Tomato Fruit Quality,
Pre and Post harvest Factors

HDC Pc5/C/88/0021/2

CONTENTS

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TOMATO FRUIT QUALITY, PRE AND POST HARVEST FACTORS

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Abstract

Investigations into various aspects of tomato fruit quality were continued at the same four sites in 1988. Assessments of product life, chemical composition, and physical disorders were made, and the effect of a wide range of factors on the fruit quality assessed in this way, was studied. Where possible the indications from results over the two years 1987 and 1988, are discussed.

The main results were:

a) Variety trials

Trials of new varieties were monitored at Efford and Stockbridge House. As in 1987 the trial at Stockbridge was grown in soil as well as rockwool. In addition varietal response to other factors were studied. Details of quality characteristics of 14 varieties are given.

Fruit quality was again better on the soil crop, compared with rockwool, but the difference was much smaller in 1988 than in 1987. Levels of fine net cracking and goldspot were higher on rockwool than in soil. No differences in firmness were detected in 1988 between soil and rockwool grown fruit.

b) Temperature regimes

Fruit grown at blueprint temperatures was firmer than fruit from the Dutch regime, and there was no evidence of better product life from the Dutch temperatures. Fruit shape was unaffected by temperature, but disorders such as red noses and radial and net cracking were affected. There were varietal differences in the responses, and the change in temperature from one regime to the other also had a significant effect.

Calypso suffered particularly from netting, radial cracking and red noses, under the Dutch regime. In contrast Counter suffered less from red noses under the Dutch regime.

c) Humidity and nutrition

Low humidity by day and night gave the best product life but not the best chemical composition. Product life and composition were improved by increased conductivity. Higher EC reduced boxiness and netting. High calcium reduced fine net cracking but increased goldspot.

d) CO_2, substrates and nutrition

Some preliminary investigations of CO_2 effects are described. Fruit grown on perlite was less firm with lower acidity than rockwool. Low conductivity levels to control growth gave poorer shape and more uneven ripening.

e) Effect of salinity on cherry tomatoes

Higher EC improved flavour, but there was some yield loss at 8 mS due to smaller fruit. Increased salinity did not give firmer fruit, but it gave some protection against softening after mechanical stress. Conditioning to simulate handling damage doubled the rate of ethylene production and reduced product life.

f) Goldspot and fine net cracking

Reviews are included of the latest information and results on these two disorders. A trial at Luddington was not able to prove conclusively that goldspot reduces product life. Goldspot is still frequently associated with skin cracking and the effects of these two factors on product life need to be distinguished.

At Efford, goldspot did reduce product life, but was also associated with both radial and fine net cracking.

g) Firmness testing

Results are presented to confirm that firmness testing cannot be satisfactorily repeated on the same fruit. Separate samples must be used for successive measurements during a trial.

The full report gives detailed figures for 14 parameters in 57 tables.

Objective

To investigate the effect of a range of pre and post harvest factors on the final quality of tomato fruits. To develop clear guidelines on techniques for improving fruit quality through to point of sale. To examine all quality aspects of new tomato varieties.

Introduction

Fruit quality needs now to be assessed, not only in terms of visual characteristics but to also include composition, firmness and shelf life characteristics.

Results from the HDC trials in 1987 produced many indications that these quality parameters were certainly influenced by a wide range of cultural and post harvest management practices.

Temperature, cultivar, humidity, nutrition and handling were all shown to play a role on one or more characteristics. The trials in 1988 were designed to look more specifically at selected factors and to further elucidate the interactions between factors.

Materials and Methods

Using results from 1987 trials, the fruit from ADAS and IHR sites were assessed in 1988 for those quality parameters which gave the most relevant results in 1987. Parameters were selected from the following list:

i) Product life (colour, weight changes, firmness)

ii) Composition (soluble solids, acidity, dry matter and sugar analysis)

iii) Physical characteristics - these were modified slightly from 1987 to include the following:

- boxiness
- slabsidedness
- ribbing
- radial cracking
- fine net cracking
- red noses
- goldspot.

Unless otherwise stated, standardised techniques were adopted at all sites for these assessments. Full details may be found in Appendix I.

Fruit assessed

Fruit from the following ADAS trials were assessed:

1. Efford EHS

1. P-Block, Heated Variety Trial
2. F-Block, Temperature regimes and Variety Trial (HDC-funded Project PC/2)
3. M-Block, Humidity and Nutrition Trial
4. Assessment of goldspot and shelf life.

2. Stockbridge House EHS

1. Environments and CO_2
2. Substrates and nutrition
3. Heated Variety Trial.

The following trials were also undertaken:

IHR - Littlehampton

1. The effect of three levels of salinity on the fruit quality of cherry tomatoes, using NFT.

Luddington EHS

1. The effect of goldspot on the shelf life of tomatoes

2. An assessment of the fruit firmness tester.

Acknowledgements

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1. Efford EHS

1.1 P-Block Variety Trial 1987/88

Treatments:

Variety	Seed House	Resistance
Calypso	ZwR	TM C5 F2 V Wi
Compacto	Pi/VdB	TM C5 F2 V Wi
Counter	"	TM C5 F2 V Wi
Criterium	"	TM C5 F2 V Wi
LM 25	MOS	TM C5 F2 V Wi N
W 704	Pi/VdB	TM C5 F2 V Wi N
E.17.902 (Blizzard)	ENZ	TM C5 F2 V Wi
E.17.945 (Cyclon)	ENZ	TM C5 F2 V Wi
RS 85042 (Favorset)	RS	TM C5 F2 V Wi N
RS 86006	RS	TM C5 F2 V Wi
W 1138 (Liberto)	Pi/VdB	TM C5 F2 V Wi N
669	ZwR	TM C5 F2 V Wi
663 (Rapide)	ZwR	TM C5 F2 V Wi

Abbreviations:
ZwR - Rijk Zwaan
Pi/VdB - Pinetree Vandenberg
MOS - Leen de Mos
ENZ - ENZA
RS - Royal Sluis

Culture:

Sown: 12 November 1987

Planted: at first anthesis: 4-7 January

Substrate: Rockwool

Temperature: Blueprint

Quality Assessment:

Product life: Week 17 and 33

Physical appearance: Week 16, 27 and 32

Table 1:1 Product life and composition of tomato varieties. Mean of assessments in weeks 17 and 33

Variety	Firmness mm compression (after 8 days)	Inedibility (no. out of 5)	% fruit weight after storage (8 days)	% dry matter	% soluble solids	Titratable acidity mEq/100 ml sap
Counter (Control)	3.42	1.50	95.57	5.64	4.87	5.10
Calypso	3.11	1.25	95.77	5.96	5.07	7.15
Compacto	3.17	1.13	95.15	5.59	4.83	5.80
Criterium	3.04	1.92	95.33	5.56	4.94	5.60
LM 25	3.43	2.46	94.83	5.72	4.95	6.40
W 704	3.03	1.63	95.65	5.53	4.86	5.75
E.17.902	3.28	1.38	96.31	5.77	5.03	5.95
E.17.945	3.03	2.63	95.54	5.98	5.19	7.15
RS 85042	3.17	1.13	95.41	5.47	4.66	5.95
RS 86006	3.63	3.31	94.09	5.57	4.85	5.40
W 1138	3.22	1.25	95.43	5.46	4.76	5.40
669	3.12	1.63	94.98	5.71	4.97	6.30
663	3.07	1.75	94.90	5.95	5.23	6.15
Mean	3.21	1.76	95.30	5.69	4.94	6.01

Table 1:2 Physical characteristics of tomato varieties (scored 0-4, where 0 = excellent, none present). Mean of assessments in weeks 16, 27 and 32

Variety	Boxiness 1)	Slabsidedness 2)	Ribbing	Red noses 3)	Radial cracking	Fine net cracking	Goldspots
Counter (Control)	0	0.22	0.70	1.08	0.78	0.45	2.15
Calypso	0.03	0.15	0.55	0.78	0.58	0.48	1.38
Compacto	0.05	0.18	0.58	0.97	1.07	0.93	1.70
Criterium	0.05	0.22	1.18	0.88	0.95	1.02	1.47
LM 25	0.02	0.25	0.43	0.85	0.40	0.68	2.18
W 704	0.05	0.30	0.48	0.53	1.00	0.63	1.23
E.17.902	0	0.10	0.53	1.30	0.53	0.47	1.65
E.17.945	0	0.40	0.78	0.73	0.85	0.82	1.38
RS 85042	0	0.05	0.63	1.02	0.70	0.78	1.88
RS 86006	0.03	0.23	0.78	1.10	1.10	0.95	1.25
W 1138	0.05	0.25	0.55	0.58	0.93	0.47	2.05
669	0.05	0.03	0.67	1.05	1.15	0.95	1.53
663	0	0.52	0.63	1.43	1.00	0.82	1.67
Mean	0.03	0.22	0.66	0.95	0.85	0.73	1.66

1) and 2) See Appendix I.3 for explanation of characteristics

3) Red noses is distinct from general uneven ripening recorded in 1987.

Results

An overall summary of varietal performance is given in Tables 1:1 and 1:2. These represent the meaned results of several assessments. Full data analysis is tabulated in Appendix II.

Individual variety performances were as follows:

Counter (The control variety used as comparison)

Counter is not a particularly firm fruit when compared to other varieties in the 1987/88 trial. In the first assessment, week 17, Counter was close to the average, but later in the season, week 33, it was one of the softest varieties, only exceeded by RS 86006. This difference between early and late firmness was also evident in Criterium.

If firmness data and percentage weight loss (expressed as a percentage of the original fresh weight) are compared, Counter gives a very similar pattern for both parameters. Weight loss is low in the early assessment but high in the later one.

For dry matter content, Counter is similar to the trial average. Counter is also average on sugar content (% soluble solids), but pH levels were high, which means that Counter lacks acid content. This suggests that the flavour may not be very good.

The edibility test is a very subjective test and the data should be interpreted with caution. However, the results do indicate a pattern. Counter had a very good shelf life in week 17 compared to other varieties. In week 33 it fared less well. This does confirm the results from the firmness test and the fruit weight data. Note that the assessments in week 17 were done after 13 days, while week 33 was after 9 days. Direct comparison between week 17 and 33 is therefore difficult.

Counter did not show any boxiness (hollow fruits), although slabsidedness was about average. Counter suffered slightly from ribbing, especially early in the season. Levels of red noses were fairly high, although not the worst in the trial.

Counter had a very good skin finish early in the season, later netting and radial cracking did develop, but generally Counter was not badly affected, and netting seemed to be less of a problem than radial cracking.

Counter suffered one of the highest levels of goldspot throughout the season.

Calypso

Calypso fruit were firmer than Counter. In the spring when most varieties were firm, Calypso was only average, but in the autumn when most varieties lost their firmness, Calypso did not. Calypso therefore looks promising with respect to fruit firmness. The fruit retained their weight well during shelf life. Dry matter content was high particularly in week 33. Sugar content was satisfactory, higher than Counter later in the season. pH was low, which means that Calypso is high in acidity and, together with high sugar, that should give a good overall taste. Shelf life characteristics were therefore very satisfactory.

A low level of boxy fruits were found early in the season (week 16) and Calypso suffered from slabsided fruits, although levels were still below average. Calypso showed less radial cracking than Counter, and overall levels of fine net cracking were similar.

Some red noses, ribbing and goldspots occurred, but for these disorders Calypso was close to the trial average and levels were lower than for Counter.

Calypso appears to be a very consistent variety producing moderate to good quality fruit throughout the season. In contrast to some other varieties quality did not peak and trough. Calypso was therefore very promising with respect to fruit quality at harvest and throughout shelf life.

Compacto

The fruit from Compacto were slightly firmer than Counter and average for the trial. Weight loss was high, particularly in week 33, and firmness and edibility assessments confirm the poorer shelf life of these fruit. Shelf life quality earlier in the season was much better.

Soluble solids (sugars) were average. Acidity levels were slightly better than for Counter, but still not as good as in some other varieties.

Compacto suffered boxy (hollow) fruits in the spring, but shape during the rest of the season was quite good. Levels of slabsided fruit were average. Compacto suffered badly from red noses in the summer (week 27), although fruit were quite good earlier and later in the season (weeks 16 and 32).

The problems with weight loss and firmness related to the skin finish. Radial cracking was higher than Counter in week 16, and was well above average at later assessments. Netting was also a problem later in the season.

Criterium

Criterium was the firmest variety in the trial early in the season. In contrast, however, by week 33 it was softer than average. This wide variation was even greater than that of Counter.

Criterium was free from radial cracking early in the season but developed high levels later on. Fine net cracking was moderately high throughout the season, although particularly bad early and late. The high levels of radial cracking and netting in week 32 may well explain the poor fruit firmness at this time.

Despite the problems with netting and radial cracking, the weight loss during shelf life was not excessive and close to average for the trial. Edibility was not badly affected either.

Internal quality was moderate to poor. Sugar and acidity levels were average in week 17. In week 33 sugar levels were fairly high and acidity low, a poor combination for good fruit flavour.

Dry matter percentage was low in week 17, but slightly improved in week 33.

The shape of Criterium apart from ribbing was very good in main season, although some slabsidedness was present in weeks 16 and 32. Boxiness (hollow fruits) were found in week 16.

Criterium is well known for its ribbing. As in 1986/87 higher levels of ribbing than any of the other varieties throughout the season were again recorded in this trial.

Criterium showed average levels of red noses, but with less of a peak in week 27 than seen for some other varieties. Level of goldspot was slightly less than average.

LM 25

In terms of firmness LM 25 was similar to Counter in being rather soft. During shelf life most varieties lost least weight in the spring assessment and most in autumn. However, LM 25 lost as much in week 17 as in week 33. Weight loss in week 17 was therefore higher than any other variety. As might be expected, this produced a high incidence of inedible fruits in week 17.

Dry matter and percentage soluble solids (sugar) content were average, as were acidity levels over the whole season. Acidity levels were actually much better than for Counter in week 17.

Fruit from LM 25 were slightly boxy earlier on and showed some slabsidedness. Over the whole season levels were slightly higher than average.

LM 25 had less ribbing and radial cracking than any other variety in the trial. When the other varieties were badly affected by radial cracking in the autumn assessment, LM 25 was not. Netting, however, was relatively high in week 33, but over the whole season it was just below average.

LM 25 showed some red noses, but less than Counter. LM 25 along with Counter had the highest incidence of Goldspot.

W 704

W 704 produced good firmness results and also kept its weight well during storage. Fruit were slightly low on dry matter content. Levels of soluble solids were average (similar to Counter), as was acidity.

Overall shelf life quality was only moderate in week 17 although improved in week 33.

In terms of shape, W 704 did develop some boxiness early in the season and showed higher than average levels of slabsidedness in week 32.

W 704 showed very little red noses in weeks 16 and 32 but, together with some other varieties, had a high incidence in week 27. Overall the average for the season for W 704 was the lowest in the trial. Levels of ribbing were low. Radial cracking was fairly high in weeks 27 and 32, although netting was at an average level.

W 704 had very few goldspots in weeks 16 and 27, although levels had risen by week 32.

E.17.902 (Blizzard)

A moderately firm fruit that keeps its weight very well indeed during shelf life. E.17.902 lost less weight than any of the other varieties, especially in week 33, where other varieties had problems. As a result numbers of inedible fruit at the end of shelf life were quite good.

E.17.902 had medium levels of acidity, and dry matter and sugar content were high in week 33. The fruit shape was very good. No boxiness in the spring, and only very little slabsidedness.

Only red noses caused E.17.902 problems. High levels developed, especially in week 27.

Radial cracking and netting were very low throughout the season. This undoubtedly contributed to the good shelf life.

E.17.945 (Cyclon)

The product life and the internal composition of E.17.945 was good. It showed a very good firmness, weight loss during shelf life was slightly below average, and it had a high dry matter, sugar and acidity content, which should contribute to a good flavour. Although the number of inedible fruits in week 17 was high. E.17.945 generally had a good product life.

It was therefore disappointing to note some problems in the physical appearance. E.17.945 showed no boxiness, but slabsidedness was high, especially in weeks 16 and 32. The fruits were also affected by ribbing. Levels of netting were constant throughout the season. This means that, compared to other varieties, levels were relatively high in spring and relatively moderate in autumn. Radial cracking was at an average level.

E.17.945 had slightly less goldspots than the trial average.

RS 85042 (Favorset)

Most varieties lost more weight during shelf life in the autumn than in the spring. RS 85042 was the complete reverse and lost most in week 17, although the overall figure was slightly below average. Dry matter content was also low in week 17, firmness was average but edibility good at the end of shelf life.

The chemical composition of RS 85042 had a low percentage soluble solids (sugar) but was of average acidity.

The fruit shape was very good with no boxy fruits, no slabsidedness in weeks 16 and 27 and only a low incidence in week 32.

There were no red noses and no radial cracking in week 16. During the rest of the season these characteristics were just above average, while netting was average.

The level of goldspots was fairly high.

RS 86006

RS 86006 fruits lost a lot of weight during shelf life, the weight loss was especially high in week 33 at 6.9 per cent. RS 86006 also produced the softest fruits. The firmness and weight loss also affected the shelf life with poor edibility assessments after. Dry matter content, % soluble solids and acidity were similar to Counter, and just below average for the trial.

The high incidence of both radial cracking and netting might also have been contributory to the poor shelf life. Levels of netting were particularly high in week 32.

RS 86006 suffered higher than average levels of red noses, (similar to Counter). Fruit shape was affected on average level by boxiness and slabsidedness. Ribbing was above average although RS 86006 was relatively low on goldspots all season.

W 1138 ('Liberto')

A variety with good firmness and shelf life and slightly above average fruit weight after storage (i.e. below average weight loss). The dry matter content was lower than for Counter. The percentage soluble solids (sugar) and acidity were below average.

A few fruits were boxy early in the season and slabsidedness was at a relatively high level in week 32 compared to some other varieties. W 1138 did not develop much red noses even in week 32 when levels were generally high.

The incidence of radial cracking was fairly high but levels of fine net cracking were similar to Counter and quite low. W 1138 had a fairly high level of goldspot.

669

669 was a fairly firm variety and shelf life (edibility) was also good despite relatively high weight loss in week 33. The dry matter content and soluble solids were of an average level, whilst acidity was better than average.

The fruit shape was good. 669 had some boxy fruits in week 17, but virtually no slabsided fruits were found in any of the three assessments.

Levels of red noses were average for the trial.

The level of radial cracking on 669 was the highest of all varieties. Fine net cracking was similarly extensive. The skin cracks must have contributed to the high weight loss in week 33, although 669 still managed to retain reasonable firmness and shelf life.

663 (Rapide)

Another firm variety, especially in week 17. In week 33 weight loss during shelf life was higher and firmness impaired although edibility assessment was still at an average level.

663 had a high dry matter content and a high % soluble solids. Acidity levels were better than average.

No boxiness (hollow fruits) were found from this variety. However, levels of slabsidedness were the highest in the trial, particularly in weeks 27 and 32. Red noses were also a problem and levels again the highest in the trial. Levels of ribbing and goldspots were low, especially early in the season.

Discussion: 1987/88 compared to 1986/87 results

Detailed variety shelf life assessments for certain varieties are now available from two years of work and the following conclusions may be drawn.

Counter: In both 1987 and 1988 Counter lacked fruit firmness and a poor balance of internal constituents. However overall shelf life was satisfactory and skin finish generally good, particularly in the early part of the season.

Red noses were a problem on fruit during the mid summer of 1988 and uneven ripening (of the whole fruit, not just the 'nose') a problem in late 1987.

Calypso: Generally 1987 and 1988 results confirmed that Calypso has low levels of boxiness, radial cracking, uneven ripening and goldspot characteristics. Internal composition is also good. In 1987 fruit were less firm than average whilst results in 1988 were quite satisfactory.

Criterium: Characterised by ribbing, low acidity levels and high levels of fine net cracking. Firmness assessed showed considerable variation in 1988, although 1987 assessments indicated fruit were very firm.

W 704: In both years fruit are confirmed as very firm although boxiness appears to be a problem early on and slabsidedness a problem later in the season. Levels of radial cracking were also higher than average in both seasons.

W 704 has therefore both positive and negative characteristics and does seem to lack consistency throughout the season.

663 (Rapide): This variety had reasonable firmness and shelf life in both seasons. Fruit composition was quite good. Uneven ripening was a problem in both years. Slabsidedness was evident in 1988, but no particular shape problem was recorded in 1987. Netting and radial cracking were above the average in both seasons.

Summary

Although broad conclusions can be drawn from the two years of results now available they serve to illustrate the variation, not only between varieties, but also within a single variety throughout the season. A characteristic such as radial cracking may be present at very low levels early in the season but may suddenly become a major problem as climatic conditions change.

Results from the 1987/88 trial indicate that the varieties with the best shape were 669, RS 85042 and E.17.902. When averaged over the whole season, least red noses developed on W 1138 and W 704. LM 25, E.17.902 and Calypso had least radial cracking during the season, and Calypso, Counter, E.17.902 and W 1138 had least fine net cracking. Calypso and E.17.902 are therefore varieties with the best skin finish. W 704 and RS 86006 had fewest goldspots, but for W 704 this was very unevenly spread during the season.

Many varieties had equally firm fruits. When combining the spring and the autumn assessments RS 86006, Counter and LM 25 gave the softest fruits. RS 86006 also had the greatest weight loss during shelf life, while E.17.902 lost least weight.

In terms of chemical composition Calypso, E.17.945 and 663 had the highest dry matter and sugar content. Calypso and E.17.945 also had the highest levels of acidity. This gives them the best levels of overall composition.

1.2 F-Block temperature regimes x variety trial

1.2.1. Temperature treatments

The temperature regimes were the ADAS blueprint and the Dutch regime. Two intermediate regimes were also examined starting with Dutch or Blueprint at the beginning of the season and changing to the alternative on 18 April (wk 16). This then gave the four following temperature treatments: Blueprint/Blueprint, Blueprint/Dutch, Dutch/Blueprint and Dutch/Dutch.

The applied temperatures were:

Blueprint	Night °C	Day °C	Night vent °C	Day vent °C
Standing out (9 Dec) to first anthesis (Stage 2)	16	18	25	24
1st anthesis (4 Jan) to start of pick (Stage 3)	16	20	25	24 + 2*
Weekly reduction	16	19.5	25	25
from start of pick (25 Feb)	16	19.0	25	24
	16	18.5	25	23
	16	18.0	25	22
To end of crop	16	18	25**	21

Notes:

* Additional two degrees dependent on light levels,
e.g. 24°C at 0 mW cm^{-2}
26°C at 20 mW cm^{-2}
until 19 January then straight 26°C

** From August a minimum night ventilation setting of 3 per cent was given. No minimum pipe temperatures were used.

Dutch	Night °C	Day °C	Night vent °C	Day vent °C
Standing out (9 Dec)	18	18	20	19
16 Dec to 4/5 truss in flower	17.5	18	20	19
4/5 truss in flower (12 Feb) to end of crop	17	17.5	20	18

Notes:

1. Minimum pipe temperature 40°C night
   50 to 40°C (50 at 0 mW cm^{-2})
   (40 at 20 mW cm^{-2})
   until 2 June then range reduced to 40-35°C
2. Minimum night ventilation of 3 per cent from August

1.2.2. Varieties: Calypso, Counter and Criterium

(See also: HDC Report C88/0540: 'Temperature regimes for long-season tomatoes' 1987/8. (Project PC/2) by Mike Leatherland, Efford EHS)

Fruit quality assessments:

Product life: Week 13, 21 and 27

Physical disorders: Week 12, 15, 20, 25 and 34

Results

1.2.1. **Temperature regimes**

Summarised results of the whole seasons performance are listed in Tables 1:3 to 1:6. Full analysis may be found in Appendix II.

