

Ripening of gooseberry (*Ribes uva-crispa*)

Modning af stikkelsbær (Ribes uva-crispa)

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Summary

18 cultivars of gooseberry were harvested by machine at different maturity stages.

The firmness of the gooseberry fruits can be determined by use of an Instron apparatus equipped with an 'Ottawa' cell. The order of ripening of the 18 cultivars was almost the same in 1990 and 1991. On average the firmness decreases 7 units per day or 50 units a week. A more simple method for estimation of maturity is evaluation of the seed colour which changes from yellow to brown during ripening.

'Invicta', 'Greenfinch' and 'Hönings Früheste' are early varieties, while 'London', 'White Lion' and 'Spine Free' are ready for harvesting one month later. The other cultivars 'Grüne Kügel',

'May Duke', 'Nr 3098', 'Winhams Industry', 'Alice Marie', 'Weisse Triumph', 'Whitesmith', 'Pixwell', 'Rote Orleans', 'Green Willow' and 'Careless' ripen in the period between the early and late cultivars. The order of ripening of the cultivars is expected to be similar from year to year.

During ripening the content of soluble solids (mainly sugars) and titratable acid increases linearly with time. The increase in titratable acidity can be explained by increasing acid concentration and decreasing concentration of cations.

The gooseberry flavour of stewed gooseberries decreased slightly with the harvest time, which means that the early harvest gives rise to products with the strongest gooseberry flavour.

Key words: *Ribes uva-crispa*, gooseberry, harvesting time, soluble solids, acidity, firmness.

Resumé

18 sorter af stikkelsbær blev i 2 år høstet med maskine på 3 forskellige udviklingstrin.

Stikkelsbærrenes fasthed og dermed modenheden kan bestemmes ved brug af et Instronapparat, som er udstyret med en 'Ottawa' celle. Modningsrækkefølgen for de 18 sorter var næsten den samme i begge forsøgsår 1990 og 1991. I gennemsnit aftog fastheden med 50 instronenheder om ugen.

Ud fra tidlige målinger af fasthed kan høsttiden estimeres. Flere målinger tæt på det ønskede udviklingstrin kan anvendes til mere nøjagtig bestemmelse af høsttidspunktet.

Høsttidspunktet kan også vurderes ud fra kernefarven, som ændres fra gul til brun under modningen.

'Invicta', 'Greenfinch' og 'Hönings Früheste' er tidlige sorter, medens 'London', 'White Lion' og 'Spine Free' skal høstes en måned senere.

Andre sorter som 'Grüne Kügel', 'May Duke', 'Nr 3098', 'Winhams Industry', 'Allice Marie', 'Weisse Triumph', 'Whitesmith', 'Pixwell', 'Rote Orleans', 'Green Willow' og 'Careless' modner imellem de tidlige og sene sorter.

Under modningen forøges indholdet af opløseligt tørstof og titrerbar syre lineært med tiden. Det er meget almindeligt, at indholdet af opløse-

ligt tørstof stiger under frugternes modning. Et stigende indhold af titrerbar syre skyldes forøget syredannelse og aftagen i koncentrationen af kationer.

Stikkelsbærsmagen i stikkelsbærgrød aftog svagt med høsttiden, hvilket betyder, at den bedste smag opnås ved tidlig høst.

Nøgleord: *Ribes uva-crispa*, stikkelsbær, høsttidspunkt, opløseligt tørstof, titrerbar syre, fasthed.

Introduction

Only a small area of gooseberries is grown in Denmark, but the fruits can be used for processing of jam, jelly and canned whole or stewed gooseberries.

Mechanical harvesting of gooseberries can be carried out by use of a black currant harvester, but no method for determination of the optimum harvesting time is known.

The Danish industry prefers green gooseberries for processing of the above mentioned products. Mature gooseberries of some cultivars contain anthocyanins or proanthocyanins which give rise to products with red or brown colour with low consumer preferences.

