	absent or small
Number of lenticels	many
Size of lenticels	medium
Length of stalk	very short
SSC %*	12.8
Firmness	medium
TA %	1.57
Vitamin C, mg/100 g	17.24
Taste (0-6)	1
Sell appearance (0-6)	4
Aroma (0-4)	3

TOLLEIVSEPLE



Tree vigour	weak
Tree habitus	upright
Type of bearing	on spurs and long shoots
Flowering time	medium
Flower diameter (mm)	51.0
Position of stigmas relative to anthers	same level/above
Leaf length (mm)	8.30
Leaf width (mm)	5.66
Leaf length/width ratio	1.5
Incisions of leaf blade margin	serrate type 1 / biserrate

Fruit harvest time	mid-season
Fruit weight, g	99
Shape	conic-globose-obloid
Area of overcolour (1-9)	1.8
Over colour	orange-red
Pattern of over colour	blushed
Background colour	white yellow/ yellow green
Colour of flesh	white cream
Bloom of skin	weak
Greasiness of skin	absent or weak
Fruit ribbing	weak-moderate
Area of russeting	absent or small
Number of lenticels	medium
Size of lenticels	misc.
Length of stalk	very short/short
SSC %*	11.8
Firmness kg cm ²	8.19
TA %	0.78
Vitamin C, mg/100 g	4.9
Taste (0-6)	4
Sell appearance (0-6)	3.5
Aroma (0-4)	2

TOKHEIMSEPLE



Tree vigour	strong
Tree habitus	spreading
Type of bearing	on spurs and long shoots
Flowering time	May-16 (medium)
Flower diameter (mm)	61.0
Position of stigmas relative to anthers	above
Leaf length (mm)	9.53
Leaf width (mm)	6.43
Leaf length/width ratio	1.5
Incisions of leaf blade margin	serrate type 2/ bicrenate

Fruit harvest time	Mid-season
Fruit weight, g	126
Shape	miscellaneous
Area of overcolour (1-9)	1.8
Over colour	pink red
Pattern of over colour	striped and mottled/blushed
Background colour	white green/ green
Colour of flesh	white
Bloom of skin	moderate
Greasiness of skin	absent or weak
Fruit ribbing	weak-moderate
Area of russetting	absent or small
Number of lenticels	many
Size of lenticels	medium/large
Length of stalk	short
SSC %*	11.3
Firmness kg cm ²	8.26
TA %	1.81
Vitamin C, mg/100 g	6.74
Taste (0-6)	4
Sell appearance (0-6)	2
Aroma (0-4)	1

TORMOD



Tree vigour	weak
Tree habitus	spreading/dropping
Type of bearing	on spurs and long shoots
Flowering time	medium
Flower diameter (mm)	56.5
Position of stigmas relative to anthers	above
Leaf length (mm)	9.17
Leaf width (mm)	6.05
Leaf length/width ratio	1.5
Incisions of leaf blade margin	bicrenate/ serrate type 1

Fruit harvest time	mid-season
Fruit weight, g	140
Shape	obloid
Area of overcolour (1-9)	5.3
Over colour	pink red/red
Pattern of over colour	solid blush with strongly defined stripes
Background colour	misc.
Colour of flesh	white
Bloom of skin	weak
Greasiness of skin	absent or weak
Fruit ribbing	weak-moderate
Area of russetting	misc.
Number of lenticels	few
Size of lenticels	small/medium
Length of stalk	very short/short
SSC %*	10.9
Firmness kg cm ²	10.69
TA %	1.25
Vitamin C, mg/100 g	9.15
Taste (0-6)	2
Sell appearance (0-6)	3.5
Aroma (0-4)	1

TRANSPARENTE BLANCHE



Tree vigour	medium
Tree habitus	spreading
Type of bearing	on long shoots
Flowering time	medium
Flower diameter (mm)	59.5
Position of stigmas relative to anthers	above
Leaf length (mm)	10.08
Leaf width (mm)	6.81
Leaf length/width ratio	1.5
Incisions of leaf blade margin	crenate/ bicrenate

Fruit harvest time	early
Fruit weight, g	139
Shape	misc.
Area of overcolour (1-9)	1.0
Over colour	-
Pattern of over colour	-
Background colour	white green/green
Colour of flesh	white greenish
Bloom of skin	absent or weak
Greasiness of skin	absent or weak
Fruit ribbing	weak-moderate
Area of russeting	absent or small
Number of lenticels	medium/many
Size of lenticels	medium/large
Length of stalk	misc.
SSC %*	10.7
Firmness kg cm ²	6.85
TA %	0.94
Vitamin C, mg/100 g	12.79
Taste (0-6)	3.5
Sell appearance (0-6)	4.5
Aroma (0-4)	2.5