Product life

The fruit from the Blueprint regime was firmer than from the Dutch regime (significant in week 13). There was also a trend towards less weight loss for the Blueprint regime fruits in the summer assessment. This coincided with the number of inedible fruits found, although differences are not statistically significant. Internal qualities such as per cent dry matter and per cent soluble solids were poorer for Blueprint regime fruits, although the acidity levels were not affected by temperature.

Physical disorders

The fruit shape, assessed as boxiness, slabsidedness and ribbing was not affected by temperature regimes.

The severity of red noses was affected by the temperature regimes particularly in wks 20 and 25. In the early season when the overall incidence was low, the Blueprint was slightly better than the Dutch regime, but in week 25, when the red nose problem was at its highest, the Dutch regime fared better than the Blueprint. However, this was only true for the Dutch/Dutch regime. The Dutch regime changing to Blueprint in April was significantly worse than the Blueprint/Blueprint ($P = 0.01$). There was also a significant interaction between temperature and variety, and this is discussed under varieties on p.25.

Levels of skin cracks, both radial and net cracking, were increased in the Dutch temperature regime. The week 20 sample showed a considerable rise in both netting and radial cracking for the temperature regime which changed in wk 16 from Dutch to Blueprint. Apart from this the early temperature regime had the greatest effect on skin cracks. The number of goldspots was not affected by the temperature regime.

Table 1:3 Product life and composition of temperature and variety treatments. Mean of seasons assessments (weeks 13, 21 and 27)

Treatments	Firmness mm compression (after 8 days)	Inedibility (no. out of 5)	% fruit weight	% dry matter	% soluble solids	Titratable acidity mEq/100 ml sap
Mean of temperature regimes						
Blueprint/Blueprint	3.18	3.06	94.56	5.41	4.53	5.9
Blueprint/Dutch	3.30	3.50	94.35	5.50	4.57	6.0
Dutch/Blueprint	3.33	3.47	94.24	5.42	4.61	5.9
Dutch/Dutch	3.35	3.22	93.77	5.52	4.62	5.9
Mean of varieties						
Calypso	3.45	4.02	93.76	5.64	4.76	6.7
Counter	3.34	3.25	94.86	5.43	4.49	5.8
Criterium	3.08	3.17	94.08	5.31	4.49	5.5

Table 1:4 Physical characteristics of temperature and variety treatments (scored 0-4, where 0 = excellent). Mean of seasons assessments (weeks 12, 15, 20, 25 and 34)

Treatments	Box-iness	Slabsided-ness	Ribbing	Red noses	Radial cracking	Fine net cracking	Goldspot
Mean of temperature regimes							
Blueprint/Blueprint	0.07	0.26	0.88	0.58	0.57	0.72	1.39
Blueprint/Dutch	0.10	0.25	1.07	0.41	0.66	0.83	1.46
Dutch/Blueprint	0.14	0.39	1.20	0.76	0.83	1.26	1.64
Dutch/Dutch	0.11	0.23	1.16	0.44	0.81	1.14	1.16
Mean of varieties							
Calypso	0.03	0.16	0.78	0.49	0.78	1.24	1.04
Counter	0.07	0.34	0.97	0.85	0.60	0.70	1.70
Criterium	0.21	0.35	1.49	0.31	0.77	1.03	1.51

Table 1:5 Product life and composition of treatments. Mean of seasons assessments (weeks 13, 21 and 27)

Treatments		Firmness mm compression (after 8 days)	Inedibility (no. out of 5)	% fruit weight	% dry matter	% soluble solids	%Titratable acidity mEq/100 ml sap
Bluep/Bluep	Calyp	3.25	3.67	94.27	5.55	4.70	6.9
	Count	3.21	2.83	95.16	5.45	4.48	5.8
	Crite	3.08	2.67	94.26	5.22	4.40	5.4
Bluep/Dutch	Calyp	3.48	4.00	93.82	5.73	4.76	6.9
	Count	3.45	3.33	94.76	5.50	4.48	5.8
	Crite	2.99	3.17	94.48	5.27	4.49	5.5
Dutch/Bluep	Calyp	3.55	3.90	93.78	5.55	4.74	6.5
	Count	3.29	3.50	94.86	5.35	4.53	5.8
	Crite	3.17	3.17	94.09	5.37	4.55	5.5
Dutch/Dutch	Calyp	3.52	4.50	93.15	5.75	4.84	6.4
	Count	3.42	3.33	94.66	5.42	4.49	5.4
	Crite	3.11	3.67	93.49	5.40	4.54	5.9

Table 1:6 Physical characteristics of temperature/variety treatments (scored 0-4, where 0 = excellent). Mean of seasons assessments (weeks 12, 15, 20, 25 and 34)

Treatment		Box-iness	Slabsided-ness	Ribbing	Red noses	Radial cracking	Fine net cracking	Goldspot
Bluep/Bluep	Calyp	0.02	0.12	0.54	0.36	0.47	0.73	1.04
	Count	0.04	0.20	0.84	0.97	0.68	0.84	1.76
	Crite	0.16	0.46	1.26	0.41	0.56	0.58	1.37
Bluep/Dutch	Calyp	0.00	0.11	0.84	0.43	0.70	0.98	1.07
	Count	0.12	0.27	0.92	0.67	0.63	0.66	1.66
	Crite	0.17	0.38	1.44	0.14	0.66	0.87	1.66
Dutch/Bluep	Calyp	0.06	0.26	0.86	0.60	0.99	1.79	1.17
	Count	0.07	0.55	1.08	1.25	0.55	0.62	1.98
	Crite	0.29	0.35	1.66	0.42	0.94	1.38	1.79
Dutch/Dutch	Calyp	0.04	0.14	0.88	0.58	0.98	1.47	0.88
	Count	0.06	0.33	1.02	0.49	0.53	0.68	1.40
	Crite	0.23	0.23	1.60	0.25	0.92	1.29	1.20

1.2.2. Varieties

Product life

Criterium was the firmest of the varieties. All three varieties lost least fruit weight during shelf life if grown in the Blueprint rather than Dutch regime, however, Counter was less affected by the regime than Calypso or Criterium.

The rate with which the fruits became inedible when kept in a shelf life room, was slightly higher for Calypso than for Counter and Criterium, but differences were not significant. The fruits from Calypso seemed especially poor (inedible after 14 days storage) when grown under the Dutch regime. Counter and Criterium also seemed to store better from the Blueprint/Blueprint regime.

Calypso had a significantly higher dry matter and soluble solids content than Counter and Criterium. Criterium had a higher level of soluble solids in the Blueprint regime than in the Dutch in week 21. Calypso had the highest level of acidity (= lowest pH) regardless of temperature regime.

Physical disorders

Criterium was boxier with more ribbed fruits, and together with Counter, more slabsided than Calypso. These shape characteristics were not significantly different, but Criterium tended to be poorest in the Blueprint and Counter to be poorest in the 'Dutch changing to Blueprint' regime.

There was also an interaction between the effects of temperature and variety on red noses. Looking at variety alone, Counter was worse affected by red noses in weeks 25 and 34 when the problem was greatest, compared to Calypso and Criterium.

It was also seen in the Efford Variety trial (Blueprint temperature), that Counter is prone to red noses. From the interaction between temperature and variety in weeks 20 and 25 it becomes clear that Counter gets much more red noses when grown under the BP regime than under the Dutch regime, and is more susceptible to the problem compared with any of the other varieties. Criterium behaved similarly to Counter in that it prefers the Dutch regime which reduces the degree of red noses from wk 16 onwards. Calypso, however, gets less red noses in the Blueprint regime.

The level of radial cracking was highest in weeks 20, 25 and 34, and Counter experienced low levels compared to Calypso and Criterium. Again Counter had less radial cracking when the temperature regime had either changed to Dutch or been Dutch all season, except for week 25. Calypso had twice the incidence of radial cracking if grown under the Dutch regime, particularly for the early part of the season. The continuous Blueprint regime was best for Calypso, in order to reduce radial cracking. Criterium reacted in a similar way to Calypso.

Calypso and Counter were shown to be resistant to fine net cracking in the Efford variety trial. In this temperature trial, Calypso showed overall a higher level of netting. Clearly Calypso suffers under the Dutch temperature regime throughout the year and as seen for radial cracking, the incidence of net cracking was doubled when grown in the Dutch regime compared to the Blueprint. Counter did not appear to be affected by the temperatures in the same way as Calypso and Criterium. Counter had the lowest incidence of fine net cracking of all the varieties, except when they were all grown under Blueprint regime when Counter was slightly worse than the other varieties.

Variety and not temperature had the dominating influence over goldspots. Levels were highest on Counter and lowest on Calypso.

Conclusion

The 1987/88 experiment confirmed the findings of 1986/87, where temperatures were found to have an important effect on the fruit quality. Furthermore it can be concluded from the 1987/88 trial, that individual varieties were strongly affected by the temperature regimes. Important disorders such as netting, radial cracking and red noses were increased for Calypso under the Dutch regime. These led to greater weight loss during shelf life and a loss of firmness.

Calypso and, to some extent Criterium, produce better fruit quality when grown in the Blueprint regime with relatively high day and low night temperatures, than when grown in the Dutch regime with relatively low day and high night temperatures.

Counter was not as affected by temperatures as the other two varieties but the Dutch regime did reduce the incidence of red noses with Counter. The Dutch regime also achieved the best internal quality.

Because of some varietal differences in response to temperature regime, it appears that the choice of temperature regime, needs to be carefully chosen to suit the variety if good fruit quality is to be maximised.

1.3 M-Block Humidity and nutrition

Treatments

Humidity Continuous high or low humidity (0.1 to 0.8 kPa vpd respectively) or diurnal changes in humidity (between 0.1 and 0.8 kPa vpd).

	Day	Night
High/High	0.1 (96)	0.1 (96)
High/Low	0.1 (96)	0.8 (66)
Low/High	0.8 (66)	0.1 (96)
Low/Low	0.8 (66)	0.8 (66)

'Day' was between 0.600 and 18.00, the remaining period 'night'.

Figures in brackets are % RH at 20°C.

Treatment period: 20 January to 2 March

Nutrition

Sub treatments

	EC (mS)	Ca (mg litre^{-1})
i.	5.0	150
ii.	5.0	300
iii.	7.0	150
iv.	7.0	300

EC levels in the slab

Calcium levels in applied feed.

Nutrition treatment applied in January and February.

Variety: Counter

Temperature regime: Blueprint Sowing date: 26 October

Fruit quality assessments:

Product life and composition weeks 11 + 15

Physical appearance weeks 11 + 14

Table 1:7 Product life and composition of meaned humidity and nutrition treatments. Assessments taken week 11

Treatment	Firmness mm compression	Inedibility (no. out of 5)	% dry matter	% soluble solids	Titratable acidity mEq/100 ml sap
Humidity regimes					
High/High	4.94	3.88	5.68	4.81	6.9
High/Low	4.63	3.44	5.42	4.66	6.9
Low/High	4.71	3.06	5.56	4.79	7.1
Low/Low	3.96	0.44	5.28	4.53	6.2
Nutrition Ec/Ca level					
5/150	4.65	3.00	5.44	4.68	6.9
5/300	4.69	3.19	5.38	4.66	6.5
7/150	4.41	2.19	5.56	4.73	6.7
7/300	4.51	2.44	5.56	4.73	6.9

Table 1:8 Physical characteristics of meaned humidity and nutrition treatments. Assessments taken week 11 (scored 0-4, where 0 = excellent)

Treatments	Boxiness	Slabsidedness	Blotchy ripening	Radial cracking	Fine net cracking	Goldspots
Humidity regimes						
High/High	1.09	0.58	0.01	0.01	0.70	0.69
High/Low	0.98	0.53	0.06	0	0.73	0.80
Low/High	0.90	0.43	0.03	0.05	0.60	0.61
Low/Low	1.00	0.26	0.01	0	0.46	0.43
Nutrition Ec/Ca level						
5/150	1.24	0.35	0.01	0.03	0.83	0.40
5/300	1.45	0.55	0.06	0.01	0.73	0.76
7/150	0.64	0.34	0.04	0.03	0.58	0.49
7/300	0.64	0.55	0	0	0.36	0.88

Results

Summarised results for week 11 are listed in Tables 1:7 and 1:8. Full analysis may be found in Appendix II.

Humidity

The fruits from the lowest humidity treatment were significantly firmer in week 11 (P = 0.001) and were edible for longer.

However, the percentage soluble solid and the dry matter content were significantly poorer from the low humidity treatment although acidity levels were not affected.

Physical characteristics were not greatly affected by humidity levels. Only the levels of goldspots and netting were significantly different (see Appendix II Table 34) and these only in week 14. The level of goldspots was higher in the treatments with high day humidity than those with low day humidity.

The amount of netting was significantly lower (P = 0.05) from the high/low and low/high than from low/low humidity in week 14 (see Table 34 Appendix II). This result should be regarded with caution, since it is only just significant, and because the humidity treatment had stopped 5 weeks prior to the assessment.

Nutrition

Sub treatments - EC and Calcium

The higher EC of 7 mS in the slab early in the life of the crop appeared to improve the product life of the early tomatoes. There was an increase in dry matter content, the fruits were slightly firmer and were edible for longer. There was also an indication that the percentage soluble solids increased with the higher EC (see Table 31 Appendix II).

The benefits of an EC of 7 mS were only seen in fruits picked in week 11 (14.3.88), and were not repeated in the fruits picked in week 15 (11.4.88). Because the EC treatments ended on 2 March, the fruits picked in April were only exposed to the treatments in their very early development stage.

There was an indication, however, that the dry matter content was reduced (in week 15) when calcium levels were increased, but this should not be given very much weight, as the significance was very small ($P = 0.05$).

Boxiness in the fruits picked in week 11 was significantly reduced by the higher EC of 7 mS ($P = 0.001$). The higher EC, together with the higher calcium level of 300 mg/litre, also reduced netting, while the increased Ca level significantly increased the number of goldspots for both EC levels, only in week 11.

In week 14 an inconsistent result was seen for goldspots. EC/Ca level of 7/150 had least goldspots and were of a level even lower than the 5/150 treatment. The Ec/Ca 7/300 level had the most goldspots. This result was highly significant, even though the nutrition treatment stopped 5 weeks prior to this assessment.

Discussion

The first fruits in the experiment were picked in week 7, but insufficient fruit was available for fruit quality assessments until week 11. The fruits sampled in week 11 were affected by the treatments, but the effect had diminished by the second assessment in week 14-15.

Conclusion

Fruits grown under low humidity conditions day and night, had the best product life, but not the best internal quality. The physical disorders were not affected by humidity, except that the number of goldspots seemed to increase with high day humidity treatments.

Increasing the conductivity from 5 mS to 7 mS improved the fruit product life and internal quality. The higher EC also reduced the severity of boxiness (hollow fruits) and of netting. Netting, however, was also affected by the calcium level, where high EC and calcium reduced fine net cracking. High calcium also increased the level of goldspots, possibly in interaction with high EC. These findings confirm those of the 1986/87, where product life was poorer from high humidity treatments. Similarly the response of boxiness, netting and goldspots to nutrition treatments were similar to those of the previous year.

1.4 Effect of goldspot on the shelf life of tomatoes

A trial was carried out at Efford EHS in August 1988 to determine whether goldspot affected shelf life. The background to this problem and the results obtained are discussed further at 4.1 and 5.1 in this report.

In the Efford trial, fruit was taken from ten different experimental plots in M Block, which had all received the same treatments. Within each plot, fruit were selected with either a) no visible goldspot symptoms or b) severe goldspot symptoms (G). These are identified in Table 1:9 as Plot 1 and Plot 1G etc.

The twenty samples of fruit were then stored for shelf life and other testing in the standard way as set out in Appendix I.

The results shown in Table 1:9 indicate the following:

a) Product life was reduced in the fruit with severe goldspot. The firmness and weight loss were significantly reduced, and the percentage uneatable show trends for higher values.

b) Fruit showing severe goldspot also had higher levels of cracking. The level of radial cracking was significantly higher and the amount of netting showed a similar but not significant trend. The reduction in product life may therefore be due to this higher level of cracking which is well known to increase weight loss, rather than to the goldspot itself.

c) There were no effects of goldspot on chemical composition (percentage soluble solids).

Table 1:9 Product life, chemical composition and physical characteristics (cracking only scored 0-4) on fruit with high and low levels of goldspot - scored week 30

Plot No.	Firmness (mm)	% compression	Radial cracking	Netting	% fruit weight	% uneatable 9 days	% uneatable 13 days	% solubl solids
1	3.75	7.89	1.2	0.8	95.87	0.0	20.0	4.95
1 G	3.75	8.35	1.4	1.4	95.53	7.7	53.8	4.90
2	3.66	7.87	1.0	0.6	96.11	12.5	50.0	4.80
2 G	3.95	8.43	1.8	1.0	95.07	20.0	46.7	5.00
3	3.62	7.73	0.6	0.4	96.05	20.0	40.0	4.85
3 G	3.78	8.17	1.0	0.6	95.09	25.0	58.3	4.85
4	3.94	8.59	0.6	0.6	95.93	0.0	50.0	4.85
4 G	4.10	8.75	2.0	1.6	94.97	22.2	66.7	5.15
5	3.73	7.97	1.0	0.8	96.49	-	-	4.85
5 G	3.72	7.72	1.6	1.2	95.60	18.8	50.0	4.70
6	3.86	8.44	1.0	1.0	96.09	16.7	33.3	4.80
6 G	3.81	8.33	1.6	0.2	96.14	5.9	29.4	4.90
7	3.95	8.56	0.6	1.2	96.49	18.2	45.5	4.95
7 G	3.91	8.34	1.8	1.6	95.34	23.5	58.8	4.95
8	3.88	8.40	2.0	1.8	95.48	25.0	75.0	5.25
8 G	4.12	8.93	1.0	1.2	95.64	5.9	47.1	5.00
9	3.53	7.50	1.0	0.6	95.88	6.7	53.3	5.00
9 G	4.31	9.20	2.2	1.8	94.90	25.0	50.0	5.00
10	3.94	8.46	1.4	0.8	95.72	12.5	12.5	4.95
10 G	4.22	9.01	1.2	0.6	95.46	0.0	20.0	4.90
Mean:								
-Goldspot	3.79	8.14	1.04	0.86	96.01	12.40	42.18	4.93
+Goldspot	3.97*	8.52	1.56*	1.12	95.37**	15.02	47.87	4.94
Total mean	3.88	8.33	1.30	0.99	95.69	13.71	45.02	4.93
SED	0.0785	0.1789	0.229	0.2022	0.1493	4.673	5.908	0.05
LSD	0.18	-	0.52	-	0.4852	-	-	-
Signif.	*	n.s.+ (p=0.06)	*	n.s.	**	n.s.	n.s.	n.s.

2. Stockbridge House EHS

2.1 Environments and CO_2

Culture

Sowing date: 24 November 1987

Planting date: 16 January 1988

Substrate: Rockwool

Varieties: Counter, Calypso, Criterium

Treatments

B340 ADAS BLUEPRINT

CO_2 1000 vpm when vents less than 5% open

340 vpm when vents greater than 5% open

After late April 340 vpm regardless of vent position.

B500 ADAS BLUEPRINT

CO_2 1000 vpm when vents less than 5% open

500 vpm when vents greater than 5% open

After late April 340 vpm regardless of vent position.

D340 DUTCH REGIME

CO_2 1000 vpm when vents less than 5% open

340 vpm when vents greater than 5% open

After late April 340 vpm regardless of vent position.

D500 DUTCH REGIME

CO_2 1000 vpm when vents less than 5% open

500 vpm when vents greater than 5% open

After late April 340 vpm regardless of vent position.

ADAS Blueprint

	Temperature set points (°C)			
	Day	Night	Day vent	Night vent
Stage 3				
1st anthesis to start of pick	20	16	26	25
	then reduce by 0.5°C per week			
Stage 4				
Start of pick to end of crop	18	16	21	25

Dutch Regime

	Day	Night	Day vent	Night vent
Standing out	18	18	19	20
1 week from standing out	18	17.5	19	20
4/5 truss in flower to end of crop	17.5	17	18.5	20

Minimum pipe temperatures: 50°C day with light reduction
40°C night

Design

Each regime was replicated twice, using 8 compartments (2 blocks) of the multifactorial unit. Varieties were randomised within compartments.

Quality assessments - mainly carried out monthly over the periods indicated

Composition: sugars and % dry matter	April-September
Titratable acidity	April-August
Product life: (firmness) after 6 days in shelf life room	May-September
Physical appearance: (ribbing, poor shape, goldspot and fine net cracking)	April-September

Results and discussion

No statistical analysis of the data is feasible. Comments are therefore based only on observable differences. Summarised tables of assessments are given in Tables 2:1 and 2:2. Detailed tables may be found in Appendix II.

Product life

In general the biggest differences between treatments were varietal differences rather than differences attributed to temperature or CO_2 regime.

In all treatments fruit firmness decreased throughout the season (compression measurements of the fruit increased). Criterium appeared to be the firmest variety.

Results also indicate that the Dutch regime was generally producing slightly firmer fruit than the Blueprint.

The dry matter content in fruit reached a peak in June and July. Calypso appeared to contain the highest levels and Criterium the lowest. No differences between environmental regimes were recorded.

Similarly differences in levels of soluble solids were not consistent between treatments. Limited records of total levels of reducing sugars from August and September assessments (Table 38 Appendix II) suggest Criterium to contain the lowest sugar levels in August, whilst Calypso had the lowest levels in September.

Titratable acidity levels in fruit were generally highest in June. Again consistent differences between treatments were not evident.

Physical appearance

Angular and slabsided fruit were more prominent throughout the trial later in the season and Counter was generally worse than Criterium and Calypso. Calypso was at its worst from the high CO_2, blueprint regime in September (see Appendix II Table 40). As might be expected, Criterium had more ribbing than the other varieties.

Fine net cracking was worst early in the season. However, results indicate that the high CO_2 regime produced lower levels than the lower CO_2 regime. Goldspot was worse in the high CO_2, blueprint regime and was generally more evident in fruit later in the season.

Table 2:1 Product life and chemical composition of meaned temperature, CO_2 and variety treatments. Mean of seasons assessments

	Firmness mm compression	% dry matter	% soluble solids	Titratable acidity
Mean of environments				
B340	3.00	4.6	4.0	6.7
B500	3.03	4.6	4.1	6.8
D340	2.96	4.6	4.1	6.8
D500	2.88	4.6	4.0	6.4
Mean of varieties				
Counter	3.10	4.6	3.9	6.8
Criterium	2.80	4.5	4.1	6.4
Calypso	3.00	4.8	4.2	6.9

Table 2:2 Physical characteristics of meaned temperature, CO_2 and variety treatments. Mean of season assessments (scored 0-4, when 0 = excellent, none present)

	Poor shape	Ribbing	Fine net cracking	Goldspot
Mean of environments				
B340	0.18	0.54	0.57	0.85
B500	0.21	0.55	0.46	1.06
D340	0.15	0.71	0.52	0.85
D500	0.16	0.57	0.42	0.82
Mean of varieties				
Counter	0.29	0.53	0.34	0.90
Criterium	0.14	0.78	0.56	0.97
Calypso	0.11	0.48	0.59	0.82

2.2 Substrates and Nutrition

Sowing date: 23 November 1987

Planting date: 19 January 1988

Variety: Counter

2.2.1 Substrates: Rockwool (15 cm wide)

Standard perlite bag (approx 15 litre perlite/plant)

Reduced volume, low profile perlite bag (approx 12 litre perlite/plant).

Perlite bags were used in a gulley system with polystyrene bridges between each bag. Sampling of the perlite was by means of tubes (dipwells) inserted into the bags and a sample of the reservoir solution withdrawn by syringe. Frequency and volume of irrigation was regulated according to the needs of the rockwool.

2.2.2. Nutrition from planting:

1. ADAS regime, feeding at 5000 microsiemens, dropping to 2500 microsiemens at first pick.
2. Low conductivity regime, feeding at 1500 microsiemens increasing to 2500 once fruit on first truss was cherry-sized.
3. High conductivity regime, using main season feed to 2500 microsiemens with sodium chloride added to raise conductivity to follow set points of ADAS regime.

