

Project Title: Apples & pears: Evaluation of Braeburn and Conference clones

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The results and conclusions in this report are based on a series of experiments conducted over a one-year period. The conditions under which the experiments were carried out and the results have been reported in detail and with accuracy. However, because of the biological nature of the work it must be borne in mind that different circumstances and conditions could produce different results. Therefore, care must be taken with interpretation of the results, especially if they are used as the basis for commercial product recommendations.

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

Signature

Date

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Grower Summary

Headlines

Braeburn clones

As this was the first cropping season firm conclusions are inappropriate. Nevertheless, the 3 Braeburn clones currently favoured by the UK industry, Hillwell, Schneider and Lochbuie, all performed well. Total yields for Hillwell and Schneider were close to the average whereas yields for Lochbuie were 73% more than average. The quantity of fruit produced above 65mm and mean fruit weight were close to average for Hillwell and Lochbuie, however Schneider had the highest % of >65mm fruit (57%) and higher than average fruit weight. The Royal clone performed poorly.

On this very preliminary evidence, therefore, it appears that UK growers are correct in considering the standard clones Lochbuie, Schneider and Hillwell rather than Laimburger, Mariri Red (Redfield), Fenwicks and Royal Braeburn. However, results in subsequent years may modify this initial conclusion.

Irradiated Conference clones

Data is required for the next few seasons before any conclusions can be made about the suitability of any particular clone for UK conditions. 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.

Background and expected deliverables

With funding provided originally by the UK Apple and Pear Research Council (APRC), and subsequently the HDC, 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 HRI 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 current project is scheduled to run until March 2006 by which time the agronomic performance of 6 compact clones of Conference on EMC will have been compared over 7 years (1999-2005) and the cropping and quality of 5 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

Seven clones of Braeburn (Hillwell, Schneider, Laimburger, Lochbuie, Mariri Red, Fenwicks, and Royal Braeburn) on M9 rootstocks were planted in the spring of 2001 on the 'Brogdale at Bradbourne' site at East Malling. In 2003 the fruit was harvested on 10 October and transported immediately to the Jim Mount Building. On arrival 2 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 1.5-2°C and removed on 7 January 2004 for grading and quality assessment.

Yield

The highest yield was from Lochbuie (16.4 kg per tree). The poorest yield was from Royal Braeburn (5 kg per tree) closely followed by Laimburger. The cropping levels of the other clones were close to the average of 9.5 kg per tree (11.9 tonnes per ha).

Fruit size

Of the three clones widely planted in the UK Schneider produced the highest % of >65mm fruit (57%). Average fruit weight and percentage of fruit above 65mm was highest for the low yielding Laimburger. If this large fruit size is sustained with larger crops then this clone may show promise. In contrast, the low yielding Royal clone also produced the smallest fruit. Mariri Red carried a crop (10.1 kg per tree) that was close to the average but fruit tended to be small when compared to other clones producing similar yields. Fruit maturity factors indicate that this clone would have benefited from later harvest.

Maturity

Apart from Fenwicks, and to a lesser extent Mariri Red, the differences in fruit maturity parameters between clones were small. Fenwicks was much more mature at harvest as evidenced by its yellow background colour, high internal ethylene concentration and greater starch loss. This clone would appear to mature earlier than the others in trial and would benefit from an earlier harvest. On the other hand, Mariri Red appeared to be slightly immature at harvest and might benefit from a later harvest date.

Storage

With the exception of Fenwicks, fruit from all clones stored well in air at 1.5-2°C 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 no post-harvest fungicide treatments had been applied. There were no external or internal physiological disorders in fruit from any of the clones.

Eating quality

Apples from the Fenwicks clone had a yellow background and were much softer than those from other clones and scored poorly in an informal tasting of the fruit due to its poor texture. It is possible that earlier picking could significantly improve its ex-store quality. The remaining clones were generally similar in firmness and background colour and scored highly in informal sensory tests.