TVEITEPLE



Tree vigour	strong
Tree habitus	spreading/upright
Type of bearing	on spurs and long shoots
Flowering time	medium
Flower diameter (mm)	48.0
Position of stigmas relative to anthers	above
Leaf length (mm)	7.68
Leaf width (mm)	5.39
Leaf length/width ratio	1.4
Incisions of leaf blade margin	crenate

Fruit harvest time	mid-season
Fruit weight, g	121
Shape	conic-globose-obloid
Area of overcolour (1-9)	5.4
Over colour	red/violet-red
Pattern of over colour	solid blush with weakly defined stripes
Background colour	yellow green/green
Colour of flesh	white cream
Bloom of skin	absent or weak
Greasiness of skin	weak
Fruit ribbing	weak-moderate
Area of russetting	absent or small
Number of lenticels	medium/many
Size of lenticels	misc.
Length of stalk	very short
SSC %*	12.2
Firmness kg cm ²	6.69
TA %	0.79
Vitamin C, mg/100 g	13.98
Taste (0-6)	4
Sell appearance (0-6)	2.5
Aroma (0-4)	2.5

ULGENES



Tree vigour	strong
Tree habitus	spreading
Type of bearing	on spurs and long shoots
Flowering time	medium
Flower diameter (mm)	55.0
Position of stigmas relative to anthers	above
Leaf length (mm)	7.82
Leaf width (mm)	5.93
Leaf length/width ratio	1.3
Incisions of leaf blade margin	serrate type 1 / crenate

Fruit harvest time	mid-season
Fruit weight, g	115
Shape	conic-globose-obloid
Area of overcolour (1-9)	4.2
Over colour	red
Pattern of over colour	striped and mottled/solid blush with strongly defined stripes
Background colour	yellow green/green
Colour of flesh	cream
Bloom of skin	moderate
Greasiness of skin	weak
Fruit ribbing	absent or weak
Area of russeting	absent or small
Number of lenticels	few/medium
Size of lenticels	small/medium
Length of stalk	very short
SSC %*	11.6
Firmness kg cm ²	8.46
TA %	1.07
Vitamin C, mg/100 g	5.66
Taste (0-6)	5
Sell appearance (0-6)	3
Aroma (0-4)	1.5

VÅGAEPLE



Tree vigour	medium
Tree habitus	upright
Type of bearing	on long shoots
Flowering time	very late
Flower diameter (mm)	large
Position of stigmas relative to anthers	above
Leaf length (mm)	8.51
Leaf width (mm)	6.00
Leaf length/width ratio	1.4
Incisions of leaf blade margin	serrate type 1 / biserrate

Fruit harvest time	late
Fruit weight, g	131
Shape	globose
Over colour	pink-red
Pattern of over colour	solid blush
Background colour	white yellow
Colour of flesh	greenish
Fruit ribbing	weak
Area of russetting	small
Number of lenticels	medium
Size of lenticels	medium
Length of stalk	very short
SSC %*	12.52
Firmness	firm
TA %	1.15
Vitamin C, mg/100 g	9.79
Taste (0-6)	1
Sell appearance (0-6)	4
Aroma (0-4)	2

PRINS



Tree vigour	medium
Tree habitus	spreading/dropping
Type of bearing	on spurs and long shoots
Flowering time	medium
Flower diameter (mm)	53.0
Position of stigmas relative to anthers	above
Leaf length (mm)	8.40
Leaf width (mm)	6.40
Leaf length/width ratio	1.3
Incisions of leaf blade margin	serrate type 1 or 2

Fruit harvest time	mid-season
Fruit weight, g	118
Shape	obloid
Area of overcolour (1-9)	2
Over colour	orange-red
Pattern of over colour	solid blush with weakly defined stripes
Background colour	white green/green
Colour of flesh	white cream
Bloom of skin	weak
Greasiness of skin	absent or weak
Fruit ribbing	moderate
Area of russetting	absent or small
Number of lenticels	medium
Size of lenticels	medium
Length of stalk	very short
SSC %*	11.4
Firmness kg cm ²	8.42
TA %	0.8
Vitamin C, mg/100 g	10.59
Taste (0-6)	2.5
Sell appearance (0-6)	1
Aroma (0-4)	0.5