Nutrition from first harvest:

All treatments, 2500 microsiemens.

Environment:

ADAS Blueprint.

The experiment was designed to examine the effect of three substrates and three nutritional regimes. The trial was of the split-plot type with the nutritional treatments applied to complete rows and each row split into six sub-plots for the three types of growing media.

Quality assessment

Composition (sugars, % dry matter, titratable acidity): April-August/Sept

Product life (firmness): May-September

Physical appearance (ribbing, poor shape, fine net cracking and goldspot: April-September.

Results and Discussion

Comments are based on observable differences between treatments. Statistical analysis of the results is not available.

2.2.1. Substrates

Effect of substrate

Most detailed results are available from the assessments of fruit on the three substrates grown under the standard ADAS nutritional regime.

Product life

Fruit firmness appeared to be affected by substrate. Fruit grown on perlite were frequently softer (less firm) than fruit grown on rockwool. There was also an indication that fruit grown on perlite had lower titratable acidity levels than rockwool grown fruit.

Physical characteristics

There were no large differences in the physical characteristics of fruit from the different substrates. Rockwool had more ribbing than perlite in May, (Table 2:4). The indication of more uneven ripening on perlite in May (see Table 2:5), is not reflected in the percentage Class I grade out.

2.2.2. Effect of nutrition

Since the nutrition treatments were only applied up to the first harvest, assessments on individual nutritional regimes have only been made from April through to May.

Product life (see Table 2:3)

No differences were discernible in the firmness, total dry matter and soluble solids content of the nutrition treatments. Titratable acidity levels were lowest in the ADAS nutrition treatment. The taste of this latter would be expected, as a result, to be poorer.

There are indications of poorer shape on the Low Conductivity and Salt treatments in May, and of more uneven ripening on the Low Conductivity, and these relate to the yield data which showed reduced percentage Class I fruit in that month.

Table 2:3 Product life and chemical composition of substrate and nutrition treatments. Mean of April, May, June and July assessments

Nutrition/ substrate	Firmness* mm compression	% dry matter	% ** soluble solids	Titratable acidity mEq/100 ml sap
ADAS				
Rockwool	2.6	5.0	4.5	6.9
Perlite	N/A	N/A	N/A	N/A
New Perlite	3.0	5.0	4.2	6.0
SALT				
Rockwool	2.7	5.0	4.2	7.8
Perlite	N/A	N/A	N/A	N/A
New Perlite	2.9	5.0	4.3	7.3
LOW CONDUCTIVITY				
Rockwool	2.9	5.0	4.4	7.5
Perlite	N/A	N/A	N/A	N/A
New Perlite	2.8	4.9	4.3	7.0

* firmness measurements from May, June and July only.

** % soluble solids records for April, June and July only

Table 2:4 Physical characteristics of substrate and nutrition treatments (scored 0-4, where 0 = excellent, none present)

	Apr	May	Interim mean	June	July	Aug	Sept	Mean
<u>Poor shape</u>								
ADAS								
Rockwool	0.05	1.0	0.52	0.15	0	0.40	0.95	0.42
Perlite					0.10	1.10	0.60	
New Perlite	0	0.85	0.42	0.20	0	0.80	0.70	0.42
			0.47					
SALT								
Rockwool	0.05	1.10	0.57					
Perlite	0.4	1.4	0.9					
			0.73					
LOW CONDUCTIVITY								
Rockwool	0.05	1.55	0.8					
Perlite	0.05	1.0	0.52					
			0.66					
<u>Ribbing</u>								
ADAS								
Rockwool	0.50	0.95	0.72	0.50	0	0.10	0	0.34
Perlite					0	0.15	0	
New Perlite	0.80	0.25	0.52	0.55	0	0.05	0	0.275
SALT								
Rockwool	0.30	0.80	0.55					
New Perlite	0.40	0.45	0.42					
LOW CONDUCTIVITY								
Rockwool	0.70	0.45	0.57					
New Perlite	0.60	0.20	0.4					
	0.55	0.52		0.52	0	0.1	0	

Table 2:5 Physical characteristics of substrate and nutrition treatments (scored 0-4, where 0 = excellent, none present)

	Apr	May	June	July	Aug	Sept
<u>Fine net cracking</u>						
ADAS						
Rockwool	0	0.65	0.05	0	0	0.30
Perlite				0.05	0	0.15
New Perlite	0.05	0	0.30	0.05	0	0.20
SALT						
Rockwool	0.10	0				
Perlite	0	0.20				
LOW CONDUCTIVITY						
Rockwool	0.25	0.30				
Perlite	0	0				

	Apr	May	Interim mean	June	July	Aug	Sept	Mean
<u>Goldspot</u>								
ADAS								
Rockwool	0.15	0.45	0.3	0.40	0.70	1.05	0.40	0.52
Perlite					0.40	0.85	0.30	
New Perlite	0.2	0.35	0.27	0.55	0.65	1.10	0.75	0.6
SALT								
Rockwool	0.1	0.0	0.07					
Perlite	0.05	0.20	0.12					
LOW CONDUCTIVITY								
Rockwool	0.3	0.25	0.27					
Perlite	0.2	0.65	0.47					

	May Rockwool	Perlite	Mean
<u>Uneven ripening</u>			
ADAS	0.25	0.3	0.28
Salt	0.15	0.45	0.30
Low Conductivity	0.35	0.7	0.53
Mean	0.25	0.48	

2.3 Heated Tomato Variety Trial

Varieties	Substrates
Counter	Soil
Compacto	Rockwool
Calypso	
669	
W 704	
663 (Rapide)	
Turbo	
W 1138 (Liberto)	
E.17.902 (Blizzard)	
Criterium	
RS 85042 (Favorset)	
LM 25	

Sown: 4 February 1988

Planted: 21 March 1988

Environment: Blueprint

Quality assessment: mainly monthly assessments over the period indicated

Composition (sugars, % dry matter. titratable acidity): May/June-Sept

Product life (firmness): May-Sept

Physical appearance (ribbing, poor shape, fine net cracking, goldspot): May-Sept

Results

Summarised table of product life and physical characteristics are listed in Tables 2:6 and 2:7. Full detailed results may be found in Appendix II.

Differences between varieties were evident in most product life and physical characteristics. Comments on the outstanding features of individual varieties are listed below:

Contrary to the results in this trial in 1987, differences in fruit quality between soil and rockwool were much smaller in 1988. The percentage Class I (not shown in this report) was only slightly higher for soil compared with rockwool, and there was no consistent difference in the firmness of the fruit, nor in the chemical composition. No differences between substrates in shape or ribbing are shown in 1988. The clear result of more fine net cracking on rockwool than on soil is confirmed again in 1988, for all varieties (see Table 2:7). Goldspot, which was not recorded in 1987, occurred to a greater extent on rockwool than on soil in 1988.

Counter Counter was not noted for any particularly poor or good parameters. Its performance was average and generally reliable.

Compacto This variety gave particularly firm fruit on soil, with high levels of titratable acidity. On rockwool its performance was close to the average for all varieties.

Calypso Calypso was rather soft when grown on soil. Both soil and rockwool grown fruit contained high levels of reducing sugars, were of a good shape with little ribbing and very little goldspot. The rockwool grown crop possessed higher levels of dry matter than the other varieties but fruit developed more fine net cracking.

Table 2:6 Product life of varieties from two substrates. Mean of May-September assessments

Varieties/ substrate	Firmness mm compression	% dry matter	% soluble solids **	Reducing sugars (g/100 ml) *	Titratable acidity mEq/100 ml sap **
Soil					
Counter	3.30	5.0	4.4	2.92	8.3
Compacto	3.04	4.8	4.2	2.53	9.4
Calypso	3.50	5.1	4.5	2.96	8.1
669	3.02	4.8	4.4	2.53	7.8
W 704	3.07	4.8	4.2	2.79	7.6
663	3.18	5.3	4.5	2.38	8.0
Turbo	3.12	4.9	4.5	3.04	8.1
W 1138	3.36	4.7	4.2	2.75	7.1
E.17.902	3.24	5.2	4.4	2.85	7.6
Criterium	2.86	4.4	4.2	2.79	6.5
RS 85042	3.04	4.6	4.2	2.90	8.1
LM 25	3.30	5.1	4.4	3.13	7.6
Mean	3.17	4.9	4.3	2.80	7.9
Rockwool					
Counter	3.18	5.0	4.5	2.81	6.2
Compacto	3.22	4.7	4.4	2.70	6.4
Calypso	3.22	5.2	4.9	3.19	8.4
669	3.06	4.8	4.2	2.64	7.4
W 704	2.98	4.7	4.1	2.61	6.4
663	3.37	4.8	4.5	3.13	6.5
Turbo	3.30	5.0	4.5	3.18	7.1
W 1138	3.25	4.6	4.2	3.16	7.4
E.17.902	3.41	4.9	4.5	3.07	7.8
Criterium	3.19	4.7	4.3	3.12	6.9
RS 85042	3.01	4.7	4.3	2.42	6.9
LM 25	3.31	4.9	4.2	2.78	6.7
Mean	3.21	4.8	4.4	2.90	7.0

* Mean of August and September assessments only.

** Mean of June, August and September only

Table 2:7 Physical characteristics of varieties and substrates. Mean of May-September assessments (scored 0-4) where 0 = excellent, none present

Varieties/ substrate	Poor shape	Ribbing	Fine net cracking	Goldspot
Soil				
Counter	0.43	0.29	0.24	0.69
Compacto	0.21	0.33	0.26	0.47
Calypso	0.16	0.27	0.36	0.37
669	0.20	0.38	0.32	0.26
W 704	0.40	0.26	0.32	0.46
663	0.52	0.42	0.58	0.64
Turbo	0.58	0.32	0.25	0.42
W 1138	0.47	0.18	0.15	0.48
E.17.902	0.19	0.41	0.23	0.27
Criterium	0.15	0.58	0.38	0.63
RS 85042	0.22	0.36	0.53	0.82
LM 25	0.25	0.21	0.29	0.78
Mean	0.31	0.33	0.33	0.52
Rockwool				
Counter	0.39	0.42	0.55	1.03
Compacto	0.24	0.34	0.75	1.14
Calypso	0.11	0.18	0.78	0.76
669	0.15	0.28	0.82	0.63
W 704	0.65	0.20	0.73	0.91
663	0.18	0.24	0.67	1.09
Turbo	0.44	0.32	0.56	0.84
W 1138	0.38	0.15	0.71	1.02
E.17.902	0.16	0.42	0.64	0.62
Criterium	0.24	0.83	0.66	0.90
RS 85042	0.10	0.20	0.85	0.99
LM 25	0.16	0.47	0.71	1.12
Mean	0.27	0.34	0.70	0.92

669 Both soil and rockwool crops developed low levels of goldspot. However, fine net cracking was higher than on other varieties in trial in the rockwool grown fruit.

W 704 This variety appeared to be particularly firm on rockwool.

663 663 was a soft variety on rockwool but near average on soil. It was one of the worst varieties for net cracking in the soil grown crop although like all other varieties this problem was worse still on rockwool. Fruit contained low levels of reducing sugars on soil but higher levels on rockwool.

Turbo Similar to 663. Fruit of Turbo were soft on rockwool but possessed high reducing sugar levels.

W 1138 (Liberto) Liberto was not exceptional in any way except fruit showed very little ribbing.

E.17.902 (Blizzard) This variety showed low levels of goldspot and was a good shape on both soil and rockwool, although there was a tendency to be slightly ribby.

Criterium The soil grown crop confirmed previous observations that the variety was a firm one. Ribbing is particularly bad, especially on the rockwool crop. Soil grown fruit also possessed a low dry matter content.

RS 85042 (Favorset) Fruit were fairly firm, however, Favorset appeared prone to more netting than other varieties on both soil and rockwool. Fruit shape was particularly good on rockwool.

LM 25 Fruit was soft on both substrates. Shape was good, but with some ribbing on rockwool. Goldspot was quite severe on rockwool.

In general quality parameters did change considerably throughout the season. Firmness decreased and poor shape characteristics developed later in the year.

3. Institute of Horticultural Research - Littlehampton

3.1 The effect of three levels of salinity on fruit quality of Cherry Tomatoes grown in NFT

Introduction

In 1987 work on cv. Gardeners' Delight established the potential for a high salinity treatment as a means of improving fruit quality. Plants were grown under salinities of 3 mS and 10 mS; the high salt treatment produced high sap concentrations of titratable acids, potassium, sodium and reducing sugars. Subjecting fruit to mechanical stress (conditioning) was shown to increase the rate of CO_2 and C_2H_4 evolution. Hence the aim in 1988 was to specify the effects of salinity on fruit quality over a narrower range, with a view to the recommendation of an optimum growing level.

The focus was on four areas of fruit quality, i) physical characteristics, ii) chemical composition, iii) response to mechanical stress, and iv) sensory taste analysis.

Materials and Methods

Thirty plants per salinity of cv. Gardeners' Delight were grown in NFT at a pH of 5.8 and at EC's of 3 mS, 5 mS, and 8 mS. The salinity was raised by addition of sodium chloride solution (to produce 75 per cent of the required increase) and a macronutrient supplement of potassium nitrate (207 g/l) and calcium nitrate (93.3 g/l) (to produce the remaining 25 per cent of the increase).

1. Physical characteristics:

Parameters measured:

Crop 1: Fruit weight, dry matter.

Crop 2: Yield, fruit weight, fruit diameter, dry matter (all measurements taken from truss 2 onwards only to ensure the treatments were fully effective).

Weights and diameters: 40 fruit per week measured throughout season.

Dry matters: 100g fresh weight of selected fruit quarters, held at $80^{o}C$ for 48 hours, reweighed hot.

2. Chemical composition:

Crops 1 and 2: Potassium, sodium, reducing sugars, titratable acidity.

Ripe fruit were halved on the day of a once-weekly harvest, frozen overnight, halved and pressed through muslin, spun in a centrifuge at 2000 rev/min for 15 mins and filtered through glass wool.

Potassium and sodium were assayed on a Technicon Autoanalyser.

Reducing sugars: 5 ml sap in 50 ml distilled water, 1 ml saturated lead acetate was added, followed by 2 ml 20% potassium oxalate; made up to 100 ml and filtered before analysis on Technicon Autoanalyser.

Titratable acidity: 10 ml sap in 100 ml distilled water, titrate to pH 8.0 against 0.1 N sodium hydroxide.

3. Response to mechanical stress:

Assessed through storage life and ethylene evolution. Orange fruit, conditioned on day of harvest, were passed through the conditioning apparatus (see Appendix I Fig 1) three times, rejecting any fruit which split or lost the calyx in the process.

Crop 1: Ethylene evolution

On the day following conditioning approximately 100g of whole fruit were weighed and sealed in jars. After one hour the ambient gas in the jar was analysed by gas chromatography.

Crop 2: Storage life

Following preliminary experiments using fruit from Crop 1, a plan was developed for Crop 2.

Eighty fruit at the orange stage of ripeness were selected from each treatment on the day of harvest and 20 were measured for firmness and colour as described previously. The remaining 60 fruit, half of which were conditioned, were held at 20^{o}C. After 4, 8 and 12 days, firmness and colour readings were made from 10 fruit per treatment-condition, together with the diameters of each fruit, measured along the axis of compression. This whole procedure was repeated at weekly intervals.

4. Sensory taste analysis:

One hundred and sixty seven people attending an Open Day at IHR, Littlehampton, took part in a taste trial. Each individual compared two unknown fruit samples and was asked to score for relative acidity and sweetness on a seven point centre-zero scale, also stating his or her overall preference within each pair of samples.

Results

With the exception of storage life all parameters were analysed using analysis of variance.

1. Physical characteristics (see Tables 3:1-3:3)

   A significant reduction in fruit weight and diameter was observed as salinity increased.

   Dry matter was significantly increased by higher conductivity in the nutrient solution.

   The yield was significantly reduced in the 8 mS treatment, but no significant loss was incurred in the 5 mS treatment relative to the 3 mS.

2. Chemical composition (see Tables 3:4-3:7)

   A significant increase was observed with increasing conductivity in sodium, potassium and titratable acidity concentrations in the fruit sap.

   The effect on reducing sugar concentration appeared to be less dramatic, although there was a tendency for concentrations to be higher from higher salinity treatments. It is thought that variability may arise from the methods of extraction and analysis and work towards alternative methods is currently under way.

3. Response to mechanical stress (see Table 3:8)

   Conditioning produced a large increase in ethylene production by the fruit, but there were no differences in the responses of fruit from the different salinity treatments.

4. Storage life (see Tables 3:9-3:10)

It was thought that the effect of differing fruit sizes due to salinity treatments might influence the compression readings producing misleading results. However, over the range of diameters involved no such effect was detected.

The effect of initial readings of firmness and colour at day 0 was analysed by analysis of covariance. This revealed no significant influence of start point on subsequent readings which were analysed using a Regression Analysis producing an Analysis of Deviance.

Conditioning significantly reduced the storage life of fruit assessed in terms of firmness (Table 3:10). Analysis of compression readings showed the high salinity (8 mS) fruit to be slightly more resilient under mechanical stress.

Colour analysis did not indicate any interactions between conditioning and nutrition, but the high salinity fruit exhibited a slower rate of colour development during the storage period.

5. Sensory taste analysis

The responses of the female participants were separated from those of the male participants. Females detected differences in sweetness, finding the 3 mS fruit least sweet. Males noted differences in acidity but the order in which they tried samples was a contributory factor such that no overall treatment differences could be declared.

Females preferred 8 mS fruit and males preferred 5 mS fruit overall; taking the sampling population as a whole the 5 mS treatment produced the preferred fruit.

Conclusions

1. There are commercial advantages to be gained through growing cherry tomatoes at a salinity level higher than that at which the maximum yield is reached.

2. Raising the salinity level of the nutrient solution improves the flavour of the crop. This is indicated not only by composition analysis but by taste panel tests as well.

3. A salinity of 5 mS is sufficient to produce fruit having improved flavour but without yield penalties. A reduction in fruit size at this salinity for the cv. Gardeners' Delight has the added advantage of reducing the diameter of the fruit so that a higher proportion fall within the marketable grade.

4. Conditioning doubles the rate of evolution of ethylene which must speed up deterioration, senescence and lead to overripe fruit. Storage life was significantly reduced by conditioning treatment.

5. Increased salinity did not increase firmness of fruit but appears to allow some protection against softening damage caused by mechanical stress.

Table 3:1 Mean weight and diameter (equatorial) per fruit

Harvest date (Crop 1)	Crop 1 Weight (g)			Crop 2 Weight (g)			Crop 2 Diameter (mm)			Harvest date (Crop 2)
Week	3 mS	5 mS	8 mS	3 mS	5 mS	8 mS	3 mS	5 mS	8 mS	Week
14	24.00	21.20	18.10	23.47	20.46	16.91	37.26	36.01	33.76	34
15	22.14	19.66	17.44	23.29	21.13	16.83	37.40	36.13	33.23	35
16	22.04	18.72	16.63	21.79	17.99	16.16	36.59	34.57	33.18	36
17	18.28	17.03	14.82	21.08	17.45	13.85	36.03	33.94	31.49	37
18	18.81	17.04	13.58	18.66	14.71	12.28	34.51	32.11	30.25	38
19	16.40	16.61	13.95	19.31	16.50	13.14	34.71	33.15	30.79	39
20	15.86	14.91	12.97	18.21	16.91	13.98	34.27	33.56	31.49	40
21	15.28	14.76	12.78	18.10	16.03	13.79	34.08	33.03	31.65	42
22	17.23	16.76	14.21	17.26	16.08	14.18	33.79	32.78	31.19	43
				17.78	16.37	13.48	34.29	33.38	30.44	44
Means	18.95	17.41	14.94	19.38	17.0	14.18	35.01	33.62	31.58	
SED		0.34***			0.18***			0.13***		
df		16			964			964		

Table 3:2 Percentage dry matter in fruit

Harvest date (Crop 1)	Crop 1 3 mS	5 mS	8 mS	Crop 2 3 mS	5 mS	8 mS	Harvest date (Crop 2)
11.4.88	6.43	7.14	7.65	6.41	7.77	7.95	5.9.88
18.4.88	6.17	7.06	-	7.24	7.48	8.31	12.9.88
25.4.88	6.64	7.07	7.43	7.53	7.61	8.26	19.9.88
3.5.88	6.69	7.27	8.00	7.00	7.46	7.74	26.9.88
9.5.88	6.54	7.15	8.02	7.01	7.73	7.72	3.10.88
16.5.88	6.70	-	7.95	6.87	7.01	7.87	17.10.88
23.5.88	6.97	7.09	7.89	6.83	6.94	8.28	24.10.88
13.6.88	6.51	7.28	7.93	6.60	7.58	7.91	31.10.88
Means	6.59	7.17	7.80	6.94	7.45	8.00	
SED		0.08***			0.15***		
df		12			14		

Where *** is significant at $p < 0.001$

Table 3:3 Yield - Total weight harvested (kg) (excluding first truss) 25.8.88-3.11.88

Weeks	3 mS	5 mS	% of 3 mS yield	8 mS	% of 3 mS yield
1-3	1.484	1.359	92	1.243	84
4-7	2.406	2.362	98	1.746	73
7-10	2.080	2.120	102	1.688	81
1-10	5.970	5.841	98	4.678	78

SED for weeks 1-10 = 2.85*** (18 df)

Table 3:4 Potassium concentration (g/l sap)

Harvest date (Crop 1)	Crop 1 3 mS	5 mS	8 mS	Crop 2 3 mS	5 mS	8 mS	Harvest date (Crop 2)
14.4.88	2.63	3.00	3.09	2.65	3.01	2.14	30.8.88
20.4.88	2.50	2.90	3.03	2.83	2.78	3.17	5.9.88
28.4.88	2.97	3.06	3.20	3.11	3.03	3.37	12.9.88
6.5.88	2.79	2.94	3.67	2.95	3.09	3.21	19.9.88
12.5.88	2.93	3.14	3.45	2.31	2.90	3.06	26.9.88
26.5.88	3.30	1.79	2.87	2.82	2.92	-	3.10.88
16.6.88	1.70	2.73	3.63	2.57	2.54	2.78	13.10.88
27.6.88	1.82	2.45	2.12	3.00	3.29	3.55	17.10.88
30.6.88	2.89	2.18	3.52	2.84	3.56	2.02	24.10.88
				2.74	3.11	3.59	31.10.88
Means	2.61	2.69	3.18	2.78	3.02	2.99	
SED		21*			18*		
df		16			17		

Where * is significant at p <0.05

Table 3:5 Sodium concentration (g/l sap)

Harvest date (Crop 1)	Crop 1 3 mS	5 mS	8 mS	Crop 2 3 mS	5 mS	8 mS	Harvest date (Crop 2)
14.4.88	41.5	74.6	117.8	37.8	70.2	137.6	30.8.88
20.4.88	41.5	71.2	120.0	41.8	60.9	155.3	5.9.88
28.4.88	46.5	78.5	134.5	43.0	66.5	175.9	12.9.88
6.5.88	43.0	73.1	153.1	43.4	63.8	133.9	19.9.88
12.5.88	47.4	76.7	128.8	34.2	74.2	131.3	26.9.88
26.5.88	56.2	75.4	128.0	61.8	82.3	-	3.10.88
16.6.88	58.8	66.1	124.9	53.2	74.7	128.9	13.10.88
27.6.88	40.0	62.7	135.1	66.4	88.4	159.6	17.10.88
30.6.88	43.4	60.4	81.1	61.8	97.2	-	24.10.88
				67.5	84.0	160.8	31.10.88
Means	46.5	71.0	124.7	51.1	76.2	147.9	
SED		0.37***			0.46***		
df		17			16		

Table 3:6 Total reducing sugars (g/100 ml sap)