The aim of this study has been to develop a practical applicable method for measurement of the maturity of gooseberries.

Methods

Gooseberry planted in 3 replications with distances of 4x1 m (row x plant distance) were harvested in 1990 and 1991 with a black currant harvester (Aunslev). The 3 replications each with 4

bushes were harvested at intervals of about one week.

Firmness was determined by use of an Instron apparatus equipped with an 'Ottawa' cell. The test was done on 5 randomized samples of 200 gram of each variety and harvest. The berries were weighed into the 'Ottawa' cell and then crushed by the piston which penetrated the sample with a velocity of 200 mm/min.

200 g samples of frozen gooseberries were stored at -25°C for determination of soluble solids and titratable acid. The sample of berries was thawed in a microwave oven, diluted with 50 gram of distilled water and blended for 3 minutes in a Waring blender.

Soluble solids were determined by use of a refractometer (Bausch & Lomb) and titratable acid as citric acid was determined by titration to pH 8.1 by use of an automatic Mettler titrator. For each of the analyses 2 replications were carried out.

Jam was made from the frozen gooseberries by use of the ingredients shown in Table 1. The fruits and half of the water were boiled and a mixture of pectin and the sugar was added and heating to boiling point was repeated. A mixture of water and snowflake and solutions of sodium benzoate and potassium sorbate were added before heating again. The final weight was 5600 gram.

The stewed jam was stored at 4°C for 1 month and then at 20°C for 2 weeks until sensory evaluation by 8 trained panellists.

Table 1. Recipe for preparation of stewed gooseberries.
Recept for fremstilling af stikkelsbærgrød.

	Gram
Gooseberries	2000
Sugar	540
Pectin LM	46
Snowflake	112
Water	2882
Sodium benzoate 10%	10
Potassium sorbate 10%	10

Results

The number of days used below are calculated as the difference between the actual harvest day and the first day of harvest of the earliest cultivar.

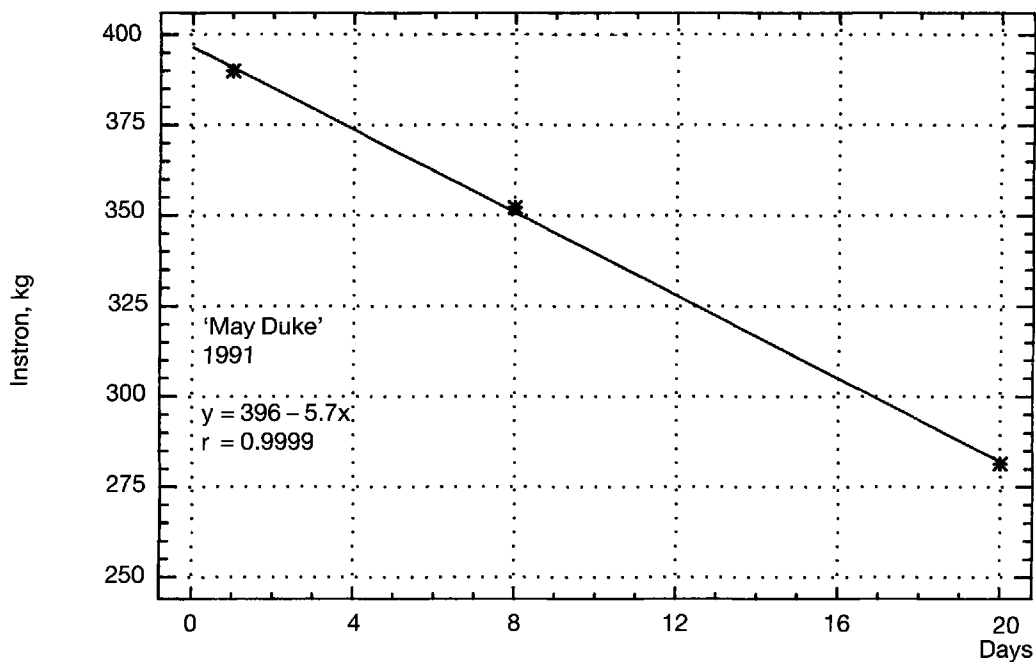


Figure 1. Firmness as a function of harvest time for 'May Duke'.
Fasthed som funktion af høsttid for 'May Duke'.

