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| **Project Title:** | Apples and pears: evaluation of Braeburn and Conference clones |
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**EAST MALLING RESEARCH**

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**Authentication**

I declare this work was done under my supervision according to the procedures described herein and that this report is a true and accurate record of the results obtained.

.....
D S Johnson

Date …….....

## Grower Summary

### Headline

***Braeburn clones***

On the evidence from three cropping seasons, it appears that UK growers are correct in planting Lochbuie, Schneider and Hillwell rather than Laimburger, Mariri Red (Redfield), Fenwicks and Royal Braeburn.

The agronomic performance of Lochbuie has been particularly high and was rated the best for appearance by growers and advisers.

***Irradiated Conference clones***

Early indications are that none of these clones is less vigorous or more productive than the standard EMLA Conference clone.

Although the irradiated clone 3-15-46 has shown promise in Italy and has been released as Conference Light, its performance in the UK trial has been disappointing. Consequently, UK growers should not consider planting it at this stage.

A completely russetted clone 3-6-58 has attracted interest from growers and may have a novelty value (see Figure 1).

### Background and expected deliverables

With funding provided originally by the UK Apple and Pear Research Council (APRC), trees of seven clones of Braeburn (Hillwell, Schneider, Laimburger, Lochbuie, Redfield, Fenwicks, and Royal Braeburn) were planted in the spring of 2001 on the 'Brogdale at Bradbourne' site at East Malling. Trees of compact clones of Conference pears produced using irradiation-breeding techniques by Dr Predieri at Bologna in Italy were obtained and planted at East Malling in spring 1999.

Significant interest in the clonal trials was expressed by members of the EMR Apple and Pear Breeding Club and the APRC Breeding and Varietal Development and Advisory Committee. Subsequently, the Tree Fruit Panel of the HDC expressed a desire to continue with these trials. The current project is scheduled to run until March 2006 by which time the

agronomic performance of six compact clones of Conference on EMC will have been compared over 7 years (1999-2005) and the cropping and quality of five clones of Braeburn on M9 will have been evaluated over 5 years (2001-2005).

The clones of Braeburn apples and Conference pears most suited to UK growing conditions will have been identified.

**Summary of the project and main conclusions**

**Braeburn clones**

The seven clones of Braeburn (Hillwell, Schneider, Laimburger, Lochbuie, Mariri Red (Redfield), Fenwicks and Royal Braeburn) on M9 rootstocks were planted in the spring of 2001 on the 'Brogdale at Bradbourne' site (MP168) at an in-row spacing of 2m and an alley width of 4m (1250 trees $ha^{-1}$). Trees were planted in a randomised block design with six replications apart from Royal Braeburn where limited material provided for only four replications. Records have focussed on yield, fruit size, colour and quality. To avoid over-cropping all trees were hand-thinned in June leaving two fruits per cluster. Trees received no irrigation.

Fruit from all trees was harvested on 10, 11 and 17 October in 2003, 2004 and 2005 respectively and transported immediately to the Jim Mount Building. On arrival, two fruits were removed from the crop from each tree and bulked to form samples of each clone for maturity assessment. The remainder of the fruit was placed into air storage and removed in January or March for grading and quality assessment.

To assess maturity at harvest, measurements were made of internal ethylene concentration, background colour and area of red colour, firmness, soluble solids concentration and starch pattern.

***Overall conclusions***

There is strong support from UK retailers for good quality Braeburn apples, although there is no price premium for UK product. Clearly, it is important that growers produce high volumes of apples at the specification required by UK multiple retailers. A minimum of 40% red coloration (not brown) is required but, being regarded as a bi-coloured cultivar when grown in the UK, this may exclude the redder clones such as Mariri Red and Royal Braeburn. When samples of the various clones were presented to growers and advisers, there was a mixed reaction to the appearance of the highly coloured clone, Mariri Red. Lochbuie scored highest on the basis of appearance.

The following conclusions are based on three cropping years (2003-05) of trees planted in 2001. Average yield in 2003, 2004 and 2005 was 11.9, 14 and 5.5 tonnes $ha^{-1}$. Although the trees were thinned to two fruits per cluster in each year, this did not ensure a sufficiently high percentage of fruit above 65mm in the first two cropping years and may have contributed to the lack of crop in 2005. The trees did not receive irrigation in any year.

The main conclusions thus are:

- On the basis of appearance Mariri Red (formerly Redfield) and the Royal clone may be too red for UK market requirements.
- Lochbuie has been most precocious in cropping, producing 73% and 67% more than the average yield for the seven clones in 2003 and 2004 respectively.
- In 2003 and 2004, the Royal clone was worst for cropping and Laimburger also produced poor yields in 2003.
- In two of the three years, Mariri Red, Fenwicks and Royal produced small fruit.
- There were no cropping or fruit size deficiencies associated with the clones currently favoured by the UK growers, i.e. Hillwell, Lochbuie and Schneider.
- Fenwicks was consistently more mature at harvest and in two years Mariri Red was least mature.
- Fenwicks was yellow and soft after air storage and fruit from the 2005 crop developed splitting and senescent breakdown. It is possible that these deficiencies in quality could be rectified by earlier harvesting.

- Measurements of the length (height) and diameter of individual fruits showed that Fenwicks produced the most elongated apple and Lochbuie the flattest.

Of the seven clones tested, Hillwell, Schneider and Lochbuie have performed consistently well and the yields of Lochbuie have been particularly high. There were no concerns about their suitability for UK production based on appearance, yield, size, harvest maturity and storage quality. However, there were concerns with the remaining four clones in the trial. Further work on harvest maturity and storage quality on Hillwell, Schneider and Lochbuie is being carried out within HDC project TF152.

**Conference clones**

Trees of clones of Conference pears produced using irradiation-breeding techniques by Dr Predieri at Bologna in Italy were planted at East Malling in spring 1999. According to Dr Predieri, the main traits of the clones supplied for the UK trial are as follows:

| Clone | Characteristics |
|---|---|
| 3-15-46 | Very compact with short internodes. Released as Conference 'Light' |
| 3-6-80 | Reduced vigour |
| 30-6-58 | Improved sensory analysis, increased calyx russetting (favourable in Italy) |
| 3-5-9 | High, consistent productivity |
| 3-15-57 | Improved sensory analysis, increased calyx russetting (favourable in Italy) |
| 3-6-6 | Possible increased resistance to frost |

When comparing UK results with those obtained in Italy, the following comments can be made:

**3-15-46**

As in 2003 and 2004, and in common with Italian experience, clone 3-15-46 (Conference 'Light') was most compact in that it had the lowest mean shoot length. However, despite its compact nature the yield efficiency of Conference 'Light' has been the poorest so far in this trial.

**3-6-80**

Clone 3-6-80 has not proved to be of particularly low vigour to date.

**3-5-9**

The accumulated yield of clone 3-5-9 has been on average less productive than clones 3-6-80, 3-6-6 and the standard EMLA Conference clone.

**3-6-58 and 3-15-57**

The sensory acceptability of 3-6-58 was similar to EMC and acceptability of 3-15-57 was lower than the standard clone.

**3-6-6**

The effect of frost on the cropping of clone 3-6-6 has not been assessed.

**Overall conclusions**

- Early indications are that none are less vigorous or more productive than the standard EMLA Conference clone.

- Although the irradiated clone 3-15-46 has shown promise in Italy and has been released as Conference Light, its performance in the UK trial has been disappointing showing low yield efficiency. Consequently UK growers should not consider planting it at this stage.