Harvest date (Crop 1)	Crop 1 3 mS	5 mS	8 mS	Crop 2 3 mS	5 mS	8 mS	Harvest date (Crop 2)
20.4.88	3.32	3.75	3.85	3.91	3.63	3.72	12.9.88
5.5.88	3.43	3.98	3.62	3.41	3.32	3.18	26.9.88
19.5.88	3.43	2.88	3.91	3.45	3.61	3.71	3.10.88
16.6.88	3.29	3.45	3.70	3.07	3.28	3.20	17.10.88
30.6.88	3.48	3.84	3.95	3.32	3.11	3.40	24.10.88
Means	3.39	3.58	3.81	3.43	3.39	3.44	
SED		0.18*			0.09		
df		8			8		

Where *** is significant at p <0.001

Where * is significant at p <0.05

Table 3:7 Titratable acidity (mEq/100 ml sap)

Harvest date (Crop 1)	Crop 1 3 mS	5 mS	8 mS	Crop 2 3 mS	5 mS	8 mS	Harvest date (Crop 2)
14.4.88	10.84	11.73	12.67	10.99	11.83	12.92	1.9.88
28.4.88	11.76	12.40	13.68	10.50	11.05	12.90	5.9.88
12.5.88	11.37	12.79	14.31	10.00	12.11	13.77	19.9.88
26.5.88	11.73	13.47	15.15	10.68	11.02	13.90	3.10.88
16.6.88	12.42	13.80	15.60	10.83	12.30	14.36	17.10.88
30.6.88	11.81	12.79	14.85	10.99	11.63	13.99	31.10.88
Means	11.65	12.83	14.38	10.67	11.66	13.64	
SED		0.21***			0.27***		
df		10			10		

Table 3:8 Ethylene production from ripe fruit (nl/g/hr) (Crop 1)

Harvest date (Crop 1)	Not conditioned 3 mS	5 mS	8 mS	Conditioned 3 mS	5 mS	8 mS
11.4.88	10.04	10.70	-	17.68	17.53	-
18.4.88	6.92	10.81	9.56	19.66	17.55	16.86
25.4.88	11.46	13.23	13.46	23.72	20.68	21.98
3.5.88	11.98	11.62	11.52	22.41	18.33	23.62
9.5.88	13.69	12.04	11.87	17.39	21.71	21.59
16.5.88	8.78	8.23	7.65	15.49	16.06	16.06
23.5.88	9.29	9.11	7.74	20.58	16.83	15.47
13.6.88	7.43	8.62	10.18	12.52	13.56	18.31
20.6.88	8.18	9.59	8.16	18.12	15.23	13.76
27.6.88	5.69	7.16	6.42	13.84	16.25	14.18
4.7.88	10.29	10.65	9.67	18.72	21.76	15.75
Means	9.43	10.16	9.62	18.19	17.77	17.78
SED				0.60***		
df				109		

Table 3:9 Storage life - Mean compression reading (mm) (22 Sept-3 Nov)

	Not conditioned 3 mS	5 mS	8 mS	Conditioned 3 mS	5 mS	8 mS
Day 0	2.93	2.93	3.03	-	-	-
Day 4	3.56	3.60	3.70	4.41	4.35	4.26
Day 8	3.93	3.94	3.95	4.87	4.82	4.55
Day 12	4.02	4.02	4.13	5.01	5.01	4.75

SED (80 df) 0.09

Table 3:10 Storage life - Mean compression reading (mm) (22 Sept-3 Nov) (Mean of three testing days)

	Not conditioned	Conditioned
3 mS	3.878	4.788
5 mS	3.873	4.742
8 mS	3.973	4.586
Mean	3.910	4.705

SED (80 df) for diff between overall means for conditioning treatments 0.0288

SED (80 df) for diff between figures in body of table 0.0499

Table 3:11 Storage life - Mean total colour index

	Not conditioned 3 mS	5 mS	8 mS	Conditioned 3 mS	5 mS	8 mS
Day o	40.26	43.37	43.84	-	-	-
Day 4	62.08	63.71	63.16	62.95	63.86	68.73
Day 8	66.50	68.61	68.73	68.69	69.53	68.36
Day 12	70.50	69.56	67.84	70.51	71.13	69.84

SED (80 df) 1.19

4. Luddington EHS

4.1 Effect of goldspot on the shelf life of tomatoes

Goldspot or gold speckles around the calyx and shoulders of tomato fruit have given cause for concern over the past few seasons and when numerous have, on occasions, led to downgrading of the fruit. The exact nature of the goldspot has been in dispute but recent investigations suggest they are caused by crystal sand, made of organic calcium salts, probably calcium oxalate (Outer and Veenendaal 1988).

In addition to detracting from the visual appearance of the fruit, it has been suggested that goldspot is associated with a reduced shelf life and increased fruit softening.

Materials and methods

Treatments

Level of goldspot on fruit

1. Low
2. Medium
3. High

Handling treatment

1. None
2. Simulated handling.

Fruit of a similar maturity was carefully harvested from a central area in a commercial glasshouse. The fruit was brought back to Luddington, classified according to the level of goldspot and handling treatments applied where necessary. The simulated handling consisted of dropping fruit through the apparatus previously described (Appendix I). Fruit was subsequently kept during shelf life at 20°C 50% RH.

The trial was repeated on two occasions, 20 July and 5 August.

Assessments

Fruit was scored for colour and weight loss recorded at regular intervals. Fruit firmness was recorded after 48 hours and 6 days. Level of goldspot on fruit was also assessed on a 0-4 scale, where 0 = none present.

Fruit from the first trial were cut transversely and calcium levels in both calyx and blossom ends of fruit were determined at the end of the shelf life period.

Results

Assessments on the levels of goldspot on treatments in both trials confirm that fruit were correctly classified into high, medium and low goldspot categories (Table 4:1). Overall there was more goldspot on the fruit from the later harvest.

Table 4:1

Goldspot classification	Goldspot scored 0-4 20.7.88	5.8.88
Low	0.52	1.87
Medium	1.25	2.62
High	2.17	3.55

Analysis of total calcium levels in fruit from the first trial confirmed that calcium levels were higher in the calyx end of the fruit. Also levels were greater in those fruit showing higher levels of goldspot (Table 4:2).

Table 4:2 Calcium levels in tomato fruit halves (mg/kg fresh weight)

Level of goldspot	Calyx end	Blossom end	Mean
Low	94.0	67.0	80.5
Medium	107.7	73.7	90.7
High	115.7	85.0	100.4
Mean	105.8	75.2	

There is some significant evidence at the 5 per cent and 1 per cent level of colour differences between the three levels of goldspot in the first trial after two and five days storage respectively. The treatment with higher levels of goldspot gave the lowest colour scores (Table 4:3). These effects are not consistent throughout the first trial and there is no evidence of such effects in the second trial, therefore these results must be treated with caution.

Table 4:3 Colour scores after 5 days shelf life (1st trial)
(score 1-14, where 1 = green, 14 = red)

Level of goldspot	Handling None	Simulated	Mean
Low	9.80	10.07	9.93
Medium	9.93	9.90	9.92
High	8.90	9.40	9.15
Mean	9.54	9.79	
SED (between goldspot treatments)	0.196** (10 df)		
SED (between handling treatments)	0.160 ns		

There is little evidence of treatment effects on weight loss in the first trial but some weak evidence of both goldspot level and handling treatment effects in the second trial. In the second trial the higher levels of goldspot showed higher percentage weight losses although these effects were mainly evident in the non-handled fruit (Tables 4:4 and 4:5).
The handled fruit showed little consistent evidence of differences between the goldspot treatments. Again, these effects should be regarded with caution as they are not consistent across both trials.

Table 4:4 Percentage weight after 4 days shelf life (2nd trial)

Level of goldspot	Handling None	Simulated	Mean
Low	97.18	97.27	97.22
Medium	97.00	97.07	97.04
High	96.49	97.11	96.80
Mean	96.89	97.15	
SED (between goldspot treatments)	0.135* (10 df)		
SED (between handling treatments	0.110* (10 df)		

Table 4:5 Percentage weight after 6 days shelf life (2nd trial)

Level of goldspot	Handling None	Simulated	Mean
Low	96.19	96.27	96.86
Medium	96.08	96.07	96.07
High	95.31	96.12	95.71
Mean	95.86	96.15	
SED (between goldspot treatments)	0.157* (10 df)		
SED (between handling treatments)	0.128* (10 df)		

Assessments of fruit firmness indicate that the first trial shows significant effects of goldspot on fruit firmness with the fruit firmness measurement (i.e. degree of softness as measured by fruit compression) increasing with increasing levels of goldspot (Table 4:6).

Table 4:6 Fruit firmness (mm compression) after 48 hours shelf life (1st trial)

Level of goldspot	Handling None	Simulated	Mean
Low	2.19	2.16	2.18
Medium	2.30	2.28	2.29
High	2.30	2.31	2.30
Mean	2.26	2.30	
SED (between goldspot treatments)	0.035** (10 df)		
SED (between handling treatments)	0.028 ns		

The second trial, however, shows little evidence of any consistent trend of fruit firmness over the three levels of goldspot (Table 4:7).

Table 4:7 Fruit firmness (mm compression) after 48 hours shelf life (2nd trial)

Level of goldspot	Handling None	Simulated	Mean
Low	2.30	2.24	2.27
Medium	2.20	2.38	2.29
High	2.38	2.33	2.36
Mean	2.30	2.32	
SED (between goldspot treatments)		0.047 ns	
SED (between handling treatments)		0.038 ns	

Discussion

Therefore, although there is some evidence that increasing levels of goldspot accelerate fruit softening in storage, the evidence from this trial cannot be regarded as conclusive. A further set of trials, perhaps using a larger sample size, is required to confirm or refute the results obtained from this trial.

Reference

Outer R W, Veenendaal W L H (1988) Gold speckles and crystals in tomato fruits J.Hort.Sci. 63 (4) 645-649

4.2 To assess the validity of non-destructive fruit firmness assessments

Tomato fruit firmness (or softness) is an important feature of post harvest quality. The HDC sponsored studies have utilised this technique in almost all the trials work but have considered the test to be destructive and valid 'once-only'. Since the test has been considered destructive, assessments of fruit on more than one occasion during the shelf life period requires large numbers of extra fruit from each treatment. These quantities of fruit are not always available and also necessitate extra shelf life space.

For these reasons, the following trial was designed to qualify the assumption that the compression firmness test should be considered destructive.

Materials and method

Treatments

Fruit assessed for firmness

1. 0, 2, 5 and 6 days after harvest
2. 2, 5 and 6 days after harvest
3. 5 and 6 days after harvest
4. 6 days only after harvest (control)

Tomato fruit of a uniform size and maturity were harvested from a small central area in a commercial glasshouse.

Fruit were handled very carefully and transferred to controlled shelf life conditions of 20^{o}C, 50% RH for a period of six days.

Assessments

Fruit firmness was assessed according to treatment. Fruit were scored for colour and weight records were taken after 0, 2, 5 and 6 days shelf life.

Results

The analysis of fruit firmness on day 6 showed a very highly significant difference at the 0.1 per cent level between the control fruit and the re-tested fruit. The control fruit showed a higher mm compression reading than the re-tested fruit. There were no significant differences between the three levels of re-testing (Table 4:8). It is apparent that fruit show a lower compression reading when re-tested after the initial determination.

Table 4:8 Firmness readings (mm compression) after 6 days shelf life

Number of tests received by fruit	Firmness (mm compression)	Mean
4	3.12	
3	3.19	3.20
2	3.21	
1 (Control)	3.68	3.68
SED (between control and others)	0.489*** (6 df)	
SED (any comparison)	0.599 ns	

There were no significant differences between the colour measurements of any of the treatments (Table 4:9) and no significant differences between the percentage weight loss of any treatment on days 2, 5 or 6 (Table 4:10).

Table 4:9 Colour assessments after 6 days shelf life

Number of tests	Colour score	Mean
4	11.13	
3	11.07	11.11
2	11.12	
1 (control)	11.13	11.13
SED (between control and others)	0.080 ns	
SED (any comparison)	0.098 ns	

Table 4:10 Percentage weight loss after 6 days shelf life

Number of tests received by fruit	Percentage wt	Mean
4	95.93	
3	95.91	95.97
2	96.08	
1	96.00	96.00
SED (between control and others)	0.234 ns	
SED (any comparison)	0.287 ns	

Discussion

It would appear therefore that the firmness test does affect the subsequent performance of fruit in a repeat test and as a result the firmness test should be considered destructive.

5. General reviews

5.1 Goldspot

Goldspot is the term used to refer to the distinctive golden-yellow speckling seen most usually around the calyx end of the fruit. It is now well established that these speckles arise from the formation of calcium oxalate crystals.

Concern over the occurrence of goldspot is not so much related to the detrimental effect on appearance but that it has been suggested that goldspot is associated with a loss of firmness and shorter shelf life.

Results from the 1987 and 1988 HDC tomato fruit quality work has indicated a number of factors which affect the levels of goldspot.

Time of year

Over both seasons there does not appear to be a consistent pattern in the levels of goldspot recorded. In most of the crops assessed the level tends to increase throughout the season although peaks and troughs occur within this pattern.

Variety

Varietal differences have been noted. The only variety which has been consistently 'resistant' to goldspot is Calypso. Trials at Efford and Stockbridge House in 1987 and 1988 have noted lower levels than on other varieties. Two new varieties, E.17.902 (Blizzard) and E.17.945 (Cyclon) looked promising in 1988 trials.

Conversely the two varieties Counter and LM25 have consistently developed a relatively high incidence of goldspot.

Temperature regime

Dutch work has previously suggested that the climate in which a crop is grown has a major influence on the influence of goldspot. It has been suggested that a climate controlled to give regular fruit growth and one which stimulates transpiration at night will help alleviate the development of high levels of goldspot (Willems 1987). In 1987 the HDC work indicated that early in the season (weeks 13-25) goldspot was reduced in a Blueprint versus a Dutch regime, whilst later on (weeks 29-37) the situation was reversed.

In 1988 the effects of temperature regime on goldspot were less marked although isolated assessments made in weeks 20 and weeks 34 do confirm the pattern shown above.

No variety/temperature interactions were noted. As previously mentioned, Calypso consistently develops relatively low levels of goldspot whilst Counter develops relatively high levels.

Humidity

M-block humidity investigations at Efford in 1987 did not suggest there to be a direct effect on the incidence of goldspot. In 1988 there is a suggestion from early season humidity work that levels of goldspot were reduced in a low day (0.8 k Pa vpd) versus a high day (0.1 k Pa vdp) regime. The level of night-time humidity appeared unimportant.

Nutrition

It is probably nutrition which has the greatest effect on the levels of goldspot which develop in a crop. In general increasing the nutrient conductivity will reduce the incidence of this disorder. This is in accordance with Dutch findings (Willems 1987).

Increasing the conductivity above 3.5 mS during the main part of the season reduces the incidence of goldspot (Efford 1987). This is in accordance with Dutch findings which report a similar response (Willems 1987).

Early season conductivity regimes of 5 versus 7 ms have failed to consistently affect the levels of goldspot in either the early 1987 or 1988 seasons.

Given the direct involvement of calcium in the nature of goldspot its response to altered levels of calcium in the feed solution is not surprising. Increasing calcium levels in the feed solution from 150 to 300 mg/Ca/l led to an increase in the incidence of goldspot.

In addition, Outer and Veenendaal (1988) suggested in a recent paper that excess nitrate in the nutrient solution may lead to an increased incidence of goldspot.

Substrate

Trials at Stockbridge House have provided the opportunity to directly compare identical crops grown on soil and rockwool substrates. Results indicate a higher level of goldspot in the rockwool grown crop. This is contrary to recent comments in Dutch literature which suggest soil grown crops generally suffer more from the problem (Peerlings 1988).

CO_2

There is some evidence to suggest that higher CO_2 levels will increase the level of goldspot if used in conjunction with a blueprint temperature regime (Stockbridge House 1988). The underlying cause of this effect remains unknown.

Effect on shelf life

Finally the importance of goldspot remains in the effect the condition may have on the shelf life of affected fruit. Many reports suggest goldspot is associated with an erosion of firmness and shelf life. Trials at Luddington in 1988 did not definitely confirm this although there were some indications in that direction. However it should be noted that goldspot, netting and radial cracking are often found together. It has yet to be irrevocably proved whether there is a direct relationship between the incidence of goldspot and netting or radial cracking. However the detrimental effect of fine net cracking and radial cracking on weight loss and fruit firmness is easily proved. Goldspot and cracking problems are not always distinguished when comments on fruit with poor shelf life are made. It should be noted the fruit in the trials at Luddington had very low levels of fine net cracking and radial cracking was virtually absent.

In contrast a separate trial at Efford in August 1988, a reduced shelf life was associated with fruit showing a high level of goldspot, however records showed that there was also a higher level of both fine net cracking and radial cracking present in these fruit.

References

1. Willems J. (1987) Gold speckling. Groenten en Fruit 3.7.87 pp.52-53.
2. Den Outer R W and Van Veenendaal W L H. (1988) Gold speckles and crystals in tomato fruits. J.Hort Sci 63 (4) 645-649.
3. Peerlings M. (1988) Keeping quality inspections of round and beef tomatoes. Weekblad Groenten en Fruit 9.9.88 pp.46-47.

5.2 Fine net cracking

Fine net cracking, netting, swelling cracks and russeting are all terms which have been used to refer to the tiny hair-like cracks which have caused considerable concern and attention over the last three or four seasons. Much has been written about the nature and cause of the problem.

The following is a summary of the causative factors which have been identified in the HDC fruit quality project.

In general the incidence of fine net cracking followed a similar pattern in both 1987 and 1988 seasons. Levels peaked early in the season, fell off during the summer and rose again later in the season.

<u>Variety</u>

The choice of variety does appear to have a marked effect. Turbo, Counter and W 1138 have been consistently resistant to the disorder whilst the varieties 662 and 663 have been fairly prone.

A range of Mediterranean varieties trialled as an unheated crop in 1987 produced fruit with virtually no netting at all. The older variety, Shirley, was similarly resistant.

<u>Temperature regime</u>

During the earlier part of the season the F-block temperature trials at Efford have shown that a Blueprint regime with lower night and higher day temperatures produced lower levels of netting than a Dutch temperature regime in both 1987 and 1988. Later in the season the effect of temperature regime on the incidence of netting was less marked.

1988 trials indicated an interesting interaction between temperature regime and variety. Counter developed very similar levels of fine net cracking in all temperature regimes.

In contrast Calypso showed a marked response. In the Blueprint regime levels were similar to Counter but under the Dutch regime early season levels of netting were much higher. Criterium developed less netting overall than Calypso but responded to temperatures in a similar manner.

Humidity

Humidity treatments did not directly affect levels of fine net cracking.

Nutrition

Increasing the conductivity of the nutrient solution from 5 to 7 ms reduced the incidence of fine net cracking during the early part of the season in both years.

Increasing the conductivity later in the season between 2.5 to 5 ms also appeared to slightly reduce the incidence of netting.

Substrate

Overall results from Stockbridge House in 1987 and 1988 indicate higher levels of fine net cracking on the crop grown on rockwool, compared with soil-grown crops.

Standardised assessment of tomato fruit quality

The three assessments covered are:

1. Product life
2. Chemical composition
3. Physical characteristics.

1. Product life (6 day test)

1.1 Sample: Minimum fruit number of 20 to be harvested on a Wednesday and taken bulked from all replicates, calyx retained, Class I fruit. Modal size group (usually D's but dependent on variety), ripeness stage 2 (ATB).
(Efford used 10 fruit from each replicate plot harvested on a Monday).

1.2 Handling: Fruit to be collected from the packhouse pre-grading and to be passed through the handling simulator (Fig.1) from a height of 50 cm.

1.3 Product life room temperature: 20°C, RH to be measured as that achieved at Efford and Stockbridge House and reproduced at Luddington. Fluorescent lighting 12 hrs day. No direct sunlight.

1.4 Records:

1.4.1 Colour stage of each fruit using the ATB scale, three times (Wednesday, Friday, Tuesday).

1.4.2 Bulk weight three times (Wednesday, Friday, Tuesday). (Efford recorded on day 0 and day 8).

1.4.3 Firmness of 20 fruit six days post harvesting using the compression tester (under 1 kg weight). <u>This test is considered destructive</u>. (Efford assessed fruit after 8 days using 5 fruit per plot).

1.4.4 Where possible additional fruit to be retained to assess the number of fruit still considered edible after 6 and 12 days. This assessment to be made on the basis of whether each fruit was acceptable to be eaten by a consumer on the day of assessment. (Efford retained five fruit from each sample and later assessed the number edible after a further period of shelf life).

1.5 Product life: (12 day test)

When harvesting permits an additional sample of minimum 20 fruit to be taken and product life assessments will be extended to span a 12 day period.

1.5.1 As previously described fruit to be harvested on Wednesday.

1.5.2 Colour assessments and bulk weights to be taken 5 times (Wednesday, Friday, Tuesday, Friday, Tuesday).

1.5.3 Compression testing on the 12th day.

2. <u>Chemical composition</u>

2.1 Sampling: Use the sample of 20 fruit compression tested after six days.

2.2 Juice extraction: Cut each fruit in half and place one half of each fruit in a strong polythene bag. (This should produce approximately 400g of fruit).

2.2.1 Seal bag securely using a heat sealer or stapler.

2.2.2 Freeze overnight in a domestic deep freeze.

2.2.3 Thaw overnight in a fridge and finish using a little hot water the following morning.

2.2.4 Wrap fruit in two layers of muslin and press in a fruit press.

2.2.5 Collect juice and centrifuge if possible.

2.2.6 Filter through glass wool.
(Efford filtered through coffee filters).

2.3 % soluble solids: Determine % soluble solids (Brix) with a 0-10% hand held refractometer at 20^{o}C.

2.4 Acidity: Dissolve 1.9g of sodium phosphate (Na_3 $PO_4.12$ H_2O) into 100 ml sample of extracted tomato sap and measure the resulting pH using a previously calibrated pH meter.

This indirect acidity measurement has been found to give results closely correlated to the more accurate titration method (Hobson & Kilby 1984).

Hobson G & Kilby P Rapid assessment of tomato composition during high quality fruit production and distribution. Acta Horticulturae 163 (1984), pp 47-54.

All titratable acidity figures quoted were obtained from the pH measurements in this way. For conversion % citric acid multiply by 0.064.

2.5 Percentage dry matter

2.5.1 Take small samples from the remaining halves of compression tested fruit to make up a 100% sample (including a representative sample of juice).

2.5.2 Dry in an oven for 48 hours at 80°C. (Efford fruit were dried for three days at 60°C and fresh weight figures compensated for weight loss during the shelf life period).

2.5.3 Cool in a desiccator.

2.5.4 Re-weight sample and calculate % dry matter.

2.6 Juice analysis (carried out at IHR)

Samples of juice from every nth composition test (depending on time and resources) to be stored in a domestic freezer in a polythene bottle and to be analysed at IHR to establish the relationship between % Brix and concentration of reducing sugars present in fruit.

3. <u>Physical characteristics</u>

Scoring systems used for tomato fruit characteristics/disorders.

A sample (20 fruit minimum where possible) were taken at random from ungraded fruit. Every replicate was recorded where possible.

Scoring system: 5-part scale 0-4. In most cases the scores will be:

0 - none

1 - very slight

2 - slight

3 - moderate

4 - severe.

Ribbing

The extent to which raised shoulders of 'ribs' are present at the calyx end of the fruit.

0 - none present, shoulder smooth

1 -

2 -

3 -

4 - shoulders severely raised and ribs prominent.

In 1987 boxiness was used as a term for general poor shape and included hollow and slabsided fruit. Assessments were made using the following scale:

The extent to which the total fruit surface area is flattened or angular:

0 - none, fruit spherical

1 -

2 -

3 -

4 - more than 75% of fruit surface area flattened to a single plane.