TORSTEIN



Tree vigour	strong
Tree habitus	upright
Type of bearing	on spurs
Flowering time	medium
Flower diameter (mm)	44.0
Position of stigmas relative to anthers	above
Leaf length (mm)	8.49
Leaf width (mm)	5.65
Leaf length/width ratio	1.5
Incisions of leaf blade margin	biserrate

Fruit harvest time	late
Fruit weight, g	125
Shape	globose-obloid
Area of overcolour (1-9)	6
Over colour	red/ brown-red
Pattern of over colour	solid blush with weakly/strongly defined stripes
Background colour	yellow/white green/green
Colour of flesh	white
Bloom of skin	weak
Greasiness of skin	absent or weak
Fruit ribbing	weak-moderate
Area of russetting	absent or small
Number of lenticels	medium/many
Size of lenticels	small
Length of stalk	very short
SSC %*	11.4
Firmness kg cm ²	10.67
TA %	0.81
Vitamin C, mg/100 g	6.82
Taste (0-6)	2.5
Sell appearance (0-6)	3.5
Aroma (0-4)	1

VINTERGUL



Tree vigour	weak
Tree habitus	spreading
Type of bearing	on spurs and long shoots
Flowering time	late
Flower diameter (mm)	45.5
Position of stigmas relative to anthers	above
Leaf length (mm)	7.57
Leaf width (mm)	4.90
Leaf length/width ratio	1.5
Incisions of leaf blade margin	serrate type 1 / crenate

Fruit harvest time	late
Fruit weight, g	115
Shape	conic-globose
Area of overcolour (1-9)	2.6
Over colour	red/ orange red
Pattern of over colour	only stripes (no blush)/weakly defined blush with strongly defined stripes
Background colour	yellow green/ green
Colour of flesh	white cream
Bloom of skin	weak
Greasiness of skin	weak
Fruit ribbing	weak-moderate
Area of russetting	absent or small
Number of lenticels	medium/many
Size of lenticels	small
Length of stalk	short
SSC %*	11.4
Firmness kg cm ²	8.86
TA %	0.75
Vitamin C, mg/100 g	3.07
Taste (0-6)	3
Sell appearance (0-6)	2
Aroma (0-4)	1.5

VINTERROSENSTRIPS



Tree vigour	medium
Tree habitus	spreading/upright
Type of bearing	on spurs and long shoots
Flowering time	medium
Flower diameter (mm)	51.0
Position of stigmas relative to anthers	same level/above
Leaf length (mm)	7.72
Leaf width (mm)	6.01
Leaf length/width ratio	1.3
Incisions of leaf blade margin	serrate type 1 or 2

Fruit harvest time	mid-season
Fruit weight, g	104
Shape	obloid
Area of overcolour (1-9)	4.7
Over colour	red
Pattern of over colour	solid blush with strongly defined stripes
Background colour	green
Colour of flesh	white greenish
Bloom of skin	moderate
Greasiness of skin	weak
Fruit ribbing	absent or weak
Area of russetting	small
Number of lenticels	medium
Size of lenticels	small/medium
Length of stalk	misc.
SSC %*	10.4
Firmness kg cm ²	7.99
TA %	1.00
Vitamin C, mg/100 g	7.7
Taste (0-6)	2.5
Sell appearance (0-6)	0.5
Aroma (0-4)	2

WORCESTER PEARMAIN



Tree vigour	strong
Tree habitus	upright/spreading
Type of bearing	on spurs and long shoots
Flowering time	medium
Flower diameter (mm)	49.0
Position of stigmas relative to anthers	same level/above
Leaf length (mm)	9.41
Leaf width (mm)	5.64
Leaf length/width ratio	1.7
Incisions of leaf blade margin	serrate type 2/ biserrate

Fruit harvest time	mid-season
Fruit weight, g	114
Shape	conic
Area of overcolour (1-9)	5.4
Over colour	violet/ pink-red
Pattern of over colour	solid blush with weakly defined stripes
Background colour	misc.
Colour of flesh	white cream
Bloom of skin	moderate
Greasiness of skin	weak
Fruit ribbing	absent or weak
Area of russetting	misc.
Number of lenticels	medium/many
Size of lenticels	small/medium
Length of stalk	very short
SSC %*	12.6
Firmness kg cm ²	6.87
TA %	0.60
Vitamin C, mg/100 g	5.89
Taste (0-6)	4
Sell appearance (0-6)	4
Aroma (0-4)	2.5