- There was considerable interest in the trial from growers who attended a Pear Walk at EMR on 26 August 2004 organised by HDC. The novelty of the completely russetted clone (3-6-58) appeared to be of particular interest (Figure 1).

**Financial benefits**

There are major financial implications of identifying clones of apples and pears with improved agronomic performance and that satisfy consumer requirements in terms of visual and eating quality.

**Action points for growers**

- On this current preliminary evidence, for new Braeburn plantings growers should continue to select the standard clones, Lochbuie, Schneider and Hillwell, rather than Laimburger, Mariri Red (Redfield), Fenwicks and Royal Braeburn.

- Of the three standard clones Lochbuie appears to have the best commercial potential followed by Schneider and Hillwell.

- Although the irradiated Conference clone 3-15-46 has shown promise in Italy and has been released as Conference Light, the UK trials results show disappointingly low yield efficiency for this compact clone and so growers should not consider planting it at this stage.

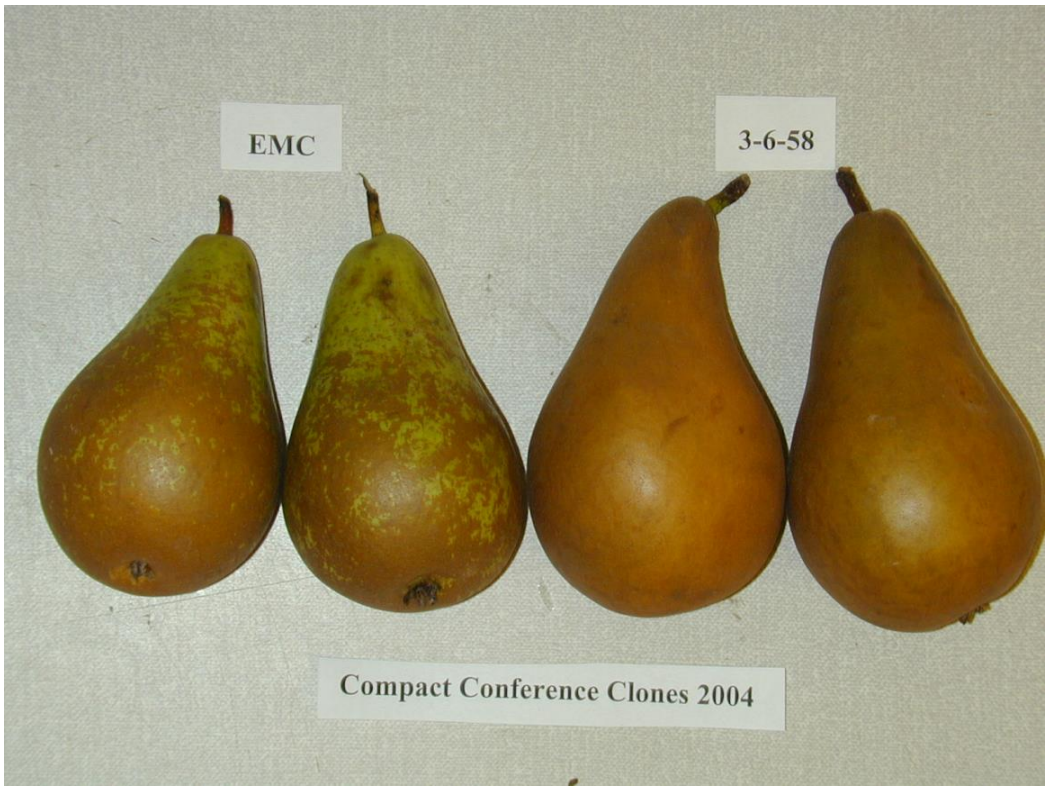



**Figure 1.** The russetted Italian clone of Conference 3-6-58 in comparison with the standard EMLA clone in 2004

## Science Section

### Introduction

With funding provided by the APRC (project SP 115), trees of seven clones of Braeburn (Hillwell, Schneider, Laimburger, Lochbuie, Mariri Red (Redfield), Fenwicks and Royal Braeburn) were planted in the spring of 2001 on the 'Brogdale at Bradbourne' site at East Malling. Trees of compact clones of Conference pears produced using irradiation-breeding techniques by Dr Predieri at Bologna in Italy were obtained and planted at East Malling in spring 1999.

The work in project SP 115 was concluded in March 2001 before any of the Braeburn clones had come into crop (see APRC Report for SP115 to 31 March 2001). The trial evaluating the compact Conference clones continued in 2001/02 as part of SP134 'Evaluation and development of new rootstocks for apple and pears' and results were presented in the APRC Report for SP134 to 31 March 2002. Significant interest in the clonal trials was expressed by members of the EMR Apple and Pear Breeding Club and the APRC Breeding and Varietal Development and Advisory Committee when they visited the trial plots on 4 September 2002. Subsequently, the Tree Fruit Panel of the HDC expressed a desire to continue with these trials and a new 3-year project was approved from 1 April 2003 with funding from the HDC (Project TF149).

### Aims of the Project

To select improved clones of Braeburn apples and Conference pears for UK growing conditions.

### Outline of results from year 1 (2003-04)

#### *Braeburn*

In the first cropping year, the average yield for all clones was 9.5 kg tree$^{-1}$ (11.9 tonnes ha$^{-1}$) but there was a large variation in the yield of fruit from the different clones. The poorest yield was from Royal Braeburn (5 kg tree$^{-1}$) and highest from Lochbuie (16.4 kg tree$^{-1}$). The cropping levels of most of the other clones were close to the average although Laimburger cropped only slightly more than Royal Braeburn. The pattern of clone effects on yield was similar whether assessed on the basis of fruit numbers or weights. Mariri Red carried a crop

that was close to the average (10.1 kg tree$^{-1}$), but fruit tended to be small when compared to other clones producing similar yields. Average fruit weight and percentage of fruit above 65mm was highest for Laimburger. In contrast, the low yielding Royal clone also produced the smallest fruit. There were no cropping deficiencies associated with the three clones currently favoured by the UK industry, i.e. Hillwell, Schneider and Lochbuie. The quantity of fruit produced above 65mm and mean fruit weight were close to average for all three clones. Although total yields for Hillwell and Schneider were also close to the average, yields for Lochbuie were 73% more than average.

Apart from Fenwicks, the differences in fruit maturity parameters between clones was small. Fenwicks was clearly much more mature at harvest as evidenced by its yellow background colour, high IEC and the extent of starch loss. Mariri Red tended to be least mature but harvesting at intervals over an extended period would be necessary in order to establish any significant clonal differences in time of ripening.

There were significant effects of clones for three of the size categories (56-60, 66-70 and 71-75mm) in the grading data. In the 56-60mm category there were higher percentages for Royal and to a lesser extent Mariri Red and lower percentages for Laimburger. The converse was generally true for the higher size categories.

With the exception of Fenwicks, fruit from all clones stored well in air at 1.5-2ºC until 7 January 2004. The incidence of rotting was low (5% or less) bearing in mind that none of the harvested fruit had been excluded from store and that no post-harvest fungicide treatments had been applied. There were no external or internal physiological disorders in fruit from any of the clones. Apples from the Fenwicks clone had a yellow background and were much softer than those from other clones. Fenwicks scored poorly in an informal tasting of the fruit due to its poor texture whereas all other clones attained high sensory scores. It is likely that the inferior sensory quality of Fenwicks apples relates to its more advanced state of maturity at the time of harvest. It is possible that earlier picking could significantly improve its ex-store quality. The remaining clones were generally similar in firmness and background colour. A subjective overall assessment was made of the extent of greasiness of the fruit removed from store. Mariri Red was least greasy while Lochbuie (quite) and Fenwicks (slight) were more affected than the remaining clones (all judged as very slight). Interestingly this pattern of clone effects tended to match the maturity status of the fruit at harvest.