In 1988 assessments at Stockbridge House were made on a similar basis, although the disorder has been more accurately termed in this report as poor shape. Assessments at Efford distinguished between truly 'hollow' and simply misshapen fruit and have assessed boxiness (the severity of hollow fruits) and slabsidedness (the extent of misshapen fruits with flat or angular sides, excluding hollow fruit) as separate characteristics.

<u>Fine net cracking</u>

This is a measure of the very fine net cracking or crazing which has been particularly evident on early crops.

0 - none present

1 - up to 25% of surface area

2 - " " 50% " " "

3 - " " 75% " " "

4 - more than 75% of fruit surface area affected.

<u>Radial cracking</u>

The traditional sealed cracks which can be formed radially around the calyx late in fruit development.

0 - none present

1 - up to ¼ of fruit circumference covered in a few large cracks or several smaller cracks

2 - up to ½ fruit circumference affected

3 - up to three quarters fruit circumference affected

4 - more than three quarters fruit " "

Red noses (Efford EHS)

The extent to which the fruit is ripening in the 'nose' end of the fruit instead of evenly ripening all over.

N.B. In the 1987 work, uneven ripening included all types of uneven colouring of the fruit and not just 'red noses'.

Goldspot

The extent to which a fine peppery goldspot covers the fruit surface:

0 - very little present (no more than 5% surface area affected)

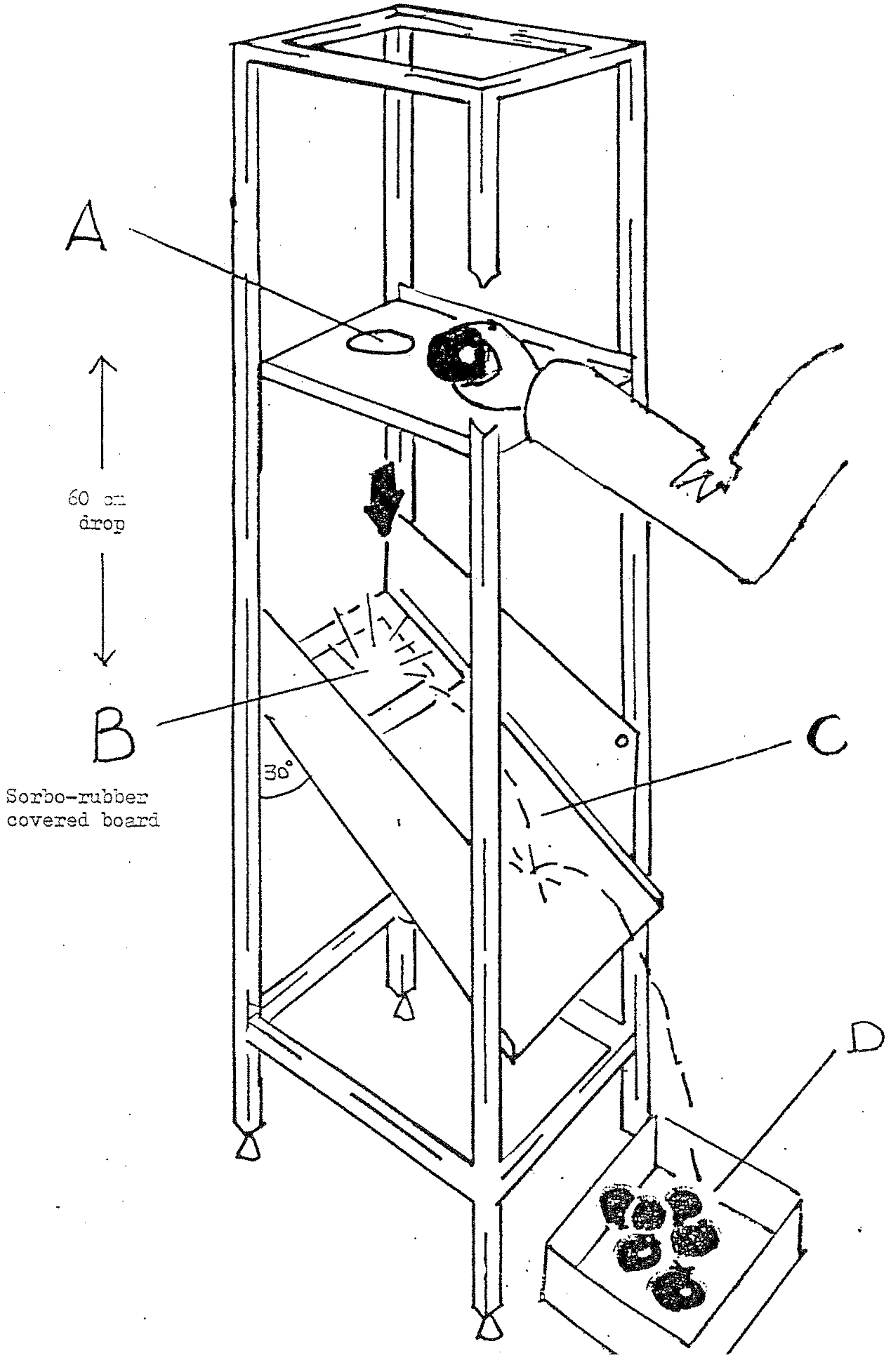
1 - up to 20% of surface area affected around calyx

2 - " " 50% " " " " " "

3 - " " 75% " " " " " "

4 - severe spotting covering more than 75% of fruit surface.

FIGURE 1



EFFORD EHS, 1987/88

VARIETY TRIAL, P-BLOCK PRODUCT LIFE

TABLE 1 SOFTNESS, compression in mm

VARIETY	WEEK 17	WEEK 33	MEAN
C: COUNTER (control)	2.90	3.94	3.42
A: CALYPSO	2.84	3.39 **	3.11
B: COMPACTO	2.70	3.64	3.17
D: CRITERIUM	2.44 **	3.64	3.04
: LM 25	3.02	3.85	3.43
J: W 704	2.63	3.43 **	3.03
K: E 17.902	2.96	3.60	3.28
L: E 17.945	2.71	3.35 **	3.03
N: RS 85042	2.83	3.50 *	3.17
P: RS 86006	3.22 *	4.05	3.63
S: W 1138	3.03	3.41 **	3.22
V: 669	2.82	3.41 **	3.12
H: 663	2.64	3.51 *	3.07
EAN	2.83	3.59	3.21
SED	.1325	.1739	
LSD	*:.274 **:.371 ***:.496	*:.353 **:.473	
SIGNIFIC.	***	**	

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EFFORD EHS

EFFORD EHS, 1987/88

VARIETY TRIAL, P-BLOCK PRODUCT LIFE

TABLE 2 COMPRESSION, %

VARIETY	WEEK 17	WEEK 33	MEAN
C: COUNTER (control)	6.50	8.43	7.46
A: CALYPSO	6.72	7.38 *	7.05
B: COMPACTO	6.25	7.85	7.05
D: CRITERIUM	5.62 *	7.75	6.68
: LM 25	7.06	8.53	7.79
J: W 704	5.88	6.92 **	6.40
K: E 17.902	6.66	7.48 *	7.07
L: E 17.945	6.52	7.19 **	6.85
N: RS 85042	6.74	7.61	7.17
P: RS 86006	7.52 **	8.56	8.04
S: W 1138	6.77	7.35 *	7.06
V: 669	6.50	7.17 **	6.83
H: 663	6.07	7.58	6.82
EAN	6.52	7.67	7.10
SED	.343	.438	
LSD	*:.708 **:.959	*:.889 **:1.191	
SIGNIFIC.	**	**	

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EFFORD EHS, 1987/88

VARIETY TRIAL, P-BLOCK PRODUCT LIFE

TABLE 3 % FRUIT WEIGHT AFTER STORAGE

VARIETY	WEEK 17	WEEK 33	MEAN
C: COUNTER (control)	96.22	94.91	95.57
A: CALYPSO	95.95	95.59	95.77
B: COMPACTO	95.74	94.56	95.15
D: CRITERIUM	95.65	95.01	95.33
F: LM 25	94.78 ***	94.88	94.83
J: W 704	96.06	95.25	95.65
K: E 17.902	96.44	96.17 *	96.31
L: E 17.945	95.83	95.25	95.54
N: RS 85042	95.07 ***	95.74	95.41
P: RS 86006	95.08 ***	93.10 **	94.09
S: W 1138	95.69	95.17	95.43
V: 669	95.77	94.19	94.98
H: 663	95.86	93.93	94.90
MEAN	95.71	94.90	95.30
SED	.2943	.553	
LSD	*:.597 **:.80 ***:1.054	*:1.122 **:1.504 ***:1.982	
SIGNIFIC.	***	***	

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EFFORD EHS, 1987/88

VARIETY TRIAL, P-BLOCK PRODUCT LIFE

TABLE 4 % DRY MATTER

VARIETY	WEEK 17	WEEK 33	MEAN
C: COUNTER (control)	5.52	5.75	5.64
A: CALYPSO	5.63	6.30 ***	5.96
B: COMPACTO	5.49	5.70	5.59
D: CRITERIUM	5.31 *	5.81	5.56
F: LM 25	5.52	5.91	5.72
J: W 704	5.39	5.68	5.53
K: E 17.902	5.44	6.10 **	5.77
L: E 17.945	5.65	6.32 ***	5.98
N: RS 85042	5.20 **	5.73	5.47
P: RS 86006	5.48	5.66	5.57
S: W 1138	5.30 *	5.62	5.46
V: 669	5.49	5.93	5.71
H: 663	5.72 *	6.18 ***	5.95
MEAN	5.47	5.90	5.69
SED	.0867	.1028	
LSD	*:.1758 **:.2357 ***:.3105	*:.2085 **:.28 ***:.368	
SIGNIFIC.	***	***	

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EFFORD EHS

EFFORD EHS, 1987/88

VARIETY TRIAL, P-BLOCK PRODUCT LIFE

TABLE 5 % SOLUBLE SOLIDS

VARIETY	WEEK 17	WEEK 33	MEAN
C: COUNTER (control)	4.91	4.83	4.87
A: CALYPSO	4.95	5.20 ***	5.07
B: COMPACTO	4.82	4.84	4.83
D: CRITERIUM	4.81	5.07 *	4.94
F: LM 25	4.89	5.01	4.95
J: W 704	4.82	4.91	4.86
K: E 17.902	4.91	5.15 **	5.03
L: E 17.945	5.09 *	5.29 ***	5.19
N: RS 85042	4.58 **	4.74	4.66
P: RS 86006	4.95	4.75	4.85
S: W 1138	4.71	4.81	4.76
V: 669	4.86	5.07 *	4.97
H: 663	5.03	5.42 ***	5.23
MEAN	4.87	5.00	4.94
SED	.0922	.0923	
LSD	*:.187 **:.2507 ***:.3303	*:.187 **:.251 ***:.3306	
SIGNIFIC.	***	***	

M.H.CHRISTENSEN
EFFORD EHS

EFFORD EHS, 1987/88

VARIETY TRIAL, P-BLOCK PRODUCT LIFE

TABLE 6 ACIDITY, pH

VARIETY	WEEK 17	WEEK 33	MEAN
C: COUNTER (control)	8.98	9.58	9.28
A: CALYPSO	7.50 ***	8.43 ***	7.96
B: COMPACTO	8.33 **	9.19 *	8.76
D: CRITERIUM	8.28 **	9.60	8.94
F: LM 25	7.68 ***	9.23	8.45
J: W 704	8.35 **	9.21	8.78
K: E 17.902	8.05 ***	9.28	8.66
L: E 17.945	7.38 ***	8.55 ***	7.96
N: RS 85042	8.18 **	9.00 *	8.59
P: RS 86006	8.63	9.51	9.07
S: W 1138	8.48 *	9.55	9.01
V: 669	7.95 ***	8.84 ***	8.39
H: 663	7.98 ***	8.96 **	8.47
MEAN	8.13	9.15	8.64
SED	.228	.188	
LSD	*:.462 **:.620 ***:.8166	*:.381 **:.511 ***:.673	
SIGNIFIC.	***	***	

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A>EFFORD EHS, 1987/88

VARIETY TRIAL, P-BLOCK PRODUCT LIFE

TABLE 7 ACIDITY - converted to titratable acidity (mEq/100 ml Sap)

VARIETY	WEEK 17	WEEK 33	MEAN
C: COUNTER (control)	5.40	4.80	5.10
A: CALYPSO	8.10	6.20	7.15
B: COMPACTO	6.40	5.20	5.80
D: CRITERIUM	6.40	4.80	5.60
F: LM 25	7.60	5.20	6.40
J: W 704	6.30	5.20	5.75
K: E 17.902	6.80	5.10	5.95
L: E 17.945	8.40	5.90	7.15
N: RS 85042	6.50	5.40	5.95
P: RS 86006	5.90	4.90	5.40
S: W 1138	6.00	4.80	5.40
V: 669	7.00	5.60	6.30
H: 663	6.90	5.40	6.15
MEAN	6.75	5.27	6.01

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VARIETY TRIAL, P-BLOCK   PRODUCT LIFE

TABLE 8   INEDIBLE, no of fruits out of 5

VARIETY	WEEK 17	WEEK 33	MEAN
C: COUNTER (control)	1.75	1.25	1.50
A: CALYPSO	2.25	.25	1.25
B: COMPACTO	1.25	1.00	1.13
D: CRITERIUM	3.00	.83	1.92
: LM 25	3.75 *	1.17	2.46
J: W 704	3.00	.25	1.63
K: E 17.902	2.00	.75	1.38
L: E 17.945	4.50 *	.75	2.63
N: RS 85042	2.25	.00	1.13
P: RS 86006	4.50 *	2.13	3.31
S: W 1130	2.25	.25	1.25
V: 669	3.00	.25	1.63
H: 663	2.50	1.00	1.75
EAN	2.77	.76	1.76
SED	.92	.711	
LSD	*:1.865	-	
SIGNIFIC.	*	n.s.	

NOTE: WEEK 17: AFTER 13 DAYS
WEEK 33: AFTER 9 DAYS

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EFFORD EHS, 1987/88

VARIETY TRIAL, P-BLOCK PHYSICAL APPEARANCE

TABLE 9 BOXINESS, SCORE (0-4)

VARIETY	WEEK 16	WEEK 27	WEEK 32	MEAN
C: COUNTER (control)	0	0	0	.00
A: CALYPSO	.1	0	0	.03
B: COMPACTO	.15	0	0	.05
D: CRITERIUM	.15	0	0	.05
F: LM 25	.05	0	0	.02
J: W 704	.15	0	0	.05
K: E 17.902	0	0	0	.00
L: E 17.945	0	0	0	.00
N: RS 85042	0	0	0	.00
P: RS 86006	.1	0	0	.03
S: W 1138	.15	0	0	.05
V: 669	.15	0	0	.05
H: 663	0	0	0	.00
MEAN	.08	.00	.00	.03
SED	.118	-	-	
LSD	-	-	-	
SIGNIFIC.	n.s.	-	-	

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VARIETY TRIAL, P-BLOCK PHYSICAL APPEARANCE

TABLE 10 SLABSIDEDNESS, SCORE (0-4)

VARIETY	WEEK 16	WEEK 27	WEEK 32	MEAN
C: COUNTER (control)	.2	.2	.25	.22
A: CALYPSO	.2	.05	.2	.15
B: COMPACTO	.15	.15	.25	.18
D: CRITERIUM	.3	0	.35	.22
F: LM 25	.15	.25	.35	.25
J: W 704	.25	.1	.55	.30
K: E 17.902	0	.2	.1	.10
L: E 17.945	.5	.15	.55	.40
N: RS 85042	0	0	.15	.05
P: RS 86006	.35	.1	.25	.23
S: W 1138	.2	0	.55	.25
V: 669	.05	0	.05	.03
H: 663	.15	.65 **	.75	.52
MEAN	.19	.14	.33	.22
SED	.1949	.1413	.2336	
LSD	-	*:.2865 **:.3841	-	
SIGNIFIC.	n.s.	**	n.s.	

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VARIETY TRIAL, P-BLOCK PHYSICAL APPEARANCE

TABLE 11 RIBBING , SCORE (0-4)

VARIETY	WEEK 16	WEEK 27	WEEK 32	MEAN
C: COUNTER (control)	1.2	.45	.45	.70
A: CALYPSO	1.05	.35	.25	.55
B: COMPACTO	.9 *	.45	.4	.58
D: CRITERIUM	1.6 **	1.05 **	.9 *	1.18
F: LM 25	.8 **	.25	.25	.43
J: W 704	.95	.25	.25	.48
K: E 17.902	1.1	.3	.2	.53
L: E 17.945	1.25	.8	.3	.78
N: RS 85042	.9 *	.7	.3	.63
P: RS 86006	1.15	.7	.5	.78
S: W 1138	1.1	.4	.15	.55
V: 669	1.25	.3	.45	.67
H: 663	.85 *	.65	.4	.63
MEAN	1.08	.51	.37	.66
SED	.1416	.1901	.1812	
LSD	*:.2871 **:.385 ***:.507	*:.385 **:.5168	*:.3674	
SIGNIFIC.	***	**	*	

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VARIETY TRIAL, P-BLOCK PHYSICAL APPEARANCE

TABLE 12 BLOTCHY RIPENING, SCORE (0-4)

VARIETY	WEEK 16	WEEK 27	WEEK 32	MEAN
C: COUNTER (control)	.4	1.8	1.05	1.08
A: CALYPSO	.5	.85 *	1	.78
B: COMPACTO	.15	2.25	.5	.97
D: CRITERIUM	.25	1.3	1.1	.88
F: LM 25	.65	1.3	.6	.85
J: W 704	0 *	1.55	.05 *	.53
K: E 17.902	.35	2.25	1.3	1.30
L: E 17.945	.2	1.25	.75	.73
N: RS 85042	0 *	1.65	1.4	1.02
P: RS 86006	.15	2.05	1.1	1.10
S: W 1138	.2	1.15	.4	.58
V: 669	.4	1.4	1.35	1.05
H: 663	.1	2.2	2 *	1.43
MEAN	.26	1.62	.97	.95
SED	.167	.397	.435	
LSD	*:0.338	*:0.805	*:0.883 **:1.183	
SIGNIFIC.	*	*	**	

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VARIETY TRIAL, P-BLOCK PHYSICAL APPEARANCE

TABLE 13 RADIAL CRACKING, SCORE (0-4)

VARIETY	WEEK 16	WEEK 27	WEEK 32	MEAN
C: COUNTER (control)	0	1.15	1.2	.78
A: CALYPSO	.15	.9	.7	.58
B: COMPACTO	.4 **	1.25	1.55	1.07
D: CRITERIUM	0	1.25	1.6	.95
F: LM 25	.2	.3	.7	.40
J: W 704	.05	1.6	1.35	1.00
K: E 17.902	.05	.75	.8	.53
L: E 17.945	.15	1.35	1.05	.85
N: RS 85042	0	1.2	.9	.70
P: RS 86006	.4 **	1.35	1.55	1.10
S: W 1138	.05	1.2	1.55	.93
V: 669	.35 *	1.45	1.65	1.15
H: 663	.2	1.75	1.05	1.00
MEAN	.15	1.19	1.20	.85
SED	.125	.3924	.3489	
LSD	*:.2535 **:.3399	-	*:.7075	
SIGNIFIC.	**	n.s.	*	

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EFFORD EHS, 1987/88

VARIETY TRIAL, P-BLOCK PHYSICAL APPEARANCE

TABLE 14 NETTING, SCORE (0-4)

VARIETY	WEEK 16	WEEK 27	WEEK 32	MEAN
C: COUNTER (control)	.15	.3	.9	.45
A: CALYPSO	.65	.25	.55	.48
B: COMPACTO	.35	.95	1.5	.93
D: CRITERIUM	.65	.3	2.1 *	1.02
F: LM 25	.4	.3	1.35	.68
J: W 704	.05	.6	1.25	.63
K: E 17.902	.3	.3	.8	.47
L: E 17.945	.6	.9	.95	.82
N: RS 85042	.3	1.05	1	.78
P: RS 86006	.45	.65	1.75 *	.95
S: W 1138	.15	.35	.9	.47
V: 669	.8	.65	1.4	.95
H: 663	.35	1	1.1	.82
MEAN	.40	.58	1.20	.73
SED	.2472	.3069	.4025	
LSD	-	-	*:.8162	
SIGNIFIC.	n.s.	n.s.+ (P=0.056)	*	

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EFFORD EHS, 1987/88

VARIETY TRIAL, P-BLOCK PHYSICAL APPEARANCE

TABLE 15 GOLD SPOTS, SCORE (0-4)

VARIETY	WEEK 16	WEEK 27	WEEK 32	MEAN
C: COUNTER (control)	1.75	2.2	2.5	2.15
A: CALYPSO	.8 *	1.55	1.8	1.38
B: COMPACTO	.9 *	1.85	2.35	1.70
D: CRITERIUM	1.05	1.2 **	2.15	1.47
F: LM 25	2.05	2.3	2.2	2.18
J: W 704	.4 **	.7 ***	2.6	1.23
K: E 17.902	1.3	1.35 *	2.3	1.65
L: E 17.945	.75 *	1.55	1.85	1.38
N: RS 85042	1.3	2.45	1.9	1.88
P: RS 86006	.65 *	1.4 *	1.7	1.25
S: W 1138	1.8	1.7	2.65	2.05
V: 669	1.2	1.35 *	2.05	1.53
H: 663	.85 *	1.9	2.25	1.67
MEAN	1.14	1.65	2.18	1.66
SED	.4056	.3456	.4675	
LSD	*:.823 **:1.103	*:.701 **:.940 ***:1.238	-	
SIGNIFIC.	**	***	n.s.	