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). The pattern of clone effects tended to match the maturity status of the fruit at harvest.

Overall conclusions

As this was the first cropping season firm conclusions are inappropriate. Nevertheless, the 3 Braeburn clones currently favoured by the UK industry i.e. Hillwell, Schneider and Lochbuie all performed well.

The Royal clone performed poorly. Laimburger may prove useful provided yields increase and large fruit size is maintained. Fenwicks and Mariri Red may also offer potential with suitable harvest dates.

It will be important to get a market/multiple retailer appraisal of these clones in the near future bearing in mind that at one stage the markets moved against the redder forms of Gala (Galaxy, Brookfield, etc). There is no point in assessing clones for yield and storage potential etc, if the markets subsequently decide they do not like the colour.

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.

2003 performance

Their growth and cropping were measured in 2003. Clones 3-15-46 and 3-6-58 performed similarly with more growth, less 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. 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 and yield in 2003, accumulated yield and yield efficiency.

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

3-15-46

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 poor 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

Clone 3-5-9 has not shown a higher productivity or greater yield efficiency than normal Conference or a number of the other mutant clones.

3-6-58 and 3-15-57

There have been no assessments of the sensory quality of the fruit.

3-6-6

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

Early indications are that only clone 3-15-46 is less vigorous than the standard EMLA Conference clone and none of them is more productive. Four clones have performed similarly to the standard clone (3-6-80, 3-5-9, 3-15-57 and 3-6-6) whereas the remaining 2 clones (3-15-46 and 3-6-58) have cropped less well and were of much lower yield efficiency. 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 grow more dwarf 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

Data is required for the next few seasons before any conclusions can be made about the suitability of any particular irradiated clone for UK conditions. 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. These results should be discussed with Dr Predieri in the near future.

Financial benefits

There are major financial implications of identifying clones of established varieties 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.
- Although the irradiated pear 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.

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 APRC Council 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.

Objective

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

Materials and Methods

Braeburn

The 7 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 6 replications apart from Royal Braeburn where limited material provided for only 4 replications.

In this trial comparing different clones of Braeburn, records will focus on yield, fruit size, colour and quality. Fruit from these clones and those grown in commercial orchards will be used in storage experiments under HDC project TF 152.

In 2003 the fruit from all trees was harvested on 10 October and transported immediately to the Jim Mount Building. On arrival 2 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 1.5-2°C and removed on 7 January 2004 for grading and quality assessment.

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

Internal ethylene concentration (IEC). A sample of the internal atmosphere of undamaged apples was taken by syringe (0.5ml) and injected into a gas chromatograph fitted with an alumina column and FID detector. Results were expressed as parts per billion (ppb) of ethylene.

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 4 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 BRX-242 refractometer (Camlab 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 (<50, 51-55, 56-60, 61-65, 66-70, 71-75 and 76-80mm) 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 ground 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 4 replicates) on plot PR185 at East Malling. These are being compared with the standard EMLA clone of Conference 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 is 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 7 growing seasons (1999-2005).

During 2003, measurements were taken of tree girth, shoot growth (number and length) and counts were made of flower buds (spur, terminal and axillary). 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 (1999-2003) and yield efficiency was calculated from the accumulated yield and the cross sectional area of the trunks of the trees in 2003.

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

During the course of 2003 we were informed by Worldwide Fruit that the European office for Plant Variety Rights (CPVO) had considered that the Redfield clone is not different from the Mariri Red clone. Consequently, in the future no reference will be made to the Redfield clone and we will adopt the name of Mariri Red for this clone in the trial.

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 (Table 1). 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 3 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 3 clones. Although total yields for Hillwell and Schneider were also close to the average, yields for Lochbuie were 73% more than average.