***Conference***

In 2003, there were no effects of the clones on tree growth, number of floral buds or fruit yield. However, there were significant effects of the clones on accumulated data for shoot length and number, total yield and yield efficiency. There was a clear pattern in the data as regards growth and cropping over the 4-year period. Clones 3-15-46 and 3-6-58 performed similarly with more shoot growth, less fruit yield and lower yield efficiency than the remaining 4 clones (3-6-80, 3-5-9, 3-15-57 and 3-6-6) which all performed similarly.

Unfortunately, there are no trees of the standard EMLA clone of Conference in the trial. However, in an adjacent rootstock trial (PR184) there are trees of the normal EMLA clone on EMC that were planted at the same time (23 March 1999) although they originated from a different nursery. The four most promising 'compact' clones (3-6-80, 3-5-9, 3-15-57 and 3-6-6) were no different to the standard clone as regards trunk girth, fruit yield, accumulated yield and yield efficiency in 2003.

**Outline of results from year 2 (2004-05)**

***Braeburn***

In the second cropping year the average yield of 11.2 kg tree$^{-1}$ (14 tonnes ha$^{-1}$) was slightly higher than in the previous year (11.9 tonnes ha$^{-1}$) but again there was a large variation in the yield of fruit from the different clones. As in the previous year the poorest yield was from Royal Braeburn (4.6 kg tree$^{-1}$) and highest from Lochbuie (18.8 kg tree$^{-1}$). The cropping levels of most of the other clones were close to the average. The pattern of clone effects on yield was generally similar whether assessed on the basis of fruit numbers or weights. Mariri Red and Fenwicks carried crops that were close to the average (12.6 and 11.6 kg tree$^{-1}$ respectively) but fruit tended to be small when compared to other clones producing similar yields. Average fruit weights and percentages of fruit above 65mm were highest for Schneider, Lochbuie and Royal. However, the mean data for Royal should be viewed with caution since there are two missing plots in the trial that necessitate the estimation of mean values for this clone. Additionally the cropping from the remaining Royal trees was highly erratic.

There were no major cropping deficiencies associated with the three clones currently favoured by the UK industry, i.e. Hillwell, Schneider and Lochbuie. Although total yields for Hillwell and Schneider were also close to the average, yields for Lochbuie were 67% more than average which compares with 73% more than average achieved in the previous year.

Schneider produced more fruit above 65 mm than Hillwell but not as much as Lochbuie although the percentage of the crop above 65 mm was similar for Lochbuie and Schneider.

Apart from Fenwicks, the differences in fruit maturity parameters between clones was small. Fenwicks was clearly much more mature at harvest as evidenced by its yellow background colour and the extent of starch loss. As in 2003, the Mariri Red apples tended to be least mature as evidenced by a low internal ethylene and soluble solids concentration. Harvesting at intervals over an extended period would be necessary in order to establish any significant clonal differences in time of ripening.

There were significant effects of clones for all but the extremes (<50 mm and 76-80 mm) of the size categories in the grading data. Again the Royal data should be viewed with caution since there are two missing plots in the trial that necessitate the estimation of mean values for this clone. Additionally, the cropping from the remaining Royal trees was highly erratic. Lochbuie and Schneider are clearly producing more fruit in the higher size ranges (66-70 and 71-75 mm) and less in the lower size ranges (51-55 and 56-60 mm). The converse was true for Mariri Red and Fenwicks.

With the exception of Fenwicks, fruit from all clones stored well in air at 0-0.5ºC until 15 March 2005. The incidence of rotting was low (2% or less) bearing in mind that none of the harvested fruit had been excluded from store and that no post-harvest fungicide treatments had been applied. There were no external or internal physiological disorders in fruit from any of the clones. Apples from the Fenwicks and Royal clone had a yellow background and Fenwicks fruit were much softer than those from other clones. It is possible that earlier picking could significantly improve its ex-store quality. The remaining clones were generally similar in firmness and background colour. Visual appearance was assessed by 10 growers / advisers who attended the EMRA/MFSS Storage Day at EMR on 5 April 2005. Lochbuie received the highest rating (7.9 out of a possible score of 10) and Mariri Red the lowest. The assessors were clearly divided in their opinions about the completely red Mariri Red clone with scores ranging from 3 to 9. Clearly, some felt that the clone was too red and could result in customers being confused with other cultivars such as Empire. However, the reaction of a major supplier of the multiple retailers (Worldwide Fruit) was that the clone was unlikely to be an issue with their customers provided that there was consistency in the packaged product. Clearly, mixing clones with very different appearance in the same pack would be unacceptable to the customer. It is important to recognise that with the growth of the trees there will be more shading within the canopy and the amount of colour on the apples will

generally decline. It may be advantageous for growers to plant redder clones in order to meet stringent requirements for red colour imposed by retailers throughout the life of the orchards.

Measurements of the length (height) and diameter of individual fruits showed that Fenwicks was the most elongated apple and significantly more so than Schneider, Lochbuie, Mariri Red and Royal. Conversely Lochbuie was the flattest apple and significantly more so than Hillwell, Laimburger and Fenwicks.

***Conference***

In 2004, there were no significant effects of the clones on tree growth, number of floral buds or total fruit yield. Although clone 3-6-58, and to a lesser extent 3-15-57, had greater shoot length than other clones the effect just failed to reach significance at the 5% level. Clone 3-6-58 did produce a significantly higher yield of fruit above 65mm diameter.

There were significant effects of the clones on accumulated data for shoot length and number, total yield and yield efficiency. As in 2003 there was a clear pattern in the data as regards growth and cropping over the 5-year period. Clones 3-15-46 and 3-6-58 performed similarly with more shoots and shoot growth, lowest fruit yield and yield efficiency. However, in 2004, clone 3-6-58 produced a significantly higher weight of fruit in the 66-70 mm diameter band than the remaining clones, with the exception of 3-5-9. Clones 3-6-80 and 3-6-6 have the highest cumulative yield and yield efficiency and performed similarly the standard clone.

At this stage there is no indication that the Italian clones are more ‘compact’ than the standard EMLA and none have a higher accumulated yield and yield efficiency.

Sensory tests were carried out on clones 3-6-58 and 3-15-57 which were selected originally for high sensory quality. Fruits of clone 3-6-58 received significantly lower scores for sweetness, juiciness and acceptability and higher scores for firmness compared with fruits from the standard clone. The penetrometer tests showed that the fruit were firmer, i.e. less ripe, than those of the standard clone and that differences in the responses of the taste panellists may be due to differences in the state of ripeness. However, it is interesting that clone 3-15-57 generally received higher sensory scores than 3-6-58 despite being slightly firmer. In future work it will be necessary to ensure that fruit is placed at the correct storage temperature immediately after harvest and that fruit achieves the same stage of ripeness after storage before sensory analysis is carried out. Fruits that retain firmness during storage and have high sugar (soluble solids) content would be a commercial advantage. Results in

2004 suggest that both 3-6-58 and 3-15-57 offer an advantage over the standard clone in these respects.

**Targets for year 3 (2005-06)**

To continue to evaluate clones of Braeburn apples and Conference pears and assess their suitability for UK growing conditions.

