

**Contract Report for the
Horticultural Development Council**

**Apple and pear variety evaluation and
development**

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AUTHENTICATION

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

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Contents

	Page
1. GROWER SUMMARY	
1.1. Headlines	7
1.2. Background and expected deliverables	7
1.3. Summary of results and main conclusions	8
1.4. Financial benefits	9
1.5. Action points for growers	9
2. SCIENCE SECTION	
2.1 Introduction	10
2.2 Apple Variety Trial 41	10
2.3 Apple Variety Trial 42	18
2.4 Apple Variety Trial 43	26
2.5 Pear Variety Trial 18	32
3. APPENDICES	
Appendix 1. Fruit Storage and Quality Assessment Key	33
Appendix 2. Selection Index	34

1. Grower Summary

1.1 Headlines

The decision was taken by the HDC to conclude the current series of variety evaluation trials for apples and pears. Two trials (apple variety trials 39 and 40) were concluded in 2003 and the results reported in the annual report for 2003/2004. Apple variety trials 41, 42 and 43 and the pear variety trial 18 were terminated following the 2004 crop. The main conclusions were:

- Two early season varieties of apple Cybele and Delorgue were highlighted as worthy of further consideration for specialist markets.
- The two late season varieties Fukunishiki, and Cameo performed well in most respects especially storage potential. Cameo is available for planting with fruit marketed under a licensing arrangement. Fukunishiki is not readily available but may be worth further evaluation.

1.2 Background and expected deliverables

The profitability of apple and pear production in the UK is poor. UK products usually taste better than the foreign imports, but rarely command a sufficient premium to compensate for the higher production costs. Apples and pears need to appeal to the public and retailers alike, to command a premium price in the markets. The selection and proactive development of new scion varieties and/or 'clones' with unique attributes will best achieve this. Such varieties may be generated as part of UK or overseas programmes of breeding and selection. These varieties should be of high quality, distinct from the current 'commodity varieties' and/or offer opportunities for production in cultural systems with minimal chemical inputs (e.g. organic systems).

Objectives

1. To increase the range of new scion selections evaluated from both UK and overseas sources.
2. To streamline the selection process as much as possible.
3. To network with other countries in variety evaluation, to be aware of new information and planned exploitation initiatives at an early stage.
4. To aid the planned release of new varieties and recommend any further development work necessary (e.g. further storage work).
5. To communicate the results of the work effectively to all relevant facets of the apple and pear industries.
6. To review existing trials and report findings in preparation for the next phase of HDC funded Variety Development work that might be undertaken in future.

1.3 Summary of results and main conclusions

2002

1. Apple variety trial 39 produced its fourth crop from 19 named varieties which displayed an interesting range of fruit characteristics and harvest season. Of particular note were Chevadel, Jubile, Delorgue, Cameo and Fukunishiki.
2. Apple variety trial 40 also produced its fourth crop but none of the seven numbered selections had outstanding attributes.
3. Variety trials 42 and 43 produced their first crop in 2002.
4. Apple variety trial 43 established well during the season.

2003

1. Advanced selections E83/4 and E210/198 from previous replicated trials and small-scale grower trials were reviewed and details collated. E83/4 is being considered for further development due to its attractive fruit colour and good eating quality linked to good orchard performance. E210/198 is not recommended for further development, its dull fruit colour and unattractive fruit shape give a generally poor appearance and marketability despite favorable orchard characteristics
2. Apple variety trial 39 was terminated and results from 5 years cropping were collated. Apple variety trial 39 included a range of named varieties, of which Cybele, Delorgue, Fukunishiki and Cameo were of most interest. Cameo has already gained a commercial place and a marketing club has been formed to develop it.
3. In apple variety trial 40, varieties from the East Malling Research Apple and Pear Breeding Club programme were primarily evaluated. All are bi-coloured varieties and, despite some reasonable orchard performance, none had the outstanding attributes needed to compete in this crowded part of the UK apple market.

2004

1. No selection in apple variety trial 41 was considered suitable for commercial growing. However E303-20, E409-7 and E303-47, whilst not of sufficient merit to warrant commercial development as bi-coloured apples, may provide useful parental material within the breeding programme.
2. No selections in apple variety trial 42 had the necessary attributes to produce a commercially viable variety. Although a number had desirable agronomic characteristics, none displayed the outstanding fruit quality (in particular eating quality), which is required for success in the current highly competitive market for apples.
3. Only E505-163 from apple variety trial 43 produced results, which indicate that further evaluation might be worthwhile.

1.4 Financial Benefits

The interesting selections and varieties identified in these trials offer the possibility of reducing unit costs of production by virtue of their higher yield of quality fruit compared to many standard varieties.

1.5 Action Points for Growers

When considering new plantings a number of varieties from this programme could be considered:

- Cameo is worth considering as a late variety with very good storage potential. It's development into a fully commercial variety is at an advanced stage and is currently being coordinated both by a marketing club within Europe and the European license holder on behalf of members.
- The early varieties Cybele and Delorgue are worth considering in special situations.
- Fukunishiki is an exceptional late variety that might have merit for some growers on favourable sites.
- No other varieties included in the trials displayed the necessary characteristics for commercial success.