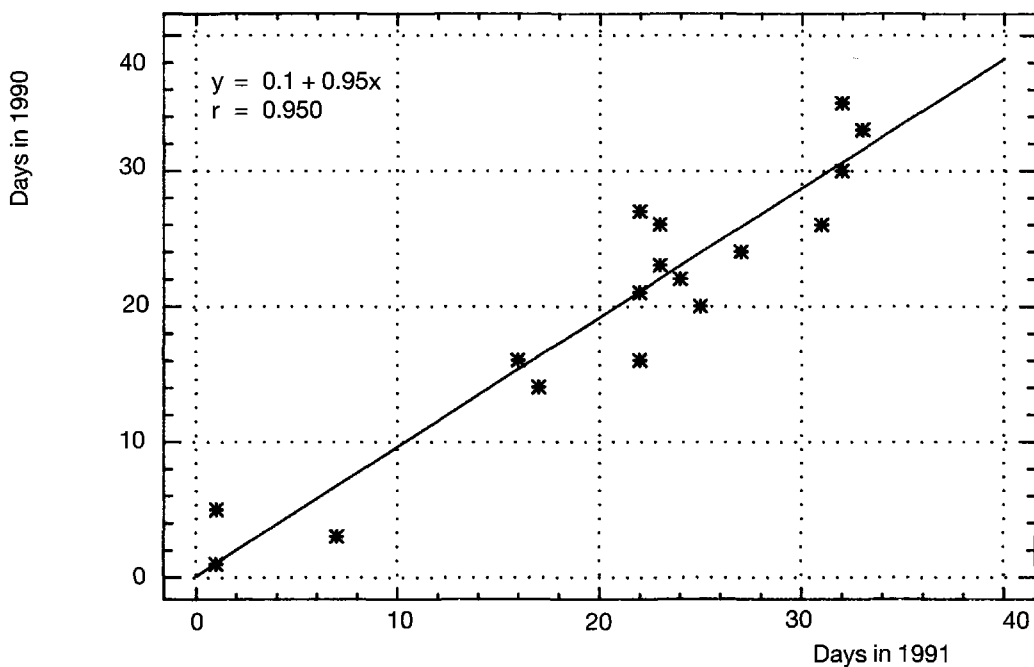


Figure 2. Days in 1990 and 1991 to obtain a firmness of 300 kg for 18 cultivars.
Dage i 1990 og 1991 for at opnå en fasthed på 300 kg hos 18 sorter.