**Materials and Methods**

***Braeburn***

The seven clones of Braeburn (Hillwell, Schneider, Laimburger, Lochbuie, Mariri Red (Redfield), Fenwicks and Royal Braeburn) on M9 rootstocks were planted in the spring of 2001 on the 'Brogdale at Bradbourne' site (MP168) at an in-row spacing of 2m and an alley width of 4m (1250 trees $ha^{-1}$). Trees were planted in a randomised block design with six replications apart from Royal Braeburn where limited material provided for only four replications.

In this trial comparing different clones of Braeburn, records have focussed on yield, fruit size, colour and quality. To avoid over-cropping all trees were hand-thinned on 2 June 2005 leaving two fruits per cluster.

In 2005, the fruit from all trees was harvested on 17 October and transported immediately to the Jim Mount Building. On arrival, two fruits were removed from the crop from each tree and bulked to form samples of each clone for maturity assessment. The remainder of the fruit was placed into air storage at 0-0.5ºC and removed on 15 March 2006 for grading and quality assessment.

To assess maturity at harvest measurements were made of background colour and area of red colour, firmness, soluble solids concentration and starch pattern (see below).

**Background colour.** The colour of the non-blush side of the fruit was assessed using commercial (World Wide Fruit /Qualytech) colour charts. Background colour of each fruit was compared against four cards that range from green (1) to yellow (4). The average score was calculated for each sample.

**Red colour.** The percentage area of red colour on each apple was estimated and assigned to one of six categories, i.e. 0, 1-20, 21-40, 41-60, 61-80 and >80% that were ascribed a score of 0, 1, 2, 3, 4 and 5 respectively. The total score was divided by the number of fruit in the sample (12) and multiplied by 20 to give a maximum score of 100.

**Fruit firmness.** Two measurements were made on the opposite sides of each fruit using an LRX (Lloyd Instruments) materials testing machine fitted with an 11mm probe. Measurements were made in the equatorial region after removal of the peel. Firmness was the maximum force (N) recorded during the insertion of the probe to a depth of 8mm.

**Soluble solids concentration**. Juice was extracted from each apple using a 'Chylofel' (Copa - Technologie S.A.) apparatus and mixed to form a composite sample. Soluble solids concentration (%) was measured using a PR-32 digital refractometer (Atago Ltd).

**Starch test.** Half of each apple cut for internal examination was dipped in a solution containing 0.1% w/v iodine and 4% w/v potassium iodide. Dipped sections were left for at least an hour before being assessed. Each apple was scored (1-slight central discoloration to 10-no peripheral discoloration) using the starch conversion chart for apples (circular type) issued by Ctifl. An average score was calculated for each sample.

On removal from store, the crop from each tree was size graded (56-60, 61-65, 66-70, 71-75, 76-80 and >80mm) using sizing rings and the number and weight of fruit in each size grade was recorded. The percentage of fruit (by weight and number) in each size category was calculated. A sub-sample of 20 fruit was taken (random selection) from the crop from each tree and inspected for the presence of rots. The percentage area of red colour and intensity of background colour on each apple was estimated and the firmness measured as described above. Finally each apple was cut and examined for the presence of internal physiological disorders.

***Conference***

Six clones of Conference pear (3-15-46, 3-6-80, 3-6-58, 3-5-9, 3-15-57 and 3-6-6) on EMC rootstock are being trialled (randomised block design with four replicates) on plot PR185 at East Malling. These are being compared with the standard clone on EMC rootstock in an adjacent plot (PR184). All trees have been managed in an identical way since they were planted in March 1999. Trees produced their first significant crop in 2001 (see APRC report

on project SP134 to March 2002). It was anticipated that the trees will come into regular cropping during the period of the project. By the end of the project (31 March 2006) the agronomic performance of these compact clones of Conference will have been compared over seven growing seasons (1999-2005).

During 2005, measurements were taken of tree girth, shoot growth (number and length) and counts were made of flower buds (spur, terminal and axillary). The trees were harvested on 6 September 2005 and the total yield of fruit from each tree was recorded and also the weight of fruit above 65mm diameter. Average shoot growth and accumulated yield were calculated for the period since planting (1999-2005) and yield efficiency was calculated from the accumulated yield and the cross sectional area of the trunks of the trees in 2005. The crop from each tree was stored in air at -0.5 to -1°C until 6 January 2006 at which time firmness and soluble solids measurements were made on bulked samples of fruit. Informal sensory analysis was performed on fruit ripened at 20°C for 4 days. Eight tasters were asked to score (max. 10) pears on the basis of their aroma, astringency, sweetness, juiciness, firmness, sliminess and grittiness and to give an overall acceptability score out of 9.

*Statistical analyses*

All data were subjected to an analysis of variance (ANOVA). The overall effects of clones can be compared using the standard errors of the difference between means (s.e.d.) and degrees of freedom (d.f.) given in the tables.

**Results and Discussion**

***Braeburn***

An average yield of 4.4 kg tree$^{-1}$ (5.5 tonnes ha$^{-1}$) was disappointing, being much lower than in 2004 (14 tonnes ha$^{-1}$) and 2003 (11.9 tonnes ha$^{-1}$). The light crop was due to lack of flower clusters and it is possible that the standard thinning practice used in the trial, i.e. leaving two fruits per cluster, was insufficient in 2004 to prevent poor flower development. Unlike in previous years, there was little variation in the average yield of fruit from the different clones (Table 1) but tree-to-tree variation was large particularly for Fenwicks where 50% of the trees failed to produce any crop.

Fenwicks and Royal produced fewer fruits above 65mm diameter than other clones (Table 1). Although in the case of Fenwicks reduction in fruits above 65mm diameter was related to

a generally low yield the Royal clone produced an average total yield but comprised of only 18.4% (by weight) of fruits above 65mm diameter. Mean fruit weight for the Royal clone was about half that of the other clones. In the previous year Fenwicks carried a crop that was close to average, but fruit tended to be small when compared to other clones producing similar yields.

There were no cropping differences between the three clones currently favoured by the UK industry, i.e. Hillwell, Schneider and Lochbuie. This contrasts with 2004 and 2003 when yields for Lochbuie were 67% and 73% more than average. The three clones performed similarly as regards yield, proportion of the crop above 65mm diameter and mean fruit weight.

**Table 1.** The yield (number and weight) and mean fruit weight (g) of Braeburn Clones harvested on 17 October 2005. Effect of treatments (clones) indicated as non-significant (n.s.) or significant at the 5 (*), 1(**) and 0.1% (***) level

| | **Yield by weight** | | | **Yield by number** | | | **Mean fruit wt (g)** |
|---|---|---|---|---|---|---|---|
| | **Kg tree$^{-1}$** | | **%** | **Number tree$^{-1}$** | | **%** | |
| | **Total** | **>65mm** | **>65mm** | **Total** | **>65mm** | **>65mm** | |
| Hillwell | 4.62 | 3.8 | 87.4 | 28 | 22 | 86.9 | 204.6 |
| Schneider | 4.29 | 4.0 | 93.8 | 24 | 21 | 91.0 | 197.3 |
| Laimburger | 5.35 | 5.2 | 97.8 | 27 | 25 | 96.6 | 208.3 |
| Lochbuie | 4.97 | 4.1 | 90.6 | 30 | 23 | 88.1 | 197.0 |
| Mariri Red | 4.25 | 4.1 | 95.5 | 22 | 21 | 92.1 | 210.0 |
| Fenwicks | 2.97 | 1.0 | 73.5 | 22 | 4 | 67.9 | 214.3 |
| Royal | 4.45 | 0.9 | 18.4 | 44 | 5 | 12.9 | 112.9 |
| s.e.d. (26 d.f.) | 2.023 | 1.31 | 11.32 | 16.5 | 8.5 | 11.3 | 33.86 |
| Clone effect | n.s. | * | *** | n.s. | n.s. | *** | n.s. |

Apart from Fenwicks, the differences in fruit maturity parameters between clones was small. Fenwicks was clearly much more mature at harvest, as evidenced by its yellow background colour, lack of firmness and the extent of starch loss (Table 2). In all years of the study Fenwicks has proved to be early maturing. Unlike in previous years, Mariri Red apples were not the least mature at harvest, although no internal ethylene measurements were carried out in 2005. It is important to recognise that the degree of red coloration exhibited by the various clones may not be an indicator of maturity or suitability for harvesting.