Table 1. The yield (number and weight) and mean fruit weight (g) of Braeburn Clones harvested on 10 October 2003. Total data includes the 2 fruits per tree removed at harvest for maturity assessment whereas, since these were not graded, they are therefore excluded from the >65 mm data. Treatment effects were 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	9.51	4.91	50.9	85	36	46.4	115.2
Schneider	10.14	5.93	61.7	84	42	57.0	125.3
Laimburger	6.20	4.62	77.7	44	30	74.9	141.9
Lochbuie	16.37	7.97	51.2	139	59	46.1	119.6
Mariri Red	10.13	3.63	34.1	94	27	31.5	109.3
Fenwicks	8.88	4.09	49.9	78	29	45.0	118.8
Royal	4.98	1.26	16.5	50	8	15.0	98.7
s.e.d. (27 d.f.)	1.107	1.185	10.81	12.3	8.3	10.84	7.51
Clone effect	***	***	***	***	***	***	***

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 (Table 2). 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.

Table 2. Harvest maturity parameters for different clones of Braeburn harvested on 10 October 2003. Bulk (12-fruit) samples were formed from selecting 2 fruits at random from the crop from each tree. Without formal replication no statistical analysis was possible. On 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	Internal ethylene concentration		Firmness (N)	Soluble solids (%)	Starch 1-black, 10-white
			ppb	Log ₁₀ ppb			
Hillwell	88.3	1.8	198	2.25	112.1	13.8	2.4
Schneider	86.7	2.0	237	2.30	114.4	13.8	3.1
Laimburger	86.7	1.8	375	2.50	108.7	14.0	3.0
Lochbuie	80.0	1.6	256	2.24	117.0	14.6	3.8
Mariri Red	98.3	1.7	166	2.19	117.3	13.9	2.4
Fenwicks	98.3	3.3	1551	3.15	109.2	14.3	6.5
Royal	100	-	294	2.40	103.3	14.0	2.5

There were significant effects of clones for 3 of the size categories (56-60, 66-70 and 71-75mm) in the grading data presented in Tables 3 and 4. 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.

Table 3. The effect of Braeburn clones on the percentage (by number) of apples in different size (mm diameter) categories. Trees were harvested on 10 October 2003. Treatment effects were non significant (n.s.) or significant at the 5% (*), 1% (**) and 0.1% (***) level.

	Fruit diameter range (mm)						
	<50	51-55	56-60	61-65	66-70	71-75	76-80
Hillwell	3.24	9.7	12.1	28.6	30.5	15.7	0.25
Schneider	1.55	3.6	12.9	25.0	32.5	21.5	3.04
Laimburger	0	0.3	4.5	20.3	27.7	37.4	9.73
Lochbuie	0.32	1.9	14.5	37.2	35.3	10.4	0.34
Mariri Red	0.99	7.5	24.7	35.3	20.4	9.3	1.85
Fenwicks	1.27	6.2	17.0	30.4	32.6	12.2	0.29
Royal	2.38	17.1	41.4	24.2	6.7	6.3	1.98
s.e.d. (27 d.f.)	1.721	5.74	6.59	9.24	8.07	8.03	3.081
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 10 October 2003. Treatment effects were non significant (n.s.) or significant at the 5% (*), 1% (**) and 0.1% (***) level.

	Fruit diameter range (mm)						
	<50	51-55	56-60	61-65	66-70	71-75	76-80
Hillwell	2.19	9.2	11.3	26.4	32.2	18.4	0.34
Schneider	0.62	2.3	11.0	24.4	33.5	24.2	3.96
Laimburger	0	0.2	3.5	18.6	27.4	39.1	11.24
Lochbuie	0.14	1.3	11.6	35.8	38.3	12.4	0.50
Mariri Red	0.59	5.6	22.6	37.1	23.1	8.7	2.30
Fenwicks	0.86	5.2	15.7	28.4	31.9	17.6	0.40
Royal	1.46	14.1	41.7	26.3	6.6	7.6	2.32
s.e.d. (27 d.f.)	1.194	5.36	6.76	9.00	8.78	8.24	3.57
Clone effect	n.s.	n.s.	***	n.s.	*	*	n.s.