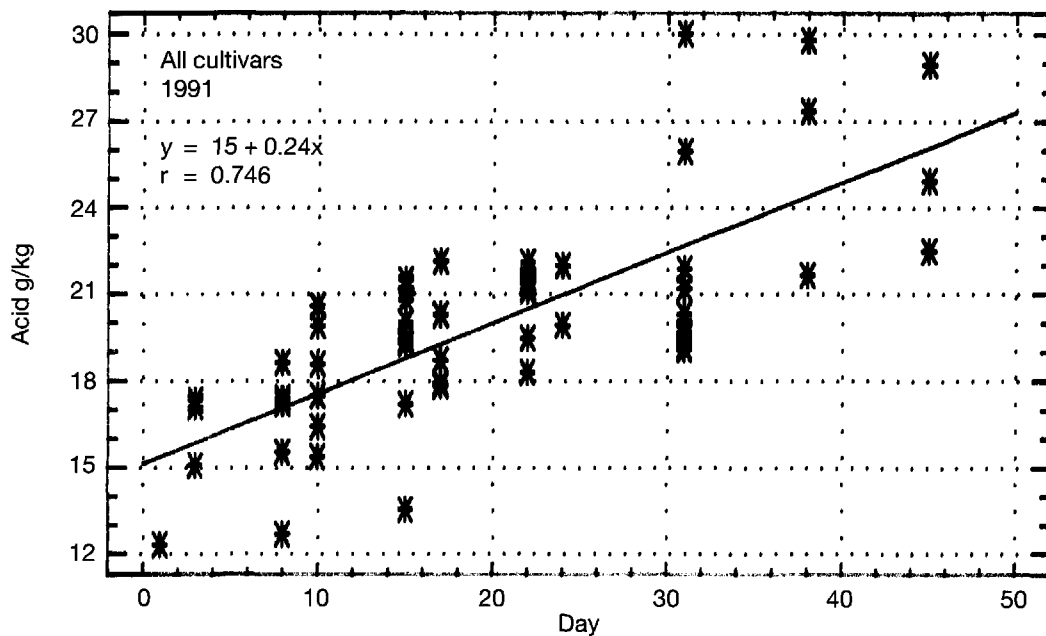
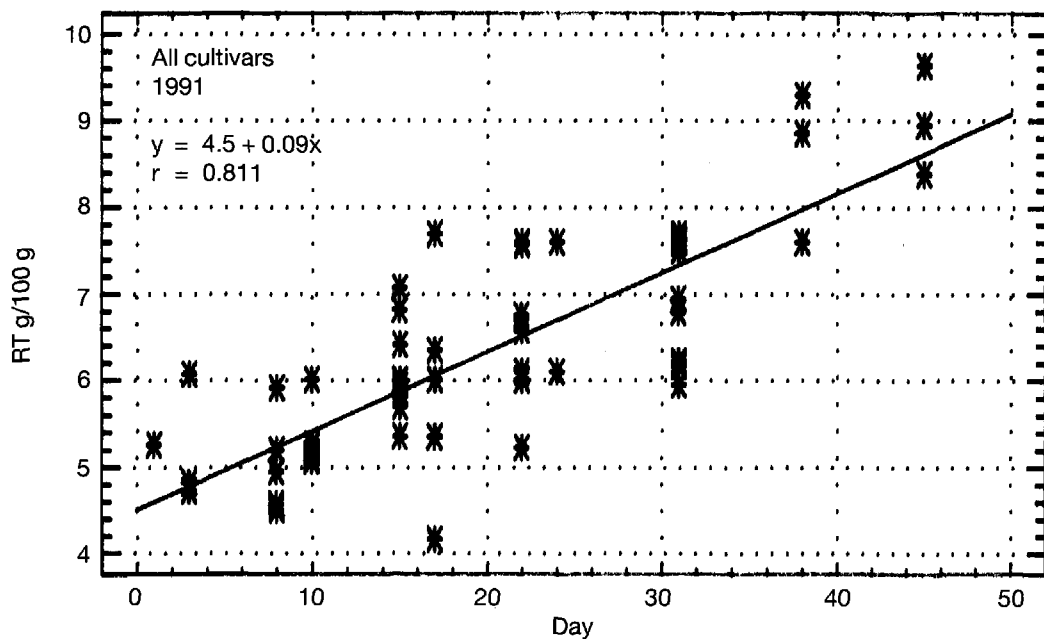


Figure 3. Soluble solids and titratable acid at different harvest times for 18 cultivars.
Opløseligt tørstof og titrerbar syre på forskellige høstidspunkter for 18 sorter.