**Table 2.** Harvest maturity parameters for different clones of Braeburn harvested on 17 October 2005. Bulk (12-fruit) samples were formed from selecting two fruits at random from the crop from each tree. Without formal replication no statistical analysis was possible. On Mariri Red and Royal apples there was insufficient area without red colour to enable an assessment of background colour

| | Red colour cover max. 100 | Ground colour 1-green, 4-yellow | Firmness (N) | Soluble solids (%) | Starch 1-black, 10-white |
|---|---|---|---|---|---|
| Hillwell | 90.0 | 3.0 | 110.9 | 13.3 | 4.7 |
| Schneider | 83.3 | 3.0 | 112.5 | 13.5 | 6.0 |
| Laimburger | 73.3 | 2.4 | 107.4 | 12.9 | 5.1 |
| Lochbuie | 90.0 | 2.7 | 110.9 | 13.2 | 5.7 |
| Mariri Red | 100.0 | - | 112.4 | 13.3 | 4.9 |
| Fenwicks | 92.0 | 3.6 | 84.2 | 13.2 | 7.6 |
| Royal | 97.5 | - | 99.5 | 12.1 | 4.8 |

The size grade-out data were extremely variable due to the variable crop load on individual trees and this is reflected by the high SED values in Tables 3 and 4. There were significant effects of clones only in the 61-65 mm size categories (Tables 3 and 4). Most of the Royal apples were in the 61-65 mm size range which contrast strongly with data for most of the other clones that had the highest proportion in the higher (71-75, 76-80 mm) size bands. The highest proportion of Fenwicks fruit was in the 61-65mm category but, unlike the Royal clone, also achieved similar proportions in the higher size bands. In 2004, Fenwicks also produced more fruit in the lower size ranges.

**Table 3.** The effect of Braeburn Clones on the percentage (by number) of apples in different size (mm diameter) categories. Trees were harvested on 17 October 2005. Effect of treatments (clones) indicated as non-significant (n.s.) or significant at the 5 (*), 1(**) and 0.1% (***) level

| | Fruit diameter range (mm) | | | | | |
|---|---|---|---|---|---|---|
| | 56-60 | 61-65 | 66-70 | 71-75 | 76-80 | >80 |
| Hillwell | 0.8 | 13.1 | 15.7 | 33.5 | 17.2 | 20.4 |
| Schneider | 0 | 9.0 | 10.8 | 33.1 | 21.9 | 25.1 |
| Laimburger | 0 | 3.4 | 8.6 | 22.9 | 23.3 | 41.7 |
| Lochbuie | 0 | 11.9 | 12.1 | 28.5 | 17.6 | 29.9 |
| Mariri Red | 0 | 7.9 | 3.3 | 26.0 | 30.6 | 32.2 |
| Fenwicks | 0 | 32.1 | 7.8 | 16.8 | 25.7 | 17.6 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Royal | 0 | 87.1 | 4.0 | 12.3 | 2.9 | 0 |
| s.e.d. (26 d.f.) | - | 11.3 | 5.57 | 10.15 | 12.68 | 18.72 |
| Clone effect | - | *** | n.s. | n.s. | n.s. | n.s. |

**Table 4.** The effect of Braeburn Clones on the percentage (by weight) of apples in different size (mm diameter) categories. Trees were harvested on 17 October 2005. Effect of treatments (clones) indicated as non-significant (n.s.) or significant at the 5 (*), 1(**) and 0.1% (***) level

| | **Fruit diameter range (mm)** | | | | | |
|---|---|---|---|---|---|---|
| | **56-60** | **61-65** | **66-70** | **71-75** | **76-80** | **>80** |
| Hillwell | 0.6 | 12.0 | 10.9 | 30.3 | 16.6 | 29.5 |
| Schneider | 0 | 6.2 | 8.9 | 28.1 | 28.1 | 28.7 |
| Laimburger | 0 | 2.2 | 7.3 | 21.1 | 23.1 | 46.2 |
| Lochbuie | 0 | 9.4 | 10.8 | 28.5 | 18.4 | 32.8 |
| Mariri Red | 0 | 4.6 | 3.1 | 27.0 | 30.9 | 34.4 |
| Fenwicks | 0 | 26.6 | 6.2 | 25.1 | 25.0 | 17.2 |
| Royal | 0 | 81.6 | 4.8 | 18.0 | 2.7 | 0 |
| s.e.d. (26 d.f.) | | 11.20 | 5.29 | 12.04 | 12.64 | 19.29 |
| Clone effect | | *** | n.s. | n.s. | n.s. | n.s. |

Fruit stored in air at 0-0.5$^{o}$C until 15 March 2006 developed physiological disorders such as bitter pit, core flush and flesh browning that were not seen in the previous years crop (Table 6). These disorders are likely to have been caused by the light crop of large fruit in 2005. It is recognised that the fruit was over-stored in that it is recommended that air-stored fruit should be marketed by the end of December. However, over-storing fruit allows clonal comparisons to be made that may have a bearing on decisions made by growers on the most appropriate clones to plant.

In contrast to the previous year, apples from the Royal clone had a green background colour but, consistent with previous results, Fenwicks fruit were much softer than those from other clones. Royal fruit were also softer than the remaining clones. Hillwell, Schneider, Laimburger, Lochbuie and Mariri Red were generally similar in firmness and background colour (not measured on Mariri Red). Fenwicks was the only clone to exhibit splitting and where symptoms of senescence were evident externally (data not shown).

Bitter pit incidence was highly variable from tree-to-tree and no significant effects of clone were found (Table 6). Transforming the core flush data to angles prior to analysis indicated no differences between Hillwell, Schneider, Laimburger, Lochbuie and Mariri Red. Fenwicks

and Royal fruit were affected by core flush to a similar extent and much less so than the remaining clones. Flesh browning was essentially limited to the Schneider clone.

**Table 5.** The quality of different clones of Braeburn apples harvested on 17 October 2005 and stored in air at 0-0.5ºC until 15 March 2006. On Mariri Red apples there was insufficient area without red colour to enable an assessment of background colour. Effect of treatments (clones) indicated as non-significant (n.s.) or significant at the 5 (*), 1(**) and 0.1% (***) level

| | **Red colour** | **Ground colour** | **Firmness** |
|---|---|---|---|
| | **Max. 100** | **1 green, 4 yellow** | **(N)** |
| Hillwell | 88.7 | 3.6 | 81.2 |
| Schneider | 85.7 | 3.6 | 84.0 |
| Laimburger | 82.4 | 3.2 | 81.3 |
| Lochbuie | 91.8 | 3.7 | 82.3 |
| Mariri Red | 99.5 | - | 88.4 |
| Fenwicks | 91.8 | 3.7 | 50.1 |
| Royal | 95.6 | 2.7 | 76.3 |
| s.e.d. (d.f.) | 5.09 (22) | 0.23 (18 ) | 2.65 (21) |
| Clone effect | * | ** | *** |