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F-BLOCK QUALITY 1989

EFFORD EHS
PRODUCT LIFE

Table 16

FIRMNESS mm

		WEEK 13	WEEK 21	WEEK 27	MEAN
BLUEP./BLUEP.	CALYPSO	3.55	2.98	3.22	3.25
	COUNTER	3.31	3.06	3.25	3.20
	CRITERIUM	3.40	2.94	2.90	3.08
BLUEP./DUTCH	CALYPSO	3.39	3.59	3.45	3.48
	COUNTER	3.62	3.15	3.57	3.45
	CRITERIUM	3.24	2.81	2.90	2.98
DUTCH/BLUEP.	CALYPSO	3.91	3.50	3.23	3.55
	COUNTER	3.69	3.09	3.08	3.29
	CRITERIUM	3.68	2.83	3.00	3.17
DUTCH/DUTCH	CALYPSO	3.78	3.50	3.29	3.52
	COUNTER	3.62	3.48	3.17	3.42
	CRITERIUM	3.53	2.65	3.14	3.11
MEAN	BLUEP./BLUEP.	3.42	2.99	3.12	3.18
	BLUEP./DUTCH	3.41	3.18	3.31	3.30
	DUTCH/BLUEP.	3.76	3.14	3.10	3.33
	DUTCH/DUTCH	3.64	3.21	3.20	3.35
EARLY TEMP.	BLUEPRINT	3.42 c.	3.09		
	DUTCH	3.70 **	3.18		
LATE TEMP.	BLUEPRINT		3.07	3.11	
	DUTCH		3.20	3.25	
VARIETIES	CALYPSO	3.66	3.39	3.29	3.45
	COUNTER	3.56	3.20	3.27	3.34
	CRITERIUM	3.46	2.81	2.98	3.08
GRAND MEAN		3.56	3.13	3.18	3.29

STATISTICS:

TEMPERATURE	SED.(5df/3df)	.053		.1403	
	SIGNIFIC.	**		n.s.	
VARIETY	SED.(12df/9df)	.0738		.1159	
	SIGNIFIC.	n.s.		n.s* (P=0.050)	

*) statistics not possible in week 21 because of insufficient data

M.H.CHRISTENSEN
EFFORD EHS 1988

F-BLOCK QUALITY 1988

EFFORD EHS
PRODUCT LIFE
Table 17 COMPRESSION %

		WEEK 13	WEEK 21	WEEK 27	MEAN
BLUEP./BLUEP.	CALYPSO	8.29	6.86	6.79	7.31
	COUNTER	7.62	6.81	6.79	7.07
	CRITERIUM	7.87	6.29	6.25	6.80
BLUEP./DUTCH	CALYPSO	7.90	8.02	7.62	7.85
	COUNTER	8.24	6.74	7.73	7.57
	CRITERIUM	7.39	6.17	6.13	6.56
DUTCH/BLUEP.	CALYPSO	9.18	7.88	6.93	7.99
	COUNTER	8.74	6.99	6.46	7.40
	CRITERIUM	8.60	6.25	6.23	7.03
DUTCH/DUTCH	CALYPSO	9.19	8.37	6.98	8.18
	COUNTER	8.46	8.08	6.81	7.78
	CRITERIUM	8.41	6.08	6.69	7.06
MEAN	BLUEP./BLUEP.	7.93	6.65	6.61	7.06
	BLUEP./DUTCH	7.84	6.98	7.16	7.33
	DUTCH/BLUEP.	8.84	7.04	6.54	7.47
	DUTCH/DUTCH	8.69	7.51	6.82	7.67
EARLY TEMP.	BLUEPRINT	7.88 c.	6.82		
	DUTCH	8.76 **	7.28		
LATE TEMP.	BLUEPRINT		6.85	6.57	
	DUTCH		7.24	6.99	
VARIETIES	CALYPSO	8.64	7.78	7.08	7.83
	COUNTER	8.26	7.16	6.95 c.	7.45
	CRITERIUM	8.07	6.20	6.32 *	6.86
GRAND MEAN		8.32	7.05	6.78	7.38

STATISTICS:

		WEEK 13	WEEK 21	WEEK 27	MEAN
TEMPERATURE	SED.(5df/3df)	.2001		.317	
	SIGNIFIC.	**		n.s.	
VARIETY	SED.(12df/8df)	.2254		.251	
	SIGNIFIC.	n.s.		*	

*) statistics not possible in week 21
because of insufficient data

M.R.CHRISTENSEN
EFFORD EHS 1988

F-BLOCK QUALITY 1988

EFFORD EHS
PRODUCT LIFE
Table 18

% FRUIT WEIGHT after shelf life

		WEEK 13	WEEK 21	WEEK 27	MEAN
BLUEP./BLUEP.	CALYPSO	93.13	94.54	95.14	94.27
	COUNTER	93.87	95.71	95.89	95.16
	CRITERIUM	93.57	94.29	94.93	94.26
BLUEP./DUTCH	CALYPSO	94.06	94.39	93.02	93.82
	COUNTER	94.47	95.60	94.20	94.76
	CRITERIUM	93.65	95.28	94.52	94.48
DUTCH/BLUEP.	CALYPSO	93.13	93.45	94.76	93.78
	COUNTER	93.99	94.79	95.81	94.86
	CRITERIUM	93.16	94.38	94.72	94.09
DUTCH/DUTCH	CALYPSO	93.51	93.11	92.84	93.15
	COUNTER	94.49	94.57	94.92	94.66
	CRITERIUM	93.59	93.85	93.04	93.49
MEAN	BLUEP./BLUEP.	93.53	94.85	95.32	94.56
	BLUEP./DUTCH	94.06	95.09	93.91	94.35
	DUTCH/BLUEP.	93.42	94.21	95.10	94.24
	DUTCH/DUTCH	93.86	93.84	93.60	93.77
EARLY TEMP.	BLUEPRINT	93.79	94.97		
	DUTCH	93.64	94.02		
LATE TEMP.	BLUEPRINT		94.53	95.21 c.	
	DUTCH		94.47	93.76 *	
VARIETIES	CALYPSO	93.46 ***	93.87 **	93.94 **	93.76
	COUNTER	94.21 c.	95.17 c.	95.20 c.	94.86
	CRITERIUM	93.49 ***	94.45 *	94.30 **	94.08
GRAND MEAN		93.72	94.50	94.48	94.23

STATISTICS:

TEMPERATURE	SED.(5df/3df)	.3223	.5255	.3793
	SIGNIFIC.	n.s.	n.s.	*
VARIETY	SED.(12df/8df)	.1505	.2224	.1952
	SIGNIFIC.	***	**	***

N.H.CHRISTENSEN
EFFORD EHS 1988

F-BLOCK QUALITY 1988

EFFORD EHS
PRODUCT LIFE

Table 19 % DRY MATTER

		WEEK 13	WEEK 21	WEEK 27	MEAN
BLUEP./BLUEP.	CALYPSO	5.09	5.76	5.80	5.55
	COUNTER	4.91	5.57	5.87	5.45
	CRITERIUM	4.77	5.42	5.47	5.22
BLUEP./DUTCH	CALYPSO	5.03	6.00	6.15	5.72
	COUNTER	5.03	5.71	5.75	5.50
	CRITERIUM	4.80	5.43	5.58	5.27
DUTCH/BLUEP.	CALYPSO	5.23	5.59	5.82	5.55
	COUNTER	5.10	5.45	5.49	5.34
	CRITERIUM	5.14	5.53	5.43	5.37
DUTCH/DUTCH	CALYPSO	5.27	5.90	6.07	5.75
	COUNTER	4.92	5.66	5.68	5.42
	CRITERIUM	5.04	5.35	5.82	5.40
MEAN	BLUEP./BLUEP.	4.92	5.59	5.71	5.41
	BLUEP./DUTCH	4.95	5.71	5.83	5.50
	DUTCH/BLUEP.	5.16	5.52	5.58	5.42
	DUTCH/DUTCH	5.08	5.64	5.86	5.52
EARLY TEMP.	BLUEPRINT	4.94 c.	5.65		
	DUTCH	5.12 *	5.58		
LATE TEMP.	BLUEPRINT		5.55	5.64 c.	
	DUTCH		5.67	5.84 *	
VARIETIES	CALYPSO	5.15 **	5.81 *	5.96 *	5.64
	COUNTER	4.99 c.	5.60 c.	5.76 c.	5.43
	CRITERIUM	4.94	5.43 *	5.57	5.31
GRAND MEAN		5.03	5.61	5.74	5.46

STATISTICS:

TEMPERATURE	SED.(5df/3df)	.0495	.0464	.0439
	SIGNIFIC.	*	n.s.	*
VARIETY	SED.(12df/8df)	.0503	.0678	.1024
	SIGNIFIC.	**	**	*

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EFFORD EHS 1988

F-BLOCK QUALITY 1988

EFFORD EHS
PRODUCT LIFE
Table 20 % SOLUBLE SOLIDS

		WEEK 13	WEEK 21	WEEK 27	MEAN
BLUEP./BLUEP.	CALYPSO	4.75	4.60	4.75	4.70
	COUNTER	4.55	4.28	4.60	4.48
	CRITERIUM	4.35	4.43	4.43	4.40
BLUEP./DUTCH	CALYPSO	4.65	4.55	5.08	4.76
	COUNTER	4.55	4.28	4.60	4.48
	CRITERIUM	4.58	4.20	4.68	4.48
DUTCH/BLUEP.	CALYPSO	4.85	4.58	4.78	4.73
	COUNTER	4.70	4.35	4.55	4.53
	CRITERIUM	4.75	4.50	4.40	4.55
DUTCH/DUTCH	CALYPSO	4.80	4.73	4.98	4.83
	COUNTER	4.55	4.33	4.58	4.48
	CRITERIUM	4.60	4.23	4.80	4.54
MEAN	BLUEP./BLUEP.	4.55	4.43	4.59	4.53
	BLUEP./DUTCH	4.59	4.34	4.78	4.57
	DUTCH/BLUEP.	4.77	4.48	4.58	4.61
	DUTCH/DUTCH	4.65	4.43	4.78	4.62
EARLY TEMP.	BLUEPRINT	4.57	4.39 c.		
	DUTCH	4.71	4.45 *		
LATE TEMP.	BLUEPRINT		4.45 c.	4.58 c.	
	DUTCH		4.38 *	4.78 ***	
VARIETIES	CALYPSO	4.76 **	4.61 ***	4.89 *	4.76
	COUNTER	4.59 c.	4.31 c.	4.58 c.	4.49
	CRITERIUM	4.57	4.34	4.58	4.49
GRAND MEAN		4.64	4.42	4.68	4.58

STATISTICS:

TEMPERATURE	SED.(5df/3df)	.0554	.0172	.0144
	SIGNIFIC.	n.s.	*	***
VARIETY	SED.(12df/8df)	.0448	.0508	.0927
	SIGNIFIC.	**	***	*

INTERACTION *:latetemp/var

M.H.CHRISTENSEN
EFFORD EHS 1988

F-BLOCK QUALITY 1988

EFFORD EHS
PRODUCT LIFE
Table 21 ACIDITY pH

		WEEK 13	WEEK 21	WEEK 27	MEAN
BLUEP./BLUEP.	CALYPSO	7.55	8.05	8.30	7.97
	COUNTER	7.60	9.15	9.30	8.68
	CRITERIUM	8.80	8.85	9.40	9.02
BLUEP./DUTCH	CALYPSO	7.55	8.20	8.20	7.98
	COUNTER	7.85	9.25	9.00	8.70
	CRITERIUM	8.10	9.25	9.35	8.90
DUTCH/BLUEP.	CALYPSO	7.80	8.50	8.15	8.15
	COUNTER	7.90	8.70	9.25	8.62
	CRITERIUM	8.40	9.05	9.75	9.07
DUTCH/DUTCH	CALYPSO	7.65	8.50	8.65	8.27
	COUNTER	8.10	9.30	9.45	8.95
	CRITERIUM	8.00	9.05	8.75	8.60
MEAN	BLUEP./BLUEP.	7.98	8.68	9.00	8.56
	BLUEP./DUTCH	7.83	8.90	8.85	8.53
	DUTCH/BLUEP.	8.03	8.75	9.05	8.61
	DUTCH/DUTCH	7.92	8.95	8.95	8.61
EARLY TEMP.	BLUEPRINT	7.91	8.79		
	DUTCH	7.98	8.85		
LATE TEMP.	BLUEPRINT		8.72	9.03	
	DUTCH		8.93	8.90	
VARIETIES	CALYPSO	7.64	8.31 **	8.33 **	8.09
	COUNTER	7.86 c.	9.10 c.	9.25 c.	8.74
	CRITERIUM	8.33 *	9.05	9.31	8.90
GRAND MEAN		7.94	8.82	8.96	8.58

STATISTICS:

TEMPERATURE	SED.(5df/3df)	.1031	.2097	.1838
	SIGNIFIC.	n.s.	n.s.	n.s.
VARIETY	SED.(12df/8df)	.1583	.1806	.2089
	SIGNIFIC.	**	**	**

M.H.CHRISTENSEN
EFFORD EHS 1988

F-BLOCK QUALITY 1988

EFFORD EHS
PRODUCT LIFE

Table 22

ACIDITY - converted to titratable acidity (mEq/100 ml Sap)

		WEEK 13	WEEK 21	WEEK 27	MEAN
BLUEP./BLUEP.	CALYPSO	7.90	6.80	6.40	7.03
	COUNTER	7.80	5.20	5.10	6.03
	CRITERIUM	5.60	5.50	5.00	5.37
BLUEP./DUTCH	CALYPSO	7.90	6.50	6.50	6.97
	COUNTER	7.20	5.10	5.40	5.90
	CRITERIUM	6.70	5.10	5.05	5.62
DUTCH/BLUEP.	CALYPSO	7.40	6.00	6.60	6.67
	COUNTER	7.10	5.80	5.10	6.00
	CRITERIUM	6.20	5.30	4.60	5.37
DUTCH/DUTCH	CALYPSO	7.70	6.00	5.80	6.50
	COUNTER	6.70	5.10	4.90	5.57
	CRITERIUM	6.90	5.30	5.70	5.97
MEAN	BLUEP./BLUEP.	7.10	5.83	5.50	6.14
	BLUEP./DUTCH	7.27	5.57	5.65	6.16
	DUTCH/BLUEP.	6.90	5.70	5.43	6.01
	DUTCH/DUTCH	7.10	5.47	5.47	6.01
EARLY TEMP.	BLUEPRINT	7.18	5.78		
	DUTCH	7.00	5.58		
LATE TEMP.	BLUEPRINT		5.77	5.47	
	DUTCH		5.52	5.56	
VARIETIES	CALYPSO	7.73	6.33	6.33	6.79
	COUNTER	7.20	5.30	5.13	5.88
	CRITERIUM	6.35	5.30	5.09	5.58
GRAND MEAN		7.09	5.64	5.51	6.08

M.H.CHRISTENSEN
EFFORD EHS 1988

F-BLOCK QUALITY 1988

EFFORD EHS
PRODUCT LIFE
Table 23

INEDIBLE number of fruits out of 5 after 14 days shelf life

		WEEK 13	WEEK 21	WEEK 27	MEAN
BLUEP./BLUEP.	CALYPSO	4.50	4.50	2.00	3.67
	COUNTER	4.00	3.00	1.50	2.83
	CRITERIUM	4.00	3.00	1.00	2.67
BLUEP./DUTCH	CALYPSO	4.50	4.50	3.00	4.00
	COUNTER	3.00	4.00	3.00	3.33
	CRITERIUM	4.00	4.00	1.50	3.17
DUTCH/BLUEP.	CALYPSO	5.00	5.20	1.50	3.90
	COUNTER	3.50	4.50	2.50	3.50
	CRITERIUM	3.50	3.50	2.50	3.17
DUTCH/DUTCH	CALYPSO	4.00	5.00	4.50	4.50
	COUNTER	2.50	5.00	2.50	3.33
	CRITERIUM	3.50	4.50	3.00	3.67
MEAN	BLUEP./BLUEP.	4.17	3.50	1.50	3.06
	BLUEP./DUTCH	3.83	4.17	2.50	3.50
	DUTCH/BLUEP.	4.00	4.40	2.17	3.52
	DUTCH/DUTCH	3.33	4.83	3.33	3.83
EARLY TEMP.	BLUEPRINT	4.00	3.83		
	DUTCH	3.67	4.62		
LATE TEMP.	BLUEPRINT		3.95	1.83	
	DUTCH		4.50	2.92	
VARIETIES	CALYPSO	4.50	4.80	2.75	4.02
	COUNTER	3.25	4.13	2.38	3.25
	CRITERIUM	3.75	3.75	2.00	3.17
GRAND MEAN		3.83	4.23	2.38	3.48

STATISTICS:

TEMPERATURE	SED.(5df/3df)	.523	.315	.498
	SIGNIFIC.	n.s.	n.s.	n.s.
VARIETY	SED.(12df/8df)	.5	.577	.685
	SIGNIFIC.	n.s.	n.s.	n.s.

M.H.CHRISTENSEN
EFFORD EHS 1988

F-BLOCK QUALITY 1988

EFFORD EHS
PHYSICAL APPEARENCE
Table 24

BOXINESS, score(0-4)

		WEEK 12	WEEK 15	WEEK 20	WEEK 25	WEEK 34	MEAN
BLUEP./BLUEP.	CALYPSO	.10	.00	.00	.00	.00	.02
	COUNTER	.20	.00	.20	.00	.00	.04
	CRITERIUM	.50	.00	.23	.09	.00	.16
BLUEP./DUTCH	CALYPSO	.00	.00	.00	.00	.00	.00
	COUNTER	.60	.00	.00	.00	.00	.12
	CRITERIUM	.40	.00	.46	.00	.00	.17
DUTCH/BLUEP.	CALYPSO	.10	.00	.19	.00	.00	.06
	COUNTER	.20	.00	.13	.00	.00	.07
	CRITERIUM	.80	.10	.55	.00	.00	.29
DUTCH/DUTCH	CALYPSO	.20	.00	.00	.00	.00	.04
	COUNTER	.30	.00	.00	.00	.00	.06
	CRITERIUM	.30	.20	.63	.00	.00	.23
MEAN	BLUEP./BLUEP.	.27	.00	.08	.03	.00	.07
	BLUEP./DUTCH	.33	.00	.15	.00	.00	.10
	DUTCH/BLUEP.	.37	.03	.29	.00	.00	.14
	DUTCH/DUTCH	.27	.07	.21	.00	.00	.11
EARLY TEMP.	BLUEPRINT	.30	.00	.11	.01		
	DUTCH	.32	.05	.25	.00		
LATE TEMP.	BLUEPRINT			.18	.01	.00	
	DUTCH			.18	.00	.00	
VARIETIES	CALYPSO	.10	.00	.05	.00	.00	.03
	COUNTER	.33 c.	.00	.03 c.	.00	.00	.07
	CRITERIUM	.50	.08	.37 **	.02	.00	.21
GRAND MEAN		.31	.03	.18	.01	.00	.10

STATISTICS:

		WEEK 12	WEEK 20
TEMPERATURE	SED.(5df/3df)	.0453	.1016
	SIGNIFIC.	n.s	n.s.
VARIETY	SED.(12df/8df)	.1124	.1119
	SIGNIFIC.	*	**

no statistics in week 15, 25 and 34

M.H.CHRISTENSEN
EFFORD EHS 1988

F-BLOCK QUALITY 1988

EFFORD EHS
PHYSICAL APPEARENCE
Table 25 SLABSIDED, score (0-4)

		WEEK 12	WEEK 15	WEEK 20	WEEK 25	WEEK 34	MEAN
BLUEP./BLUEP.	CALYPSO	.00	.20	.19	.00	.20	.12
	COUNTER	.00	.20	.00	.00	.80	.20
	CRITERIUM	.00	.10	.75	.67	.80	.46
BLUEP./DUTCH	CALYPSO	.00	.40	.00	.17	.00	.11
	COUNTER	.00	.00	.43	.34	.60	.27
	CRITERIUM	.00	.60	.36	.34	.60	.38
DUTCH/BLUEP.	CALYPSO	.00	.40	.39	.09	.40	.25
	COUNTER	.00	.20	.45	.42	1.70	.55
	CRITERIUM	.00	.30	.69	.25	.50	.35
DUTCH/DUTCH	CALYPSO	.00	.40	.10	.09	.10	.14
	COUNTER	.00	.20	.51	.34	.60	.33
	CRITERIUM	.00	.20	.66	.09	.20	.23
MEAN	BLUEP./BLUEP.	.00	.17	.31	.22	.60	.26
	BLUEP./DUTCH	.00	.33	.26	.28	.40	.25
	DUTCH/BLUEP.	.00	.30	.51	.25	.87	.39
	DUTCH/DUTCH	.00	.27	.43	.17	.30	.23
EARLY TEMP.	BLUEPRINT	.00	.25	.29	.25		
	DUTCH	.00	.28	.47	.21		
LATE TEMP.	BLUEPRINT			.41	.24	.73	
	DUTCH			.34	.22	.35	
VARIETIES	CALYPSO	.00	.35	.17	.08	.18	.16
	COUNTER	.00	.15	.35	.27	.93	.34
	CRITERIUM	.00	.30	.62	.33	.53	.35
GRAND MEAN		.00	.27	.38	.23	.54	.28

STATISTICS:

		WEEK 15	WEEK 20	WEEK 25	WEEK 34
TEMPERATURE	SED.(5df/3df)	.0558	.0664	.1481	.381
	SIGNIFIC.	n.s	n.s.	n.s.	n.s.
VARIETY	SED.(12df/8df)	.1041	.1623	.1143	.308
	SIGNIFIC.	n.s	n.s.	n.s.	n.s.

M.H.CHRISTENSEN
EFFORD EHS 1988

F-BLOCK QUALITY 1988

EFFORD EHS
PHYSICAL APPEARENCE
Table 26 RIBBING, score (0-4)

		WEEK 12	WEEK 15	WEEK 20	WEEK 25	WEEK 34	MEAN
BLUEP./BLUEP.	CALYPSO	.40	.80	.71	.50	.30	.54
	COUNTER	1.10	1.00	1.00	.50	.50	.84
	CRITERIUM	1.30	1.20	1.94	1.25	.60	1.26
BLUEP./DUTCH	CALYPSO	1.40	.70	.84	.67	.60	.84
	COUNTER	1.50	1.20	.93	.42	.60	.93
	CRITERIUM	1.90	1.30	1.46	1.50	1.00	1.43
DUTCH/BLUEP.	CALYPSO	1.10	.90	1.21	.75	.30	.85
	COUNTER	1.10	1.50	1.13	.92	.80	1.09
	CRITERIUM	1.70	1.60	2.10	1.59	1.30	1.66
DUTCH/DUTCH	CALYPSO	.60	1.00	.98	1.17	.60	.87
	COUNTER	1.30	1.00	1.04	1.17	.60	1.02
	CRITERIUM	1.50	1.60	1.84	1.59	1.50	1.60
MEAN	BLUEP./BLUEP.	.93	1.00	1.22	.78	.47	.88
	BLUEP./DUTCH	1.60	1.07	1.08	.86	.73	1.07
	DUTCH/BLUEP.	1.30	1.33	1.48	1.09	.80	1.20
	DUTCH/DUTCH	1.13	1.20	1.28	1.31	.90	1.16
EARLY TEMP.	BLUEPRINT	1.27	1.03	1.15	.82		
	DUTCH	1.22	1.27	1.38	1.20		
LATE TEMP.	BLUEPRINT			1.35	.93	.63	
	DUTCH			1.18	1.08	.82	
VARIETIES	CALYPSO	.88 *	.85	.93	.77	.45	.78
	COUNTER	1.25 c.	1.18 c.	1.02 c.	.77 c.	.63 c.	.97
	CRITERIUM	1.60 *	1.43	1.83 ***	1.48 **	1.10 *	1.49
GRAND MEAN		1.24	1.15	1.26	1.01	.73	1.08

STATISTICS:

TEMPERATURE	SED.(5df/3df)	.2335	.1	.1117	.177	.1912
	SIGNIFIC.	n.s	n.s	n.s.	n.s.	n.s.
VARIETY	SED.(12df/8df)	.1409	.1893	.157	.1836	.1458
	SIGNIFIC.	***	*	***	**	**

M.H.CHRISTENSEN
EFFORD EHS 1988

F-BLOCK QUALITY 1988

EFFORD EHS
PHYSICAL APPEARENCE
Table 27 BLOTCHY RIPENING, score (0-4)

		WEEK 12	WEEK 15	WEEK 20	WEEK 25	WEEK 34	MEAN
BLUEP./BLUEP.	CALYPSO	.20	.40	.71	.50	.00	.36
	COUNTER	.10	.00	.93	2.50	1.30	.97
	CRITERIUM	.30	.50	.43	.34	.50	.41
BLUEP./DUTCH	CALYPSO	.10	.10	.06	1.67	.20	.43
	COUNTER	.10	.20	.38	1.59	1.10	.67
	CRITERIUM	.20	.20	.06	.25	.00	.14
DUTCH/BLUEP.	CALYPSO	.30	1.00	.54	.84	.30	.59
	COUNTER	.80	.40	1.33	2.75	1.00	1.26
	CRITERIUM	.10	.20	.00	1.42	.40	.42
DUTCH/DUTCH	CALYPSO	.00	1.20	1.14	.58	.00	.59
	COUNTER	.30	.70	.06	1.08	.30	.49
	CRITERIUM	.10	1.00	.00	.17	.00	.25
MEAN	BLUEP./BLUEP.	.20	.30	.69	1.11 c.	.60	.58
	BLUEP./DUTCH	.13	.17	.17	1.17	.43	.41
	DUTCH/BLUEP.	.40	.53	.62	1.67 **	.57	.76
	DUTCH/DUTCH	.13	.97	.40	.61 **	.10	.44
EARLY TEMP.	BLUEPRINT	.17	.23	.43	1.14		
	DUTCH	.27	.75	.51	1.14		
LATE TEMP.	BLUEPRINT			.65 c.	1.39 c.	.58	
	DUTCH			.28 *	.89 **	.27	
VARIETIES	CALYPSO	.15	.68	.61	.90 ***	.13 *	.49
	COUNTER	.33	.33	.67 c.	1.98 c.	.93 c.	.85
	CRITERIUM	.18	.48	.12 *	.54 ***	.23 *	.31
GRAND MEAN		.22	.49	.47	1.14	.43	.55

STATISTICS:

TEMPERATURE	SED.(5df/3df)	.1095	.2509	.0991	.0547	.191
	SIGNIFIC.	n.s	n.s	*	**	n.s.
VARIETY	SED.(12df/8df)	.1563	.1443	.1508	.2102	.265
	SIGNIFIC.	n.s	n.s	*	***	*

INTERACTION *:temp/var **:early/latetemp
**:latetemp/var

M.H.CHRISTENSEN
EFFORD EHS 1989

F-BLOCK QUALITY 1988

EFFORD EHS
PHYSICAL APPEARENCE
Table 28 RADIAL CRACKING, score (0-4)

		WEEK 12	WEEK 15	WEEK 20	WEEK 25	WEEK 34	MEAN
BLUEP./BLUEP.	CALYPSO	.30	.00	.74	.92	.40	.47
	COUNTER	.00	.00	.68	.92	1.00	.68
	CRITERIUM	.00	.00	.51	1.50	.80	.56
BLUEP./DUTCH	CALYPSO	.00	.00	.50	1.92	1.10	.70
	COUNTER	.20	.00	.19	1.75	1.00	.63
	CRITERIUM	.00	.00	.50	1.42	1.40	.66
DUTCH/BLUEP.	CALYPSO	.10	.30	2.08	1.67	.80	.99
	COUNTER	.00	.10	1.15	1.00	.50	.55
	CRITERIUM	.00	.10	2.10	1.42	1.10	.94
DUTCH/DUTCH	CALYPSO	.10	.10	1.10	2.59	1.00	.98
	COUNTER	.00	.00	.29	1.58	.80	.53
	CRITERIUM	.00	.30	1.15	1.75	1.40	.92
MEAN	BLUEP./BLUEP.	.10	.00	.64	1.11	1.00	.57
	BLUEP./DUTCH	.07	.00	.40	1.70	1.17	.66
	DUTCH/BLUEP.	.03	.17	1.78	1.36	.80	.83
	DUTCH/DUTCH	.03	.13	.85	1.97	1.07	.81
EARLY TEMP.	BLUEPRINT	.00	.00 c.	.52 c.	1.40		
	DUTCH	.03	.15 *	1.31 *	1.67		
LATE TEMP.	BLUEPRINT			1.21 c.	1.24	.90	
	DUTCH			.62 *	1.83	1.12	
VARIETIES	CALYPSO	.13	.10	1.10 *	1.77	.83	.78
	COUNTER	.05	.03	.58 c.	1.31	1.03	.60
	CRITERIUM	.00	.10	1.07 *	1.52	1.18	.77
GRAND MEAN		.06	.08	.91	1.54	1.01	.72

STATISTICS:

TEMPERATURE	SED. (5df/3df)	.0401	.1772	.2618	.129
	SIGNIFIC.	*	*	n.s.	n.s.
VARIETY	SED. (12df/8df)	.0514	.1592	.1874	.293
	SIGNIFIC.	n.s	*	n.s.	n.s.