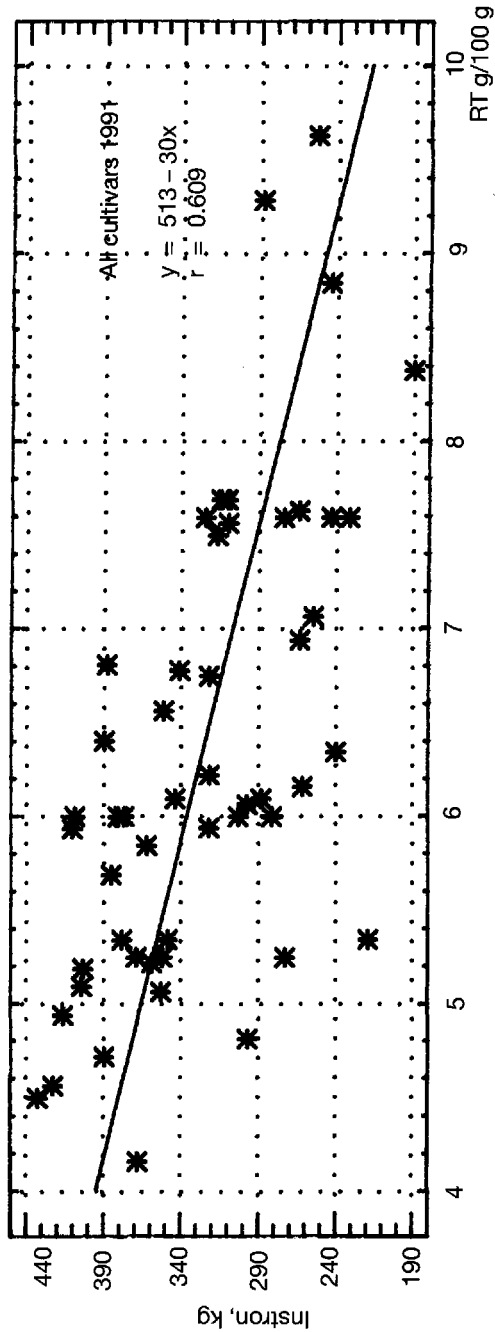
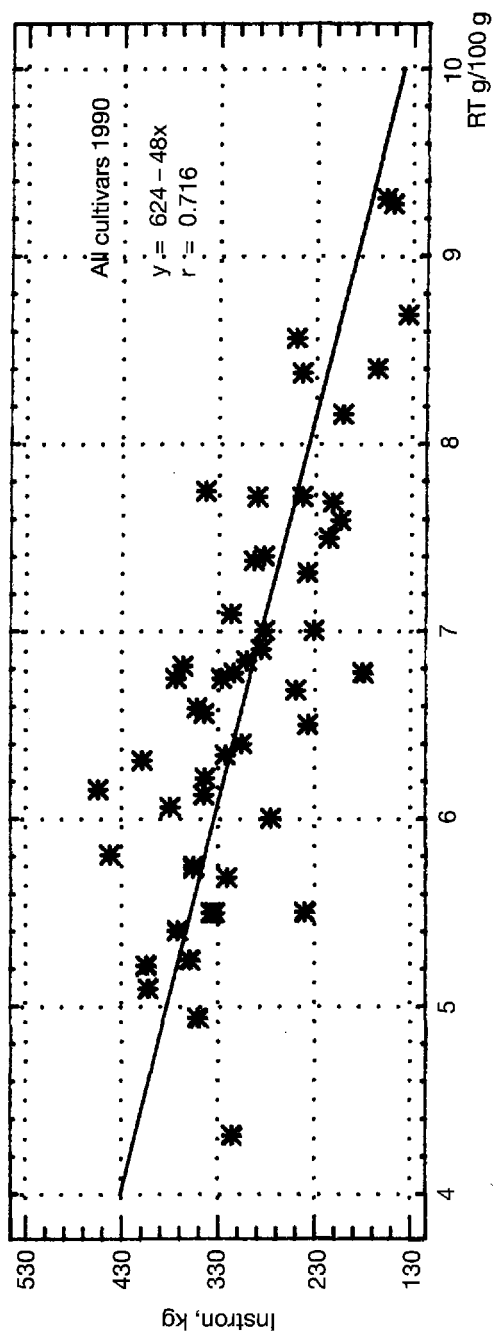


Figure 4. Relationship between Instron value and soluble solids in 1990 and 1991 for 18 cultivars harvested at 3 dates.
Sammenhæng mellem instronværdier og opløseligt tørstof i 1990 og 1991 hos 18 sorter høstet på 3 tidspunkter.