**Table 6.** The incidence of physiological disorders in different clones of Braeburn apples harvested on 17 October 2005 and stored in air at 0-0.5ºC until 15 March 2006. Effect of treatments (clones) indicated as non-significant (n.s.) or significant at the 5 (*), 1(**) and 0.1% (***) level

| | **Bitter pit (%)** | **Core flush (%)** | **Flesh browning (%)** |
|---|---|---|---|
| Hillwell | 2.8 | 38.9 | 0 |
| Schneider | 1.9 | 48.7 | 31.8 |
| Laimburger | 11.5 | 52.6 | 2.9 |
| Lochbuie | 5.8 | 25.2 | 1.0 |
| Mariri Red | 1.3 | 51.5 | 0 |
| Fenwicks | 3.2 | 4.1 | 0 |
| Royal | 0.3 | 8.8 | 0 |
| s.e.d. (20 d.f.) | 7.02 | 11.88 | 4.70 |
| Clone effect | n.s. | *** | *** |

***Conference***

According to Dr Predieri, the main traits of the clones supplied for the UK trial are as follows:

| **Clone** | **Characteristics** |
|---|---|
| 3-15-46 | Very compact with short internodes. Released as Conference 'Light'. |
| 3-6-80 | Reduced vigour. |
| 3-6-58 | Improved sensory analysis, increased calyx russetting (favourable in Italy). |
| 3-5-9 | High, consistent productivity. |
| 3-15-57 | Improved sensory analysis, increased calyx russetting (favourable in Italy). |

The average crop from the six clones in 2005 was about 50% of that recorded in the previous year and was associated with low floral bud (spur and terminal) numbers in 2005 (16-34 per tree) compared with 2004 (73-134 per tree).

As in the previous year, there were no significant effects of the clones on tree growth, number of floral buds or total fruit yield (Tables 7 and 8). Although clone 3-15-46 ('Conference Light') had greater shoot number and girth than other clones, the effects just failed to reach significance at the 5% level. Clone 3-6-6 (possible increased frost resistance) produced the highest yield but not significantly more than other clones and tended to produce more large (>65mm) fruit (Table 8).

There were significant effects of the clones on accumulated data for shoot length and number, total yield and yield efficiency (Tables 7 and 10).

As in the previous two years, there was a clear pattern in the data as regards growth and cropping over the period since planting. Clones 3-15-46 and 3-6-58 performed similarly with more shoots and shoot growth, lowest fruit yield and yield efficiency. Clone 3-15-46 had the lowest mean shoot length, i.e. shorter internodes.

Clones 3-6-80 and 3-6-6 continue to have the highest cumulative yield and yield efficiency and performed similarly the standard clone.

Unfortunately, there are no trees of the standard EMLA clone of Conference in the trial. However, in an adjacent rootstock trial (PR184) there are trees of the normal EMLA clone on EMC that were planted at the same time (23 March 1999) although they originated from a different nursery. At this stage there is no indication that the Italian clones are more compact than the standard EMLA and none have a higher accumulated yield and yield efficiency.

Sensory tests were carried out on the standard clone and clones 3-6-58 and 3-15-57, which were selected originally for high sensory quality. All fruit was ripened for 4 days at 20$^{o}$C prior to tasting. Contrary to the previous year fruits of clone 3-6-58 received significantly higher scores for sweetness compared with fruits from the standard clone (Table 12).

Clone 3-15-57 were firmer, grittier, less juicy and less acceptable than EMC or 3-6-58. Clone 3-15-57 failed to soften to an eating ripe stage (10-15 N firmness) (Fig. 1)

On the basis of these results, clones 3-15-57 and 3-6-58 do not offer improved eating quality over the standard clone.

**Table 7.** The growth of Italian compact clones of 'Conference' planted at East Malling in spring 1999 (plot PR185). Treatment effects were non significant (n.s.) or significant at the 5% (*) and 1% (**) level. Data for QC are for trees from an adjacent plot (PR184) planted at the same time but are not strictly comparable with the clone data.

| **Clone** | **Shoot growth 2005** | | **Girth 2005** | | **Average shoot growth (99-05)** | |
|---|---|---|---|---|---|---|
| | **Total length (dm)** | **Number** | **(cm)** | **Total length (dm)** | **Number** | **Mean length (dm)** |
| 3-15-46 | 58.2 | 32 | 15.8 | 58.4 | 25 | 2.34 |
| 3-6-80 | 30.3 | 14 | 13.8 | 43.1 | 15 | 2.69 |
| 3-6-58 | 56.0 | 24 | 14.0 | 64.8 | 22 | 2.91 |
| 3-5-9 | 31.0 | 15 | 13.2 | 40.8 | 15 | 2.66 |
| 3-15-57 | 36.5 | 17 | 12.8 | 41.1 | 14 | 2.96 |
| 3-6-6 | 43.5 | 21 | 14.0 | 45.7 | 16 | 2.91 |
| QC | 23.0 | 15 | 13.4 | - | - | - |
| Treatment effect | n.s. | n.s. | n.s. | ** | *** | ** |
| s.e.d. (14 d.f.) | 12.51 | 6.0 | 0.90 | 6.60 | 2.0 | 0.154 |

**Table 8.** Floral bud production and cropping in 2005 of Italian compact clones of 'Conference' planted at East Malling in spring 1999 (plot PR185). Treatment effects were non significant (n.s.) or significant at the 5% (*) and 1% (**) level. Data for QC are for trees from an adjacent plot (PR184) planted at the same time but are not strictly comparable with the clone data

| **Clone** | **Yield 2005** | | | | **Floral bud numbers 2005** | |
|---|---|---|---|---|---|---|
| | **(kg tree$^{-1}$)** | | **Number** | | **Spur and terminal buds** | **Axillary buds** |
| | **Total** | **Class 1 >65mm** | **Total** | **Class 1 >65mm** | | |
| 3-15-46 | 1.89 | 0.10 | 19 | 1 | 16 | 2 |
| 3-6-80 | 2.35 | 0.10 | 23 | 1 | 24 | 0 |
| 3-6-58 | 2.10 | 0.15 | 22 | 1 | 30 | 0 |
| 3-5-9 | 2.80 | 0.33 | 24 | 2 | 25 | 0 |
| 3-15-57 | 2.77 | 0.20 | 26 | 1 | 27 | 0 |
| 3-6-6 | 4.33 | 0.55 | 36 | 3 | 34 | 0 |

| | | | | | | |
|---|---|---|---|---|---|---|
| QC | 3.05 | 0.13 | 33 | 0 | 33 | 0 |
| Treatment effect | n.s. | n.s. | n.s. | n.s. | n.s. | n.s. |
| s.e.d. (14 d.f.) | 1.418 | 0.161 | 13.6 | 0.9 | 13.8 | 0.7 |

**Table 9.** Size grading of the 2005 crop of Italian compact clones of 'Conference' planted at East Malling in spring 1999 (plot PR185). Treatment effects were non significant (n.s.) or significant at the 5% (*) and 1% (**) level. Data for QC are for trees from an adjacent plot (PR184) planted at the same time but are not strictly comparable with the clone data

| **Clone** | **Weight (kg) of fruit in each size category** | | | | | |
|---|---|---|---|---|---|---|
| | **<50mm** | **50-55mm** | **56-60mm** | **61-65mm** | **66-70mm** | **70-75mm** |
| 3-15-46 | 0.28 | 0.75 | 0.53 | 0.23 | 0.10 | 0 |
| 3-6-80 | 0.34 | 0.59 | 0.93 | 0.38 | 0.09 | 0 |
| 3-6-58 | 0.45 | 0.55 | 0.56 | 0.39 | 0.13 | 0 |
| 3-5-9 | 0.24 | 0.81 | 0.94 | 0.67 | 0.30 | 0 |
| 3-15-57 | 0.41 | 0.73 | 0.88 | 0.55 | 0.20 | 0 |
| 3-6-6 | 0.17 | 0.76 | 1.56 | 1.25 | 0.55 | 0 |
| QC | - | - | - | - | - | - |
| Treatment effect | n.s. | n.s. | n.s. | n.s. | n.s. | - |
| s.e.d. (14 d.f.) | 0.241 | 0.456 | 0.516 | 0.401 | 0.162 | - |