H.H.CHRISTENSEN
EFFORD EHS 1988

no statistics in week 12

F-BLOCK QUALITY 1988

EFFORD EHS

PHYSICAL APPEARENCE

Table 29 NETTING, score (0-4)

		WEEK 12	WEEK 15	WEEK 20	WEEK 25	WEEK 34	MEAN
BLUEP./BLUEP.	CALYPSO	1.30	.30	.54	.92	.60	.73
	COUNTER	1.40	.10	.13	.58	2.00	.84
	CRITERIUM	1.20	.10	.16	.84	.60	.58
BLUEP./DUTCH	CALYPSO	1.30	.30	.13	2.17	1.00	.98
	COUNTER	.90	.00	.00	1.50	.90	.66
	CRITERIUM	1.20	.10	.45	1.58	1.00	.87
DUTCH/BLUEP.	CALYPSO	2.00	1.50	2.15	2.09	1.20	1.79
	COUNTER	.90	.20	.99	.50	.50	.62
	CRITERIUM	1.70	.70	2.00	1.09	1.40	1.38
DUTCH/DUTCH	CALYPSO	1.40	.50	1.34	2.92	1.20	1.47
	COUNTER	.70	.10	.16	1.42	1.00	.68
	CRITERIUM	.90	.90	1.14	2.09	1.40	1.28
MEAN	BLUEP./BLUEP.	1.30	.17	.28	.78	1.07	.72
	BLUEP./DUTCH	1.13	.13	.19	1.75	.97	.83
	DUTCH/BLUEP.	1.53	.80	1.71	1.22	1.03	1.26
	DUTCH/DUTCH	1.00	.50	.88	2.14	1.20	1.14
EARLY TEMP.	BLUEPRINT	1.22	.15 c.	.23 c.	1.26 c.		
	DUTCH	1.27	.65 **	1.30 **	1.68 *		
LATE TEMP.	BLUEPRINT			.99	1.00 c.	1.05	
	DUTCH			.54	1.94 **	1.08	
VARIETIES	CALYPSO	1.50	.65 *	1.04 *	2.02 **	1.08	1.24
	COUNTER	.98	.10 c.	.32 c.	1.00 c.	1.10	.70
	CRITERIUM	1.25	.45 *	.94 *	1.40	1.10	1.03
GRAND MEAN		1.24	.40	.76	1.47	1.07	.99

STATISTICS:

TEMPERATURE	SED.(5df/3df)	.2382	.1174	.1739	.1029	.1347
	SIGNIFIC.	n.s	**	**	*/**	n.s.
VARIETY	SED.(12df/8df)	.2239	.1535	.2119	.2408	.1756
	SIGNIFIC.	n.s	*	*	**	n.s.

M.H.CHRISTENSEN
EFFORD EHS 1988

F-BLOCK QUALITY 1988

EFFORD EHS
PHYSICAL APPEARENCE

Table 30 GOLD SPOTS, score (0-4)

		WEEK 12	WEEK 15	WEEK 20	WEEK 25	WEEK 34	MEAN
BLUEP./BLUEP.	CALYPSO	.10	.80	1.51	1.09	1.70	1.04
	COUNTER	.50	2.60	.91	2.67	2.70	1.76
	CRITERIUM	.70	2.20	.39	1.17	2.40	1.37
BLUEP./DUTCH	CALYPSO	.20	1.30	.43	1.42	2.00	1.07
	COUNTER	1.90	1.10	.85	2.25	2.20	1.66
	CRITERIUM	.80	2.40	1.40	2.42	1.30	1.66
DUTCH/BLUEP.	CALYPSO	.10	1.00	1.48	1.67	1.60	1.17
	COUNTER	.70	1.50	1.51	3.09	3.10	1.98
	CRITERIUM	1.20	2.50	1.05	1.59	1.80	1.79
DUTCH/DUTCH	CALYPSO	.00	.70	1.20	1.59	.90	.88
	COUNTER	.50	1.40	1.08	1.34	2.70	1.40
	CRITERIUM	.20	1.30	1.58	1.33	1.60	1.20
MEAN	BLUEP./BLUEP.	.43	1.67	.94	1.64	2.27	1.39
	BLUEP./DUTCH	.97	1.60	.89	2.03	1.83	1.46
	DUTCH/BLUEP.	.67	1.67	1.61	2.11	2.17	1.64
	DUTCH/DUTCH	.23	1.13	1.28	1.42	1.73	1.16
EARLY TEMP.	BLUEPRINT	.70	1.63	.91	1.83		
	DUTCH	.45	1.40	1.45	1.76		
LATE TEMP.	BLUEPRINT			1.28	1.88	2.22	
	DUTCH			1.09	1.72	1.78	
VARIETIES	CALYPSO	.10 *	.95	1.15	1.44 *	1.55 **	1.04
	COUNTER	.90 c.	1.50 c.	1.09	2.33 c.	2.60 c.	1.70
	CRITERIUM	.73	2.10	1.30	1.63 *	1.78 **	1.51
GRAND MEAN		.58	1.52	1.18	1.80	2.00	1.41

STATISTICS:

TEMPERATURE	SED.(5df/3df)	.2267	.203	.2752	.17	.152
	SIGNIFIC.	n.s	n.s	n.s.	n.s.	n.s.
VARIETY	SED.(12df/8df)	.2248	.279	.1579	.289	.265
	SIGNIFIC.	*	**	n.s.	*	**

M.H.CHRISTENSEN
EFFORD EHS 1988

M-BLOCK QUALITY 1988 (PLOT 1-64)

EFFORD EHS

Table 31 PRODUCT LIFE, WEEK 11 14/3/88

		after 8 days: mm FIRMNESS	% COMPRES.	%DRY MATTER	%SOLUBLE SOLIDS	ACIDITY pH	INEDIBLE 21/5(7 d)
HH	YEL 5/150	5.01	12.16	5.63	4.76	7.93	4.00
	GRE 5/300	5.38	12.86	5.58	4.78	8.05	4.50
	BLU 7/150	4.66	11.65	5.81	4.85	8.30	2.75
	RED 7/300	4.81	12.12	5.71	4.85	7.90	4.25
HL	YEL 5/150	4.74	11.52	5.39	4.65	7.83	3.75
	GRE 5/300	4.76	11.44	5.31	4.61	7.93	3.75
	BLU 7/150	4.47	11.03	5.55	4.71	7.85	3.50
	RED 7/300	4.55	11.21	5.45	4.68	8.23	2.75
LH	YEL 5/150	4.83	11.69	5.57	4.81	7.88	3.50
	GRE 5/300	4.74	11.12	5.44	4.74	8.00	4.00
	BLU 7/150	4.62	11.52	5.58	4.84	7.95	2.25
	RED 7/300	4.68	11.66	5.66	4.79	7.93	2.50
LL	YEL 5/150	4.04	9.52	5.18	4.58	8.35	.75
	GRE 5/300	3.96	9.38	5.21	4.50	8.98	.50
	BLU 7/150	3.87	9.36	5.32	4.51	8.20	.25
	RED 7/300	3.99	9.81	5.42	4.63	8.13	.25
MEAN	HH	4.94***	12.20***	5.68***	4.81**	8.04	3.83***
	HL	4.63**	11.30**	5.42*	4.66	7.96	3.44***
	LH	4.71***	11.50**	5.56***	4.79**	7.94	3.06***
	LL	3.96 c.	9.52 c.	5.28 c.	4.53 c.	8.41	.44 c.
MEAN	5/150	4.65 c.	11.22	5.44 c.	4.68 c.	7.99	3.00 c.
	5/300	4.69	11.20	5.38	4.66	8.24	3.19
	7/150	4.41 *	10.89	5.56 *	4.73(*)	8.08	2.19 *
	7/300	4.51	11.20	5.56 *	4.73(*)	8.04	2.44(*)
GRAND MEAN		4.56	11.13	5.48	4.70	8.09	2.70
STATISTICS							
	MAIN	***	***	***	**	n.s.	***
	Sed.(9df)	.1434	.4281	.0485	.0652	.1823	.4451
	SUB	*	n.s.	***	*	n.s.	*
	Sed.(36df)	.0957	.2655	.0476	.0264	.1795	.3407

M.H.CHRISTENSEN
EFFORD EHS 1988

M-BLOCK QUALITY 1988 (PLOT 1-64)

Table 32 EFFORD EHS
PRODUCT LIFE, WEEK 15 11/4/88

		after 8 days: mm FIRMNESS	% COMPRES.	% FRUIT WEIGHT	ADJUSTED % DRY MATTER	%SOLUBLE SOLIDS	ACIDITY pH	INEDIBLE 27/4 (16d)
HH	YEL 5/150	3.20	7.39	91.48	5.11	4.37	8.83	4.50
	GRE 5/300	3.13	7.12	90.71	5.00	4.37	8.63	4.25
	BLU 7/150	2.96	6.93	91.50	5.15	4.41	8.08	3.75
	RED 7/300	3.40	7.78	92.02	5.15	4.38	8.60	3.50
HL	YEL 5/150	2.99	6.88	94.14	4.98	4.35	8.65	3.50
	GRE 5/300	2.94	6.76	92.92	4.58	4.39	8.45	3.25
	BLU 7/150	3.10	7.20	93.62	4.59	4.57	8.35	2.50
	RED 7/300	3.06	6.97	92.88	4.94	4.32	8.30	4.50
LH	YEL 5/150	3.19	7.46	92.76	4.93	4.52	8.43	2.25
	GRE 5/300	3.03	6.95	92.63	4.92	4.27	8.58	3.75
	BLU 7/150	3.10	7.22	92.83	5.06	4.69	8.50	3.00
	RED 7/300	3.06	7.03	93.48	4.88	4.66	8.58	1.75
LL	YEL 5/150	2.91	6.83	94.09	4.84	3.83	8.43	3.25
	GRE 5/300	3.00	6.91	93.90	4.72	3.89	8.88	2.25
	BLU 7/150	2.97	6.97	93.54	4.86	3.92	8.85	1.00
	RED 7/300	3.03	7.00	94.59	4.86	3.86	8.63	2.25
MEAN	HH	3.17	7.30	91.43***	5.10 **	4.38	8.53	4.00
	HL	3.02	6.95	93.39	4.95 *	4.41	8.44	3.44
	LH	3.09	7.16	92.93**	4.95 *	4.53	8.52	2.69
	LL	2.98	6.93	94.03 c.	4.82 c.	3.87	8.69	2.19
MEAN	5/150	3.07	7.14	93.12	4.96 c.	4.27	8.58	3.38
	5/300	3.03	6.93	92.54	4.88 *	4.23	8.63	3.38
	7/150	3.03	7.08	92.87	5.01	4.40	8.44	2.56
	7/300	3.13	7.19	93.24	4.96	4.30	8.53	3.00
GRAND MEAN		3.07	7.09	92.94	4.95	4.30	8.55	3.08
STATISTICS								
	MAIN	n.s.	n.s.	***	**	n.s.	n.s.	n.s.
	Sed(9df)	.0643	.1453	.32	.0552	.226	.0986	.6168
	SUB	n.s.	n.s.	n.s.	*	n.s.	n.s.	n.s.
	Sed(36df)	.0495	.1157	.2635	.0391	.0711	.1061	.3689

M.H.CHRISTENSEN
EFFORD EHS 1988

M-BLOCK QUALITY 1988 (PLOT 1-64)

Table 33 EFFORD EHS
PHYSICAL APPEARANCE, WEEK 11

				Skin cracks			
		BOXINESS	BLOTCHY RIPENING	SLABSIDED	RADIAL	NETTING	GOLD SPOTS
HH	YEL 5/150	1.2	0	.45	0	1	.2
	GRE 5/300	1.5	.05	.85	0	.9	1.05
	BLU 7/150	.8	0	.1	.05	.55	.85
	RED 7/300	.85	0	.9	0	.35	.65
HL	YEL 5/150	1.2	.05	.3	0	.9	.8
	GRE 5/300	1.65	.1	.7	0	.8	.8
	BLU 7/150	.6	.1	.55	0	.8	.45
	RED 7/300	.45	0	.55	0	.4	1.15
LH	YEL 5/150	1.25	0	.45	.1	.9	.35
	GRE 5/300	1.25	.1	.45	.05	.8	.75
	BLU 7/150	.6	0	.45	.05	.45	.45
	RED 7/300	.5	0	.35	0	.25	.9
LL	YEL 5/150	1.3	0	.2	0	.5	.25
	GRE 5/300	1.4	0	.2	0	.4	.45
	BLU 7/150	.55	.05	.25	0	.5	.2
	RED 7/300	.75	0	.4	0	.45	.8
MEAN	HH	1.09	.01	.58	.01	.70	.69
	HL	.98	.06	.53	.00	.73	.80
	LH	.90	.03	.43	.05	.60	.61
	LL	1.00	.01	.26	.00	.46	.43
MEAN	5/150	1.24 c.	.01	.35	.03	.83 c.	.40 c.
	5/300	1.45	.06	.55	.01	.73	.76**
	7/150	.64***	.04	.34	.03	.58	.49
	7/300	.64***	.00	.55	.00	.36 **	.88***
GRAND MEAN		.99	.03	.45	.02	.62	.63
STATISTICS							
	MAIN	n.s.		n.s.		n.s.	n.s.
	Sed(9df)	.1748		.1544		.1239	.1747
	SUB	***		n.s.		**	***
	Sed(36df)	.1401		.1076		.133	.1123

*) statistics not possible for
Blotchy ripening and Radial cracking
because of the nature of the data.

M.H.CHRISTENSEN
EFFORD EHS 1988

M-BLOCK QUALITY 1988 (PLOT 1-64)

Table 34 EFFORD EHS
PHYSICAL APPEARANCE, WEEK 14

		BOXINESS	BLOTCHY RIPENING	SLABSIDED	SKIN CRACKS RADIAL	NETTING	GOLD SPOTS
HH	YEL 5/150	.6	.55	.25	.15	1	.35
	GRE 5/300	.9	.35	.25	.45	1.3	1.15
	BLU 7/150	.7	.1	.3	.2	1.05	0
	RED 7/300	.85	.2	.35	.25	.85	.65
HL	YEL 5/150	.85	.65	.35	.1	.4	.8
	GRE 5/300	.75	.6	.2	.2	1.1	.85
	BLU 7/150	.65	.5	.4	0	.6	0
	RED 7/300	.45	.6	.05	.2	1.05	1.3
LH	YEL 5/150	1.05	.4	.35	.4	.75	.25
	GRE 5/300	1.05	.25	.25	.15	.9	.2
	BLU 7/150	.35	.35	.25	.1	1.05	.1
	RED 7/300	.7	.35	.2	.05	.4	.35
LL	YEL 5/150	.9	.45	.1	.2	1	.2
	GRE 5/300	.8	.25	.1	.1	1.05	.1
	BLU 7/150	.65	.35	.25	.1	1.7	.05
	RED 7/300	.45	.55	.2	.15	1.15	.5
MEAN	HH	.76	.30	.29	.26	1.05	.54 *
	HL	.68	.59	.25	.13	.79 *	.74 **
	LH	.79	.34	.26	.18	.78 *	.23
	LL	.70	.40	.16	.14	1.23 c.	.21
MEAN	5/150	.85	.51	.26	.21	.79	.40 c.
	5/300	.88	.36	.20	.23	1.09	.58
	7/150	.59	.33	.30	.10	1.10	.04 **
	7/300	.61	.43	.20	.16	.86	.70 *
GRAND MEAN		.73	.41	.24	.18	.96	.43
STATISTICS							
	MAIN	n.s.	n.s.	n.s.	n.s.	*	**
	Sed(9df)	.2138	.1547	.0751	.0635	.1185	.1081
	SUB	n.s.	n.s.	n.s.	n.s.	n.s.	***
	Sed(36df)	.1325	.1155	.0637	.0668	.1635	.1108

M.H.CHRISTENSEN
EFFORD EHS 1988

Table 35 Stockbridge House - Environments x carbon dioxide. Fruit firmness (mm compression)

		May	June	July	Aug	Sept	Mean
B340	Counter	1.80	3.10	3.36	3.50	3.78	3.11
	Criterium	1.60	2.80	3.19	3.07	3.63	2.86
	Calypso	1.70	2.90	3.27	3.52	3.77	3.03
							3.00
B500	Counter	1.60	3.20	3.71	3.52	3.76	3.16
	Criterium	1.50	3.00	3.20	3.10	3.53	2.87
	Calypso	1.60	3.00	3.50	3.27	3.88	3.05
							3.03
D340	Counter	1.80	3.00	3.54	3.50	3.61	3.09
	Criterium	1.60	2.70	3.15	3.02	3.42	2.78
	Calypso	1.50	2.80	3.57	3.49	3.72	3.02
							2.96
D500	Counter	1.70	3.00	3.45	3.33	3.74	3.04
	Criterium	1.70	2.60	2.83	3.06	3.33	2.70
	Calypso	1.70	2.80	3.08	3.55	3.44	2.91
							2.88
Mean		1.60	2.90	3.32	3.33	3.63	

Table 36 Stockbridge House - Environments and carbon dioxide. % dry matter

		Apr	May	June	July	Aug	Sept	Mean
B340	Counter	4.1	4.2	5.2	4.8	4.5	4.6	4.6
	Criterium	4.1	4.1	4.8	4.6	4.4	4.5	4.4
	Calypso	4.4	4.2	5.3	5.1	4.8	4.5	4.7
								4.6
B500	Counter	4.1	4.2	5.3	5.1	4.6	4.3	4.6
	Criterium	4.1	4.1	5.1	4.7	4.4	4.4	4.5
	Calypso	4.2	4.5	5.4	5.1	4.6	4.6	4.7
								4.6
D340	Counter	4.1	4.2	5.1	5.2	4.7	4.5	4.6
	Criterium	4.4	4.3	4.8	4.9	4.4	4.4	4.5
	Calypso	4.4	4.5	5.2	5.1	4.8	4.8	4.8
								4.6
D500	Counter	4.0	4.0	5.4	5.1	4.8	4.6	4.6
	Criterium	4.2	4.2	5.1	4.8	4.5	4.2	4.5
	Calypso	4.5	4.4	5.2	5.3	4.8	4.5	4.8
								4.6
Mean		4.2	4.2	5.2	5.0	4.6	4.5	**4.6**

Table 37 Stockbridge House - Environments and CO_2
Brix-reducing sugars (% soluble solids)

		Apr	May	June	July	Aug	Sept	Mean
B340	Counter	4.0		3.8	3.8	3.8	3.8	3.8
	Criterium	4.0		4.2	4.1	4.2	3.9	4.1
	Calypso	4.1		4.2	4.2	4.2	4.3	4.2
								4.0
B500	Counter	3.5		4.4	4.0	4.3	3.8	4.0
	Criterium	4.1		3.9	3.8	4.0	4.0	4.0
	Calypso	3.8		4.6	4.2	4.2	4.1	4.2
								4.1
D340	Counter	3.8		4.2	3.7	4.1	3.8	3.9
	Criterium	3.6		4.1	4.3	4.0	4.3	4.1
	Calypso	3.9		4.1	4.4	4.3	4.1	4.2
								4.1
D500	Counter	4.0		4.3	4.0	3.8	3.7	4.0
	Criterium	3.6		4.4	4.0	4.1	3.7	4.0
	Calypso	4.0		4.4	3.8	4.2	4.0	4.1
								4.0
Mean		3.9		4.2	4.0	4.1	4.0	4.1

Table 38 Stockbridge House - Environments and CO_2
Reducing sugars (g/100 ml)

		Apr	May	June	July	Aug	Sept
B340	Counter					2.7907	3.3913
	Criterium					2.6697	3.2620
	Calypso					2.9870	2.0228
B500	Counter					2.9446	3.2310
	Criterium					2.4451	2.9050
	Calypso					2.9287	-
D340	Counter					2.8172	3.7115
	Criterium					2.3108	3.1789
	Calypso					2.8887	2.6767
D500	Counter					2.6952	-
	Criterium					1.1673	2.8646
	Calypso					2.5555	2.4406

Table 39 Environments and CO_2. Titratable acidity mEq/100 ml sap

		Apr	May	June	July	Aug	Mean
B340	Counter	6.7	3.9	8.7	7.4	6.7	6.7
	Criterium	6.5	3.6	11.4	3.7	6.7	6.4
	Calypso	7.6	3.8	9.0	8.1	7.1	7.1
B500	Counter	6.2	6.9	7.8	8.4	7.1	7.3
	Criterium	7.1	4.8	6.9	7.4	6.2	6.5
	Calypso	6.7	5.1	8.1	5.5	7.6	6.6
D340	Counter	7.1	3.8	8.1	10.3	7.1	7.3
	Criterium	5.6	4.9	6.7	6.9	7.4	6.3
	Calypso	7.4	5.5	8.7	5.2	7.6	6.9
D500	Counter	6.5	3.9	8.1	3.9	6.9	5.9
	Criterium	6.5	4.4	7.8	7.1	6.2	6.4
	Calypso	6.7	4.8	7.6	8.4	6.9	6.9
Mean		6.7	4.6	8.2	6.9	7.0	6.7