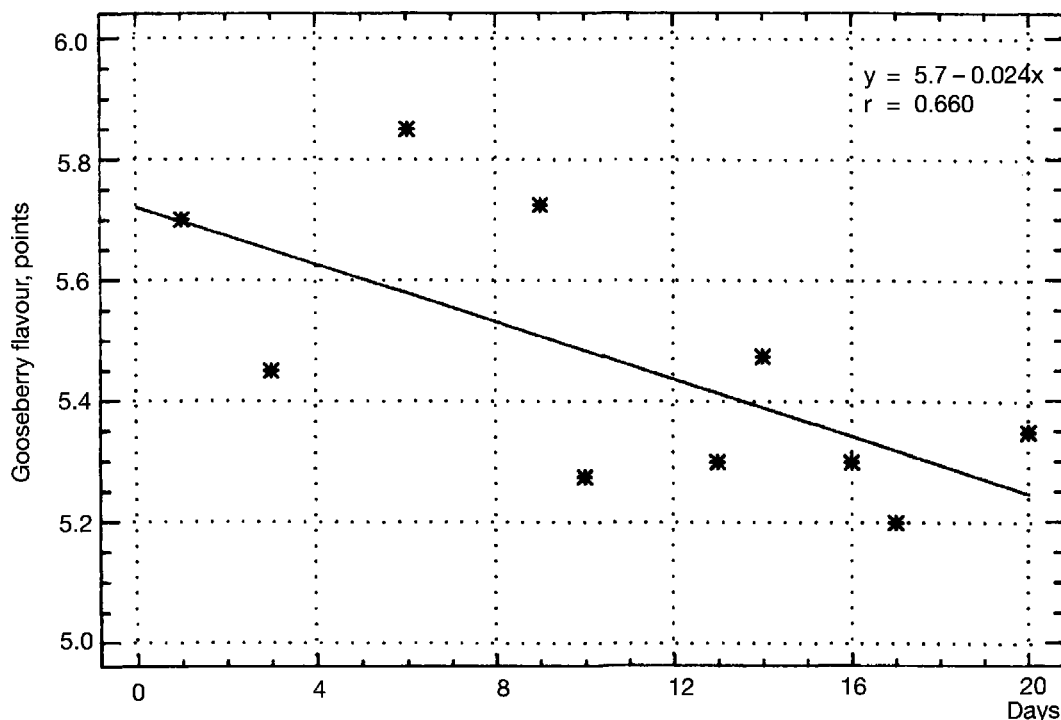


Figure 5. Gooseberry flavour and harvest time.
Stikkelsbærsmag og høsttid.

15 and 25 of June were the first days of harvest of the earliest cultivar 'Invicta' in 1990 and 1991 respectively.

For all cultivars the firmness of the berries decreased linearly with time as shown in figure 1 for the cultivar 'May Duke'.

By use of the regression coefficient the average rate of change in firmness in the 2 years for all cultivars was calculated to 7.2/day. This means that the firmness decreases by about 50 units per week.

A firmness of 300 kg was taken as proper maturity of gooseberries for processing of jam, jelly and whole canned or stewed gooseberries. Therefore the number of days from the first day of harvest to a firmness of 300 kg was calculated by use of the following equation where a is the intercept and k the regression coefficient.

$$\text{day} = a - k \cdot 300 \quad 1)$$

The values of a and k were found by linear regression. From figure 1 it appears that the number of days in 1991 for 'May Duke' to obtain a firmness of 300 kg was 17.