With the exception of Fenwicks, fruit from all clones stored well in air at 1.5-2°C until 7 January 2004 (Table 5). 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.

Table 5. The quality of different clones of Braeburn apples harvested on 10 October 2003 and stored in air at 1.5-2°C until 7 January 2004. There was insufficient rot data to justify statistical analysis. Treatment effects were non significant (n.s.) or significant at the 5% (*), 1% (**) and 0.1% (***) level.

	Red Colour	Ground colour	Firmness	Rots
	Max 100%	1 green, 4 yellow	(N)	(%)
Hillwell	83.2	2.1	89.0	0
Schneider	87.3	2.5	86.5	5.0
Laimburger	83.0	2.1	87.7	0.8
Lochbuie	84.4	2.6	86.9	0
Mariri Red	95.8	2.1	91.1	0.8
Fenwicks	89.3	3.6	68.3	2.5
Royal	99.9	2.1	86.1	0
s.e.d. (27 d.f.)	3.00	0.23	1.70	-
Clone effect	***	***	***	-

Conference

In 2003 there were no effects of the clones on tree growth, number of floral buds or fruit yield (Tables 6 and 7). However, there were significant effects of the clones on accumulated data for shoot length and number, total yield and yield efficiency (Tables 6 and 8). 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 4 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 and fruit yield in 2003, accumulated yield and yield efficiency.

Table 6. The growth of Italian 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 EMLA are for trees from an adjacent plot planted at the same time but are not strictly comparable with the clone data.

	Shoot growth 2003		Girth 2003 (cm)	Average shoot growth (1999-2003)		
	Total length (dm)	Number		Total length (dm)	Number	Mean length (dm)
3-15-46	40.3	20	13.2	61.1	24	2.56
3-6-80	30.3	20	12.0	46.5	16	2.79
3-6-58	66.8	26	11.8	61.3	21	2.95
3-5-9	32.0	15	10.9	43.5	15	2.72
3-15-57	31.8	14	10.9	38.1	12	3.12
3-6-6	46.3	20	12.5	47.2	15	3.20
EMLA	38.9	21	11.4	-	-	-
Treatment effect	n.s.	n.s.	n.s.	*	**	*
s.e.d. (14 d.f.)	13.13	4.0	0.92	8.11	2.7	0.192

Table 7. Floral bud production and cropping in 2003 of Italian 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 EMLA are for trees from an adjacent plot planted at the same time but are not strictly comparable with the clone data.

	Yield 2003				Floral bud numbers 2003	
	(kg tree ⁻¹)		Number		Spur and terminal buds	Axillary buds
	Total	Class 1 >65mm	Total	Class 1 >65mm		
3-15-46	3.10	0.13	47	1	24	17
3-6-80	2.77	0.28	23	2	33	5
3-6-58	2.05	0	17	0	36	12
3-5-9	2.83	0.40	25	2	31	7
3-15-57	1.75	0.35	13	2	23	3
3-6-6	3.88	0.30	37	1	32	2
EMLA	3.14	0.06	-	-	-	
Treatment effect	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
s.e.d. (14 d.f.)	1.327	0.296	14.2	1.4	13.6	5.7

Table 8. Cropping of Italian 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 EMLA are for trees from an adjacent plot planted at the same time but are not strictly comparable with the clone data.

	Cumulative Yield 99-03				Yield efficiency (kg/cm ²)
	(kg tree ⁻¹)		Number		
	Total	Class 1 >65mm	Total	Class 1 >65mm	
3-15-46	3.93	0.32	54	2	0.275
3-6-80	8.72	1.82	65	10	0.739
3-6-58	3.23	0.45	25	3	0.304
3-5-9	7.60	2.07	60	11	0.826
3-15-57	6.08	1.42	46	8	0.642
3-6-6	9.97	3.20	77	17	0.860
EMLA	9.66	0.75	-	-	0.919
Treatment effect	*	n.s.	n.s.	n.s.	*
s.e.d. (14 d.f.)	2.151	1.036	17.1	5.2	0.1803