Table 40 Stockbridge House - Environments and CO_2. Poor shape (0-4)

		Apr	May	June	July	Aug	Sept	Mean
B340	Counter	0.10	0.05	0.10	0.20	0.25	1.30	0.33
	Criterium	0	0.05	0.10	0.05	0.30	0.40	0.15
	Calypso	0	0.05	0	0.05	0.15	0.20	0.07
								0.18
B500	Counter	0.05	0.20	0.15	0.30	0.20	0.80	0.28
	Criterium	0	0.05	0	0.10	0.25	0.45	0.14
	Calypso	0	0	0	0	0.10	1.15	0.21
								0.21
D340	Counter	0.20	0	0.15	0	0.45	0.90	0.28
	Criterium	0	0.20	0	0	0.35	0.20	0.12
	Calypso	0.05	0	0	0	0.05	0.20	0.05
								0.15
D500	Counter	0.15	0.10	0.15	0.15	0.35	0.75	0.27
	Criterium	0	0.05	0.15	0.10	0.25	0.25	0.13
	Calypso	0	0	0.05	0.10	0.20	0.20	0.09
								0.16
Mean		0.05	0.06	0.07	0.09	0.24	0.57	

Table 41 Stockbridge House - Environments and CO_2. Ribbing (0-4)

		Apr	May	June	July	Aug	Sept	Mean
B340	Counter	0.45	1.60	0.45	0	0	0.25	0.46
	Criterium	1.00	2.50	0.50	0	0.35	0	0.72
	Calypso	0.50	1.50	0.45	0	0.15	0.05	0.44
								0.54
B500	Counter	1.00	1.40	0.75	0.05	0	0	0.53
	Criterium	0.95	2.40	0.50	0.30	0.10	0	0.71
	Calypso	0.55	1.60	0.35	0.05	0	0	0.42
								0.55
D340	Counter	0.55	1.45	0.90	0.55	0	0.05	0.58
	Criterium	1.25	3.20	0.85	0	0.30	0	0.93
	Calypso	0.50	2.25	0.95	0	0	0	0.62
								0.71
D500	Counter	1.05	1.40	0.70	0	0.10	0	0.54
	Criterium	0.90	2.05	0.45	0.75	0.30	0.05	0.75
	Calypso	0.75	1.35	0.40	0	0	0	0.42
								0.57
Mean		0.79	1.81	0.60	0.14	0.11	0.03	

Table 42 Stockbridge House - Environments and CO_2
Fine net cracking (scored 0-4)

		Apr	May	June	July	Aug	Sept	Mean
B340	Counter	1.35	0.35	0.05	0	0.10	0.60	0.41
	Criterium	1.55	1.30	0.05	0.35	0	0.75	0.67
	Calypso	1.35	1.60	0	0.50	0.20	0.20	0.64
								0.57
B500	Counter	0.85	0.10	0	0.10	0.15	0.20	0.23
	Criterium	1.45	0.75	0.05	0.50	0.30	0.35	0.56
	Calypso	1.55	1.25	0.05	0.05	0.20	0.40	0.58
								0.46
D340	Counter	0.85	0.45	0.20	0.20	0	0.30	0.33
	Criterium	1.70	0.50	0	0.80	0.10	0.05	0.52
	Calypso	1.30	1.55	0.50	0.55	0.35	0.10	0.72
								0.52
D500	Counter	1.20	0.70	0	0.10	0	0.25	0.37
	Criterium	0.75	1.20	0.15	0.45	0	0.25	0.47
	Calypso	1.05	1.15	0	0.25	0.10	0	0.42
								0.42
Mean		1.25	0.91	0.09	0.32	0.12	0.29	

Table 43 Stockbridge House - Environments and CO_2. Goldspot (scored 0-4)

		Apr	May	June	July	Aug	Sept	Mean
B340	Counter	0.55	0.20	0.80	2.00	1.00	2.05	0.77
	Criterium	0.80	0.05	0.95	1.85	1.30	1.50	1.07
	Calypso	0.45	0.15	0.85	0.85	0.95	1.10	0.72
								0.85
B500	Counter	0.45	0.35	1.15	1.35	0.85	1.75	0.98
	Criterium	0.65	0.30	1.25	1.60	1.60	1.80	1.20
	Calypso	0.35	0.20	0.85	1.75	1.10	1.75	1.00
								1.06
D340	Counter	0.40	0.25	0.80	1.40	1.10	1.40	0.89
	Criterium	0.50	0.35	1.15	1.20	1.00	0.70	0.82
	Calypso	0.70	0.40	1.00	1.45	1.15	0.40	0.85
								0.85
D500	Counter	0.35	0.70	1.00	1.30	1.15	1.25	0.96
	Criterium	0.60	0.30	0.70	1.25	1.10	0.80	0.79
	Calypso	0.50	0.40	0.75	1.10	0.80	0.70	0.71
								0.82
Mean		0.52	0.30	0.94	1.42	1.09	1.27	

Table 44 Stockbridge House - Nutrition x substrates
Fruit firmness (mm compression)

	May	June	July	Interim Mean	Aug	Sept	Mean
ADAS							
Rockwool	1.9	3.2	2.7	2.6	3.44	3.44	3.33
Perlite			3.6		3.60	3.36	3.52
New Perlite	2.0	3.2	3.7	3.0	3.42	3.70	3.61
LOW CONDUCTIVITY							
Rockwool	1.8	3.2	3.6	2.9			
New Perlite	1.7	3.1	3.7	2.8			
SALT							
Rockwool	1.6	3.2	3.4	2.7			
New Perlite	1.8	3.3	3.5	2.9			
Mean	1.8	3.2	3.5		3.49	3.50	

Table 45 Nutrition and substrates. % dry matter

	Apr	May	June	July	Interim Mean	Aug	Sept
ADAS							
Rockwool	4.5	4.7	5.5	5.5	5.05	4.7	4.6
Perlite				5.3		4.7	4.6
New Perlite	4.5	4.8	5.2	5.6	5.02	4.5	4.5
LOW CONDUCTIVITY							
Rockwool	5.1	4.8	5.2	5.1	5.05		
New Perlite	4.4	4.6	5.5	4.9	4.85		
SALT							
Rockwool	4.6	4.7	5.6	5.2	5.02		
New Perlite	4.6	4.5	5.2	5.6	4.97		
Mean	4.6	4.7	5.4	5.3		4.6	4.6

Table 46 Stockbridge House - Nutrition and substrates
Brix reducing sugars (% soluble solids)

	Apr	May	June	July	Aug	Mean	
ADAS							
Rockwool	4.2		4.7	4.7	4.1	4.4)	
Perlite				4.3	3.9	)	4.4
New Perlite	4.0		4.4	4.2	4.5	4.3)	
LOW CONDUCTIVITY							
Rockwool	4.7		4.2	4.3		4.4)	4.4
New Perlite	4.2		4.6	4.2		4.3)	
SALT							
Rockwool	4.3		4.3	4.1		4.2)	4.3
New Perlite	4.0		4.4	4.4		4.3)	
Mean	4.2		4.4	4.3		4.3	

Table 47 Nutrition and substrates. Reducing sugars (g/100 ml)

	Apr	May	June	July	Aug	Sept
ADAS						
Rockwool					2.7907	3.0036
Perlite					2.7111	3.3272
New Perlite					3.1791	2.8357
LOW CONDUCTIVITY						
Rockwool						
Perlite						
SALT						
Rockwool						
Perlite						

Table 48 Stockbridge House - Nutrition and substrates
Titratable acidity mEq/100 ml sap

	Apr	May	June	July	Aug
ADAS					
Rockwool	6.7	5.5	7.4	7.8	6.2
Perlite				7.1	6.2
New Perlite	6.7	4.4	7.6	5.5	6.5
LOW CONDUCTIVITY					
Rockwool	7.1	7.4	6.9	8.4	
New Perlite	5.9	6.7	7.8	7.8	
SALT					
Rockwool	7.4	8.1	7.4	8.4	
New Perlite	7.6	5.3	7.6	8.7	
Mean	6.9	5.9	7.4	7.6	6.4

Table 49 Stockbridge House. Varieties - Soil
Fruit firmness (mm compression)

	May	June	July	Aug	Sept	Mean
Counter	3.12	2.63	3.45	3.58	3.72	3.30
Compacto	2.86	2.66	3.15	3.20	3.34	3.04
Calypso	3.08	3.58	3.50	3.57	3.76	3.50
669	3.16	2.43	3.08	3.16	3.26	3.02
W 704	2.89	2.30	3.37	3.43	3.37	3.07
663	3.09	2.36	3.35	3.55	3.56	3.18
Turbo	2.98	2.38	3.50		3.64	3.12
W 1138	3.28	2.88	3.43	3.60	3.61	3.36
E.17.902	3.01	2.66	3.62	3.46	3.47	3.24
Criterium	2.86	2.48	2.92	3.04	3.00	2.86
RS 85042	2.95	2.54	3.07	3.37	3.30	3.04
LM 25	3.31	2.77	3.43	3.40	3.58	3.30
Mean	3.05	2.64	3.32	3.39	3.47	3.17

Varieties - Rockwool. Fruit firmness (mm compression)

	May	June	July	Aug	Sept	Mean
Counter	2.92	2.38	3.62	3.43	3.55	3.18
Compacto	2.93	2.94	3.31	3.36	3.58	3.22
Calypso	3.12	2.30	3.60	3.42	3.67	3.22
669	2.83	2.84	3.19	3.14	3.30	3.06
W 704	2.55	2.81	3.15	-	3.42	2.98
663	2.97	3.33	3.68	3.39	3.47	3.37
Turbo	2.64	3.75	3.45	3.31	3.37	3.30
W 1138	2.82	3.19	3.42	3.40	3.40	3.25
E.17.902	3.12	3.66	3.41	-	3.46	3.41
Criterium	2.57	3.30	3.30	3.30	3.48	3.19
RS 85042	2.85	2.38	3.35	3.16	3.30	3.01
LM 25	2.83	3.49	3.53	-	3.41	3.31
Mean	2.85	3.03	3.42	3.32	3.45	3.21

Table 50 Stockbridge House. Varieties - Soil
% dry matter

	May	June	July	Aug	Sept	Mean
Counter	4.7	5.9	4.7	4.8	4.9	5.0
Compacto	4.6	5.3	4.6	4.8	4.6	4.8
Calypso	4.6	6.1	5.1	4.9	4.9	5.1
669	4.4	5.1	4.7	5.1	4.5	4.8
W 704	4.8	5.3	4.5	4.8	4.5	4.8
663	4.4	6.5	5.2	5.5	5.1	5.3
Turbo	4.6	5.2	4.8	5.2	4.9	4.9
W 1138	4.6	5.1	4.5	4.7	4.6	4.7
E.17.902	4.6	6.6	4.9	5.4	4.5	5.2
Criterium	4.5	4.2	4.5	4.6	4.2	4.4
RS 85042	4.5	5.4	4.4	4.5	4.4	4.6
LM 25	4.7	6.4	4.7	4.8	4.7	5.1
Mean	4.6	5.6	4.7	4.9	4.6	4.9

Varieties - Rockwool. % dry matter

	May	June	July	Aug	Sept	Mean
Counter	4.5	5.9	4.9	5.0	4.6	5.0
Compacto	4.5	5.4	4.5	4.6	4.5	4.7
Calypso	5.0	6.2	4.8	5.0	4.9	5.2
669	4.9	5.4	4.5	4.5	4.5	4.8
W 704	4.7	5.4	4.5	4.4	4.3	4.7
663	4.8	5.4	4.5	4.8	4.5	4.8
Turbo	4.7	5.4	4.9	5.0	4.8	5.0
W 1138	4.5	5.4	4.6	4.5	4.2	4.6
E.17.902	4.8	5.8	4.7	4.7	4.7	4.9
Criterium	4.6	5.5	4.3	4.3	4.5	4.7
RS 85042	4.7	5.1	4.5	4.6	4.5	4.7
LM 25	4.9	5.6	4.4	4.8	4.6	4.9
Mean	4.7	5.5	4.6	4.7	4.5	4.8

Table 51 Stockbridge House. Varieties - soil
Brix reducing sugars (% soluble solids)

	May	June	July	Aug	Sept	Mean
Counter		4.3		4.3	4.5	4.4
Compacto		4.2		4.2	4.1	4.2
Calypso		4.6		4.2	4.7	4.5
669		4.8		4.2	4.3	4.4
W 704		4.0		4.0	4.5	4.2
663		4.4		4.4	4.7	4.5
Turbo		4.7		4.3	4.6	4.5
W 1138		4.3		3.9	4.4	4.2
E.17.902		4.7		4.3	4.3	4.4
Criterium		4.2		4.1	4.4	4.2
RS 85042		4.2		4.2	4.2	4.2
LM 25		4.4		4.2	4.7	4.4
Mean		4.4		4.2	4.4	4.3

Varieties - Rockwool. Brix reducing sugars (% soluble solids)

	May	June	July	Aug	Sept	Mean
Counter		5.0		3.8	4.6	4.5
Compacto		4.4		4.6	4.3	4.4
Calypso		4.8		5.4	4.5	4.9
669		4.3		4.3	4.0	4.2
W 704		4.3		3.9	4.1	4.1
663		4.5		4.6	4.3	4.5
Turbo		4.5		4.4	4.6	4.5
W 1138		4.2		4.0	4.3	4.2
E.17.902		4.6		4.7	4.3	4.5
Criterium		4.4		4.2	4.2	4.3
RS 85042		4.7		4.0	4.2	4.3
LM 25		4.2		4.0	4.3	4.2
Mean		4.5		4.3	4.3	4.4

Table 52 Stockbridge House. Varieties - soil. Reducing sugar analysis (g/100 ml)

	Aug	Sept	Mean
Counter	2.7142	3.1315	2.92
Compacto	2.2015	2.8558	2.53
Calypso	2.7996	3.1175	2.96
669	2.5190	2.5444	2.53
W 704	2.4993	3.0879	2.79
663	2.8165	1.9447	2.38
Turbo	2.9899	3.0464	3.04
W 1138	2.4309	3.0521	2.75
E.17.902	2.6334	3.0614	2.85
Criterium	2.5387	3.0368	2.79
RS 85042	3.0163	2.7838	2.90
LM 25	2.6960	3.5598	3.13

Varieties - Rockwool. Reducing sugar analysis (g/100 ml)

	Aug	Sept	Mean
Counter	2.4041	3.2248	2.81
Compacto	2.3187	3.0770	2.70
Calypso	3.4332	2.9523	3.19
669	2.8598	2.4230	2.64
W 704	2.4571	2.7618	2.61
663	3.1107	3.1422	3.13
Turbo	3.0210	3.3486	3.18
W 1138	3.4286	2.8977	3.16
E.17.902	3.6377	2.4931	3.07
Criterium	2.9711	3.2726	3.12
RS 85042	2.5354	2.3122	2.42
LM25	2.4829	3.0825	2.78

Table 53 Stockbridge House. Varieties - soil. Titratable acidity (mEq/100 ml sap)

	May	June	July	Aug	Sept
Counter		8.7		7.8	8.3
Compacto		9.4		8.1	11.6
Calypso		9.0		7.1	8.1
669		8.7		6.9	8.4
W 704		8.7		6.5	8.1
663		8.4		7.6	-
Turbo		10.3		7.1	7.6
W 1138		8.1		6.7	6.9
E.17.902		8.7		7.4	7.1
Criterium		8.4		5.4	6.7
RS 85042		8.7		8.1	7.4
LM 25		8.4		6.4	8.1
Mean		8.7		7.1	8.1

Varieties - Rockwool. Titratable acidity (mEq/100 ml sap)

	May	June	July	Aug	Sept
Counter		7.8		5.2	6.0
Compacto		7.4		5.4	6.9
Calypso		8.7		9.4	7.6
669		7.8		7.6	6.7
W 704		8.7		5.6	5.8
663		8.7		7.4	5.0
Turbo		9.4		7.1	5.6
W 1138		11.4		5.4	7.4
E.17.902		9.0		9.0	6.2
Criterium		8.7		6.4	6.4
RS 85042		7.8		6.0	7.1
LM 25		8.4		6.5	5.8
Mean		8.7		6.5	6.2

Table 54 Stockbridge House. Varieties - soil
Poor shape (0-4)

	May	June	July	Aug	Sept	Mean
Counter	0	0	0.25	0.65	1.25	0.43
Compacto	0	0	0	0.40	0.65	0.21
Calypso	0	0	0	0.20	0.60	0.16
669	0	0	0.05	0.20	0.75	0.20
W 704	0	0.20	0.25	1.05	0.50	0.40
663	0	0	0.05	0.35	2.20	0.52
Turbo	0	0	0.25	0.45	2.20	0.58
W 1138	0	0	0.25	0.60	1.50	0.47
E.17.902	0	0	0	0.15	0.80	0.19
Criterium	0	0	0	0.30	0.45	0.15
RS 85042	0	0	0.05	0.25	0.80	0.22
LM 25	0	0	0.05	0.60	0.60	0.25
Mean	0	0.02	0.10	0.43	1.02	0.31

Varieties - Rockwool. Poor shape (0-4)

	May	June	July	Aug	Sept	Mean
Counter	0	0	0.20	0.65	1.10	0.39
Compacto	0	0	0.05	0.50	0.65	0.24
Calypso	0	0	0	0.15	0.40	0.11
669	0	0	0.05	0.25	0.45	0.15
W 704	0	0.45	0.30	0.70	1.80	0.65
663	0	0	0.20	0.20	0.50	0.18
Turbo	0	0	0.25	0.90	1.05	0.44
W 1138	0	0	0.20	0.75	0.95	0.38
E.17.902	0	0	0	0.35	0.45	0.16
Criterium	0	0	0	0.45	0.75	0.24
RS 85042	0	0	0.10	0.10	0.30	0.10
LM 25	0	0	0	0.40	0.40	0.16
Mean	0	0.04	0.11	0.45	0.73	0.27

Table 55 Stockbridge House. Varieties - soil
Ribbing (scored 0-4)

	May	June	July	Aug	Sept	Mean
Counter	0.25	0.05	0	0.05	0.10	0.29
Compacto	0.15	1.15	0.20	0	0.15	0.33
Calypso	0.05	1.20	0	0.10	0	0.27
669	0	1.70	0	0.10	0.10	0.38
W 704	0.10	1.15	0	0.05	0	0.26
663	0.40	1.30	0.05	0.15	0.20	0.42
Turbo	0.05	1.30	0	0.15	0.10	0.32
W 1138	0.10	0.75	0	0	0.05	0.18
E.17.902	0.45	1.40	0.15	0.05	0	0.41
Criterium	0.30	1.50	0.20	0.50	0.40	0.58
RS 85042	0.15	1.50	0.05	0.05	0.05	0.36
LM 25	0.05	0.90	0	0.10	0	0.21
Mean	0.17	1.24	0.05	0.11	0.10	

Varieties - Rockwool. Ribbing (scored 0-4)

	May	June	July	Aug	Sept	Mean
Counter	0.20	1.60	0.05	0.05	0.20	0.42
Compacto	0	1.55	0.15	0	0	0.34
Calypso	0	0.75	0	0.05	0.10	0.18
669	0.05	1.30	0.05	0	0	0.28
W 704	0	0.45	0	0.15	0.40	0.20
663	0.05	0.80	0	0	0.35	0.24
Turbo	0.10	1.45	0	0	0.05	0.32
W 1138	0	0.70	0	0	0.05	0.15
E.17.902	0.10	1.90	0	0	0.10	0.42
Criterium	0.30	2.30	0.10	0.70	0.75	0.83
RS 85042	0	0.95	0	0	0.05	0.20
LM 25	0	2.10	0	0.25	0	0.47
Mean	0.07	1.32	0.03	0.10	0.17	0.34

Table 56 Stockbridge House. Varieties - soil
Fine net cracking (scored 0-4)

	May	June	July	Aug	Sept	Mean
Counter	0.25	0	0.10	0.05	0.80	0.24
Compacto	0.05	0	0.70	0.15	0.40	0.26
Calypso	1.10	0.05	0.15	0.05	0.45	0.36
669	0.05	0.15	0.45	0.40	0.55	0.32
W 704	0.10	0	0.50	0.45	0.55	0.32
663	0.55	0	0.55	0.30	1.50	0.58
Turbo	0.20	0	0.25	0.05	0.75	0.25
W 1138	0.20	0	0.10	0.05	0.40	0.15
E.17.902	0.20	0.05	0.15	0.15	0.60	0.23
Criterium	0.40	0	0.70	0.25	0.55	0.38
RS 85042	0.85	0.15	0.55	0.30	0.80	0.53
LM 25	0.40	0	0.40	0.10	0.55	0.29
Mean	0.36	0.03	0.38	0.19	0.66	0.32

Varieties - Rockwool. Fine net cracking (scored 0-4)

	May	June	July	Aug	Sept	Mean
Counter	1.30	0	0.85	0.05	0.55	0.55
Compacto	1.85	0	0.55	0.40	0.95	0.75
Calypso	1.70	0	0.80	0.25	1.15	0.78
669	1.90	0.25	0.60	0.35	1.00	0.82
W 704	1.40	0	1.00	0.25	1.00	0.73
663	1.10	0	1.20	0.15	0.90	0.67
Turbo	1.35	0	0.85	0.10	0.50	0.56
W 1138	1.75	0	0.85	0.10	0.85	0.71
E.17.902	1.45	0.05	0.65	0.10	0.95	0.64
Criterium	0.60	0	1.25	0.05	1.40	0.66
RS 85042	2.15	0	1.15	0	0.95	0.85
LM 25	1.10	0	1.00	0.20	1.25	0.71
Mean	1.47	0.02	0.90	0.17	0.95	0.70

Table 57 Stockbridge House. Varieties - soil
Goldspot (scored 0-4)

	May	June	July	Aug	Sept	Mean
Counter	0.15	0.10	1.85	0.85	0.50	0.69
Compacto	0	0.30	1.35	0.30	0.40	0.47
Calypso	0.25	0.20	1.10	0.05	0.25	0.37
669	0	0.20	0.80	0.20	0.10	0.26
W 704	0.10	0	1.55	0.15	0.50	0.46
663	0.05	0.50	1.10	0.45	1.10	0.64
Turbo	0	0.15	1.20	0.40	0.35	0.42
W 1138	0	0	1.55	0.50	0.35	0.48
E.17.902	0.10	0.15	0.80	0.10	0.20	0.27
Criterium	0.15	0.35	1.45	0.75	0.45	0.63
RS 85042	0.25	0.70	1.45	0.85	0.85	0.82
LM 25	0.45	0.95	1.50	0.60	0.40	0.78
Mean	0.12	0.30	1.31	0.43	0.46	0.52

Varieties - Rockwool. Goldspot (scored 0-4)

	May	June	July	Aug	Sept	Mean
Counter	0.10	0.90	1.50	1.50	1.15	1.03
Compacto	0.45	0.65	1.85	1.50	1.25	1.14
Calypso	0.05	0.70	0.95	1.15	0.95	0.76
669	0.15	0.60	0.85	0.80	0.75	0.63
W 704	0.40	1.10	1.45	1.10	0.60	0.91
663	0.20	0.70	1.55	1.85	1.15	1.09
Turbo	0.35	0.75	1.35	0.95	0.80	0.84
W 1138	0.05	0.65	1.40	1.55	1.45	1.02
E.17.902	0	0	1.65	1.00	0.45	0.62
Criterium	0.30	0.30	1.35	1.35	1.20	0.90
RS 85042	0	0.65	1.95	1.15	1.20	0.99
LM 25	0.35	0.85	1.75	1.35	1.30	1.12
Mean	0.19	0.66	1.47	1.27	1.02	0.92