Figure 2 shows the correlation between number of days in 1990 and 1991 for all cultivars to reach firmness of 300 kg. Table 2 shows the average number of days to reach a firmness of 300 kg.

Figure 3 shows that the content of soluble solids and titratable acid increases during ripening. The firmness decreases as shown in figure 4 with increasing content of soluble solids.

Table 3 shows that during ripening the colour of the seeds changes from yellow to brown.

8 trained panellists evaluated the jam processed from 4 cultivars, for 2 years. Figure 5 shows that the gooseberry flavour decreases with time from the first to the latest harvest.

Table 2. Average number of days in 2 years from the first harvest of the earliest cultivar 'Invicta' to harvest of each cultivar with a firmness of 300 kg.

Gennemsnitligt antal dage for 2 år fra første høst af den tidligste sort 'Invicta' til høst af bær af hver sort med en fasthed på 300 kg.

Cultivar Sort	Days Dage
'Invicta'	1
'Greenfinch'	3
'Hönings Früheste'	5
'Grüne Kügel'	16
'May Duke'	16
'Nr 3098'	19
'Winhams Industry'	22
'Alice Marie'	23
'Weisse Triumph'	23
'Whitesmith'	23
'Pixwell'	25
'Rote Orleans'	25
'Green Willow'	26
'Careless'	29
'Achilles'	31
'London'	33
'White Lion'	33
'Spine Free'	34

Discussion

A content of soluble solids of 5 to 10% and of titratable acid of 15–30 g/kg found in this experiment is of the same order as found earlier (3, 6, 7).

During ripening of other fruits such as cherries and elderberries the content of soluble solids which is mainly sugar increases (4, 5). In goose-

berries the content of soluble solids increases during ripening as shown in figure 3. According to *Batunina* (1) gooseberries are rich in sucrose, glucose and fructose and the content of soluble solids increases during ripening.

The contents of malic and citric acids in gooseberries increases during ripening and the content of cations decreases (2). These combined changes in the concentration of acids and counterions can explain that the content of titratable acid increases during ripening as shown in figure 3.

During ripening of gooseberries the firmness decreases linearly with time (Fig. 1). The number of days in 1990 and 1991 to obtain a certain firmness (300 kg) was very strongly correlated (Fig. 2). This means that the order of ripening of the cultivars can be expected to be similar from year to year.

The average rate of change in firmness was calculated to 7.2 kg per day or about 50 units weekly. From early measurement each year an estimation of the time of harvest should be possible with fairly good results. Compensation for the differences between cultivars and the effect of microclimate is possible by more measurements close to a certain firmness value as for example 300 kg. By increasing maturity or later harvest a small decrease in gooseberry flavour is obtained as shown in figure 5.

The change in seed colour from yellow to brown during maturation can be of practical value for the growers as a first estimation of maturity.

'Invicta', 'Greenfinch' and 'Hönings Früheste' are early cultivars while 'London', 'White Lion' and 'Spine Free' are late cultivars. The difference in harvest time for the early and late cultivars was one month. These differences in harvest time can be used in planning of harvesting with the aim of optimizing the use of harvesting machines and the processing equipment.

Table 3. Seed colour (1 = yellow, 3 = brown) of 18 cultivars in 1990.

Gennemsnitlig kernefarve (1 = gul, 3 = brown) for 18 sorter i 1990.

Harvest Høst	Point Punt
1	1.0
2	1.3
3	1.7
LSD	0.3

Conclusion

The optimum harvest time for gooseberries can be determined by use of an Instron apparatus equipped with an 'Ottawa' cell. The firmness decreases linearly with time during ripening but the contents of soluble solids and titratable acid decreases.

From early determinations of the firmness it is

possible to estimate the harvest time which can be found more exactly by measurement of firmness close to the optimum firmness.

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