**Table 10.** Cropping and yield efficiency of Italian compact clones of 'Conference' planted at East Malling in spring 1999 (plot PR185). Treatment effects were non significant (n.s.) or significant at the 5% (*) and 1% (**) level. Data for QC are for trees from an adjacent plot (PR184) planted at the same time but are not strictly comparable with the clone data

| Clone | Cumulative yield 99-05 (kg tree$^{-1}$) | | Number | | Yield efficiency (kg/cm$^2$) |
|---|---|---|---|---|---|
| | Total | Class 1 >65mm | Total | Class 1 >65mm | |
| 3-15-46 | 10.59 | 0.52 | 134 | 3 | 0.512 |
| 3-6-80 | 19.16 | 2.23 | 168 | 13 | 1.113 |
| 3-6-58 | 10.45 | 1.73 | 82 | 9 | 0.678 |
| 3-5-9 | 13.17 | 2.98 | 108 | 16 | 0.930 |
| 3-15-57 | 12.10 | 1.73 | 105 | 10 | 0.947 |
| 3-6-6 | 19.80 | 3.36 | 179 | 18 | 1.324 |
| QC | 19.75 | 0.87 | - | - | 1.362 |
| Treatment effect | * | n.s. | ** | n.s. | ** |
| s.e.d. (14 d.f.) | 2.909 | 1.054 | 24.55 | 5.32 | 0.1533 |

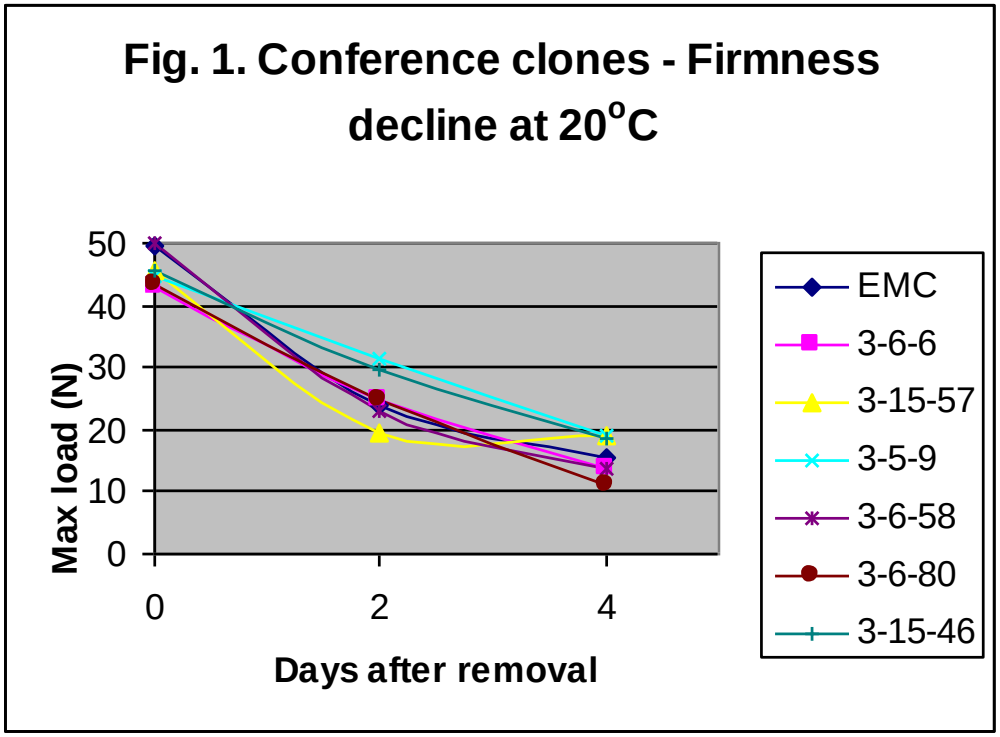
**Table 11.** Soluble solids concentrations (%) of Italian compact clones of 'Conference' (2005 crop) planted at East Malling in spring 1999 (plot PR185). Fruit stored in air at -0.5 to -1$^o$C until 20 January 2006 followed by 4 days at 20$^o$C. Data for QC are for trees from an adjacent plot (PR184) planted at the same time but are not strictly comparable with the clone data

| Clone | Soluble solids (%) |
|---|---|
| 3-15-46 | 15.1 |
| 3-6-80 | 13.2 |
| 3-6-58 | 15.8 |
| 3-5-9 | 15.9 |
| 3-15-57 | 16.8 |
| 3-6-6 | 14.2 |
| QC | 15.7 |

**Table 12.** Sensory analysis of Italian compact clones of 'Conference' (2005 crop) planted at East Malling in spring 1999 (plot PR185). Fruit stored in air at -0.5 to -1$^o$C until 20 January 2006 followed by 4 days at 20$^o$C.Treatment effects were non significant (n.s.) or significant at the 5% (*), 1% (**) and 0.1% (***) level. Data for QC are for trees from an adjacent plot (PR184) planted at the same time but are not strictly comparable with the clone data.

| | Sensory scores (maximum of 10) | | | | | | | (max. 9) |
|---|---|---|---|---|---|---|---|---|
| | Aroma | Astringency | Sweetness | Juiciness | Firmness | Sliminess | Grittiness | Acceptability |
| 3-6-58 | 5.8 | 1.8 | 6.6 | 6.6 | 4.1 | 2.4 | 3.5 | 6.5 |
| 3-15-57 | 4.5 | 1.8 | 4.7 | 4.9 | 5.9 | 2.7 | 5.6 | 4.5 |
| QC | 4.4 | 1.5 | 5.4 | 7.8 | 3.8 | 3.3 | 2.7 | 6.5 |
| Treatment effect | n.s. | n.s. | n.s. | ** | * | n.s. | ** | *** |
| s.e.d. (14 d.f.) | 0.82 | 0.36 | 1.04 | 0.68 | 0.70 | 0.70 | 0.79 | 0.45 |




**Conclusions**

***Braeburn***

There is strong support from UK retailers for good quality Braeburn apples although there is no price premium for UK product (Harding, 2006). Clearly, it is important that growers produce high volumes of apples at the specification required by UK multiple retailers. A minimum of 40% red coloration (not brown) is required but being regarded as a bi-coloured cultivar when grown in the UK this may exclude the redder clones such as Mariri Red and Royal Braeburn. When samples of the various clones were presented to growers and advisers, there was a mixed reaction to the appearance of the highly coloured clone, Mariri Red. Lochbuie scored highest on the basis of appearance.

The following conclusions are based on three cropping years (2003-05) of trees planted in 2001. Although the trees were thinned to two fruits per cluster in each year this did not ensure a sufficiently high percentage of fruit above 65mm in the first two cropping years and may have contributed to the lack of crop in 2005. The trees did not receive irrigation in any year.

The main conclusions thus are:

- On the basis of appearance Mariri Red (formerly Redfield) and the Royal clone may be too red for UK market requirements.

- Lochbuie has been most precocious in cropping producing 73% and 67% more than the average yield for the seven clones in 2003 and 2004 respectively.