Conclusions

Braeburn

Data is required for the next few seasons before any conclusions can be made about the suitability of any particular clone for UK conditions. Early indications are that none of the clones currently favoured by UK growers i.e. Hillwell, Schneider and Lochbuie are likely to perform below average as regards total yield, production of fruit above 65mm and average fruit weight. Additionally Lochbuie was the highest yielding clone in the trial and Schneider produced a higher than average proportion of fruit above 65mm. Although yield for Laimburger was below average, mean fruit weight and the percentage of fruits above 65mm were higher than any other clone. It remains to be seen whether the advantages on fruit size will be maintained in future years when higher yields are anticipated. Although Mariri Red produced an average yield, fruit size was below average. Cropping and fruit size was poorest on Royal Braeburn trees.

With the exception of Fenwicks the differences in maturity at harvest among clones was small. Fenwicks was clearly much more mature than other clones when harvested on 10 October 2003 and as a result the fruit had a pronounced yellow background colour after air storage until early January and fruit firmness was 16.8 N (1.7 kg) softer than average and sensory scores were poor. It is possible that poor quality from store can be rectified by earlier harvesting in which case Fenwicks would remain a contender for commercial planting in view of its average performance in terms of yield and fruit size. It would be important to monitor the performance of this clone in a growing season that is climatically marginal for the variety when other clones may have to be left on the tree very late in order to mature. As expected in the early years of production all clones vastly exceeded the minimum requirement for area of red coloration required by the multiple retailers (currently 40% minimum). Of general concern was the development of greasiness in stored fruit albeit generally to only a very slight extent. It is hoped that by adjustment of harvest date and storage conditions that greasiness in Braeburn can be avoided and this aspect forms part of a wider investigation of factors influencing the storage quality of Braeburn under HDC project TF152. The main conclusions thus are:

- It is only the first cropping year and assessments are a little premature;
- Hillwell, Schneider and Lochbuie all performed well;
- Lochbuie would appear to be the most precocious in cropping but it will be important to make sure it does not go biennial in 2004;
- The Royal clone performed badly with poor yields and fruit size on very young trees;
- Laimburger may be more promising than at first it seems on account of its large fruit size. The question is whether this will be sustained;
- Fenwicks looks poor on this evidence but in future years it should be picked earlier;
- Mariri Red is the reddest clone, taking account of it being slightly immature when picked and yet still firm and low in ethylene evolution and starch conversion. Its poor size will down grade it if this persists but it may be partly explained by the slightly earlier than necessary harvest; and

- It will be important to get a market/multiple retailer appraisal of these clones in the near future. At one stage the markets moved against the redder forms of Gala (Galaxy, Brookfield, etc) and so there is no point in assessing clones for yield and storage potential etc, if the markets subsequently decide they do not like the colour.

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.
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.

Data is required for the next few seasons before any conclusions can be made about the suitability of any particular clone for UK conditions. Early indications are that none of the clones are less vigorous or more productive than the standard EMLA Conference clone. Four clones have performed similarly to the normal clone (3-6-80, 3-5-9, 3-15-57 and 3-6-6) whereas the remaining 2 clones (3-15-46 and 3-6-58) have cropped less well and were of much lower yield efficiency.

In support of Italian experience clone 3-15-46 (Conference 'Light') was most compact in that the mean shoot length based on accumulated data was lowest and significantly lower than for 3-6-58, 3-15-57 and 3-6-6. 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. There have been no assessments of the sensory quality of the fruit. Therefore it is not possible to comment on the Italian experience of improved quality for clones 3-6-58 and 3-15-57. Similarly 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 rootstock 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 grow more dwarf 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 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.

These results should be discussed with Dr Predieri in the near future. The Conference clone trial has two more years to run during which time it is anticipated that the growth and cropping of the trees will increase substantially and this will allow a more critical appraisal of the performance of the trees.

References

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