- In 2003 and 2004, the Royal clone was worst for cropping and Laimburger also produced poor yields in 2003.

- In two of the three years, Mariri Red, Fenwicks and Royal produced small fruit.

- There were no cropping or fruit size deficiencies associated with the clones currently favoured by the UK growers, i.e. Hillwell, Lochbuie and Schneider.

- Fenwicks was consistently more mature at harvest and in two years Mariri Red was least mature.

- Fenwicks was yellow and soft after air storage and fruit from the 2005 crop developed splitting and senescent breakdown. It is possible that these deficiencies in quality could be rectified by earlier harvesting.

Of the seven clones tested, Hillwell, Schneider and Lochbuie have performed consistently well and the yields of Lochbuie have been exceptionally high. There were no concerns about their suitability for UK production based on appearance, yield, size, harvest maturity and storage quality. There were one or more concerns with the remaining four clones in the trial. Further work on harvest maturity and storage quality on Hillwell, Schneider and Lochbuie is being carried out within HDC project TF152.

***Conference***

After six years, indications are that none of the clones are less vigorous or more productive than the standard EMLA Conference clone.

In support of Italian experience and of results obtained in 2003 and 2004, clone 3-15-46 (Conference 'Light') was most compact in that the mean shoot length based on accumulated data was significantly lower than for other clones. However, despite its compact nature the yield efficiency of Conference 'Light' has been poor so far. Clone 3-6-80 has not proved to be of particularly low vigour to date nor has 3-5-9 provided a higher productivity or greater yield efficiency than standard EMLA Conference or a number of the other mutant clones.

Contrary to Italian experience, 3-15-57 achieved lower scores for acceptability from an informal taste panel and was firmer, less juicy and grittier than those of the standard EMC clone. The effect of frost on the cropping of the reputedly frost tolerant clone 3-6-6 has not been assessed.

When comparing UK results with those obtained in Italy the following comments can be made:

**3-15-46**

As in 2003 and 2004 and in common with Italian experience, clone 3-15-46 (Conference 'Light') was most compact in that it had the lowest mean shoot length. However, despite its compact nature the yield efficiency of Conference 'Light' has been the poorest so far in this trial.

**3-6-80**

Clone 3-6-80 has not proved to be of particularly low vigour to date.

**3-5-9**

The accumulated yield of clone 3-5-9 has been on average less productive than clones 3-6-80, 3-6-6 and the standard EMLA Conference clone.

**3-6-58 and 3-15-57**

The sensory acceptability of 3-6-58 was similar to EMC and acceptability of 3-15-57 was lower than the standard clone.

**3-6-6**

The effect of frost on the cropping of clone 3-6-6 has not been assessed.

The results are on this evidence rather disappointing, in comparison with those obtained in some Italian trials. The reasons for this may be:

- Conference trees on EMC show varying degrees of partial graft incompatibility. This is increased when they are grown in hot climates, such as in Italy. It is just possible that these compact clones are rather more sensitive to this effect than the standard clone and in the hot summer conditions in Italy they are more dwarfing than in the less stressful conditions in the UK;

- The mutant clones are relatively unstable and have reverted back to a more traditional vigorous type. This instability is made worse if they were hard pruned as part of the propagation procedure prior to them being sent to the UK;

- The controls used for comparison in the UK trial are not strictly valid as they are in an adjacent plot. However, from a grower's viewpoint trees planted reasonably close by should suffice for comparative purposes. Nonetheless it would be important to take note of any differences in the two adjacent sites, in terms of pollinators in plot, previous cropping history etc.

***Overall conclusions***

- Early indications are that none of them is less vigorous or more productive than the standard EMLA Conference clone.

- Although the irradiated clone 3-15-46 has shown promise in Italy and has been released as Conference Light, its performance in the UK trial has been disappointing showing low yield efficiency. Consequently, UK growers should not consider planting it at this stage.

**Technology transfer**

There was considerable interest in the trial from growers who attended a Pear Walk at EMR on 26 August 2004 organised by HDC. The novelty of the completely russetted clone (3-6-58) appeared to be of particular interest (Figure 2).

**References**

Predieri, S. (1998). Compact pears obtained through in vitro mutagenesis. *Acta Horticulturae* **475**:127-132

Harding, T. (2006). Marketing and condition of sale of Braeburn. MFSS AGM and EMRA Top Fruit Storage Members' Day, 30 March 2006

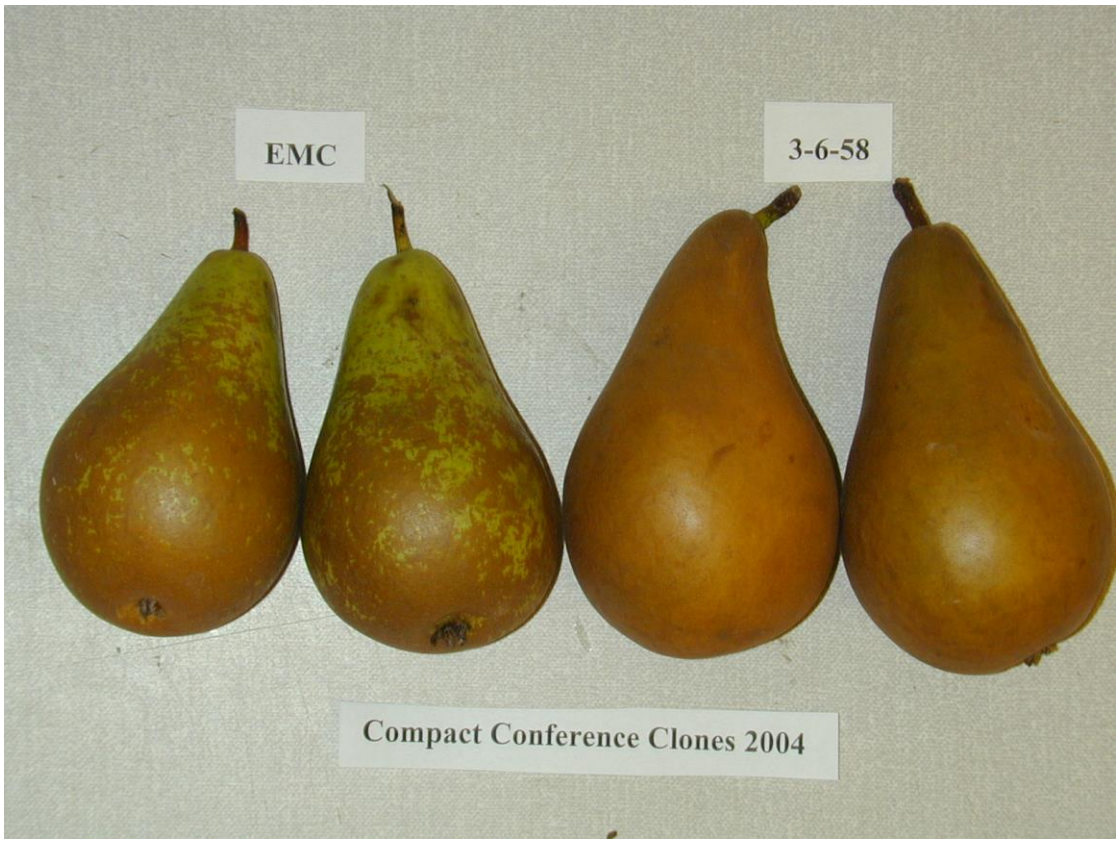



**Figure 2.** The russetted Italian clone of Conference 3-6-58 in comparison with the standard EMLA clone in 2004