2. SCIENCE SECTION

2.1 Introduction

To evaluate new selections and varieties of apples, a series of experimental plantings were made, each containing at least two control varieties for comparative purposes. Cox's Orange Pippin (as Queen Cox clone) is the continuing long term standard, providing easy comparison for growers to assess results and giving continuity with historic data. Royal Gala is used as a modern, current standard variety, and Jonagold as a standard for high yield potential. Smoothee (a Golden Delicious clone), where included in experiments, provides a standard for comparison with trials conducted elsewhere in Europe. Experiments are planned for completion after five crops have been recorded. This places a high selection pressure on varieties for precocity and high fruit quality from young trees. The trials reported here continue a long series of variety evaluation studies first begun at the National Fruit Trials in the 1950's. The sequential numbering of trials has been continued into this HDC funded project.

2.2 Apple Variety Trial 41

Materials and methods

This trial was planted in March 2000 on M9 rootstock with five single-tree plots in a complete randomised block experiment. The first crop was recorded in 2002 when data from only three replicates were utilised. Fruit was thinned to singles but not spaced. Fruit was picked when easily detached from the tree and the yields of fruit recorded. Fruit was graded for size and quality, and placed in cold store. Fruit was stored in air at 3°C and assessed at monthly intervals for quality attributes using the EUFRIN fruit quality protocol (Appendix 1). Where fruit was limited in volume, grading assessments were carried out at the most appropriate period for the selection or variety. To help direct comparison of variety performance a selection index was calculated for each cultivar taking account of fruit quality, size and total yield (Appendix 2). Cultivars were then ranked from 1 to 11 according to the selection index. Marketable yield was taken to be the sum of class 1 and class 2 yields.

Treatments (selections/varieties):

E250-3	E273-55	E303-20
E303-47	E303-71	E403-21
E409-7		

Controls (standard varieties):

Jonagold	Queen Cox	Royal Gala
Smoothee		

Results

The first crop was recorded in 2002 following successful establishment of trees. All numbered selections were received from the East Malling Apple and Pear Breeding Club programme.

Table 1: Apple variety trial 41 - Total crop yield 2002 – 2004 (kg/tree)

Selection/Variety	2002	2003	2004	Total
E250-3	1.30	5.30	6.27	12.9
E273-55	5.87	6.33	10.40	22.6
E303-20	8.03	18.23	23.93	50.2
E303-47	5.87	11.30	13.19	30.4
E303-71	6.47	4.17	7.87	18.5
E403-21	7.07	11.47	11.37	29.9
E409-7	10.03	16.97	20.27	47.3
Jonagold	10.20	18.03	23.27	51.5
Queen Cox	3.57	9.00	6.93	19.5
Royal Gala	5.50	10.07	11.60	27.2
Smoother	10.80	7.87	16.80	35.5
Significance	<0.001	<0.001	<0.001	<0.001
	(22 df)	(22 df)	(22 df)	(22 df)
SED	1.418	3.395	4.092	7.05
CV (%)	21.3	33.7	29.4	23.0

Table 2: Apple variety trial 41 - Fruit size & quality 2003

Selection/ Variety	Total yield (%) in fruit Size grades (mm)						Total yield (%) in quality classes		
	<60	60-65	65-70	70-75	75-80	>80	Class1	Class2	Other
E250-3	41.4	26.3	17.8	5.3	0.0	0.0	60.5	30.3	9.2
E273-55	35.6	20.2	9.0	10.1	3.7	0.0	41.0	37.8	21.3
E303-20	2.1	8.5	10.8	20.1	22.9	23.1	66.5	21.0	12.5
E303-47	6.3	24.5	38.9	22.3	0.9	0.0	84.6	8.2	7.2
E303-71	52.6	26.7	10.3	1.7	0.0	0.0	69.0	22.4	8.6
E403-21	24.4	35.4	24.0	8.3	0.8	0.0	72.9	20.0	7.1
E409-7	79.2	14.8	1.4	0.0	0.0	0.0	79.5	15.9	4.7
Jonagold	1.7	9.6	24.9	27.4	14.6	1.7	55.5	24.3	20.2
Queen Cox	34.2	33.5	12.1	2.7	0.0	0.0	56.0	26.5	17.5
Royal Gala	17.7	45.4	25.7	2.0	0.0	0.0	74.3	16.5	9.2
Smoother	52.2	26.1	2.6	1.7	2.6	0.0	60.9	24.3	14.8

Table 3: Apple variety trial 41 – Key variables, selection index and rank, 2003

Selection/	Yield in	Size	Yield	Selection	Rank by
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Variety	Class1 (%)	% >70mm	2003	Index	Index
E250-3	60.5	23.0	5.30	4.4	9
E273-55	41.0	22.9	6.33	4.0	10
E303-20	66.5	76.9	18.23	26.1	1
E303-47	84.6	62.1	11.30	16.6	3
E303-71	69.0	12.1	4.17	3.4	11
E403-21	72.9	33.1	11.47	12.2	5
E409-7	79.5	1.4	16.97	13.7	4
Jonagold	55.5	68.5	18.03	22.4	2
Queen Cox	56.0	14.8	9.00	6.4	7
Royal Gala	74.3	27.7	10.07	10.3	6
Smoothie	60.9	7.0	7.87	5.3	8

N.B. Yield = Total crop yield as a measure of yield potential

Table 4: Apple variety trial 41 - Fruit size & quality 2004

Selection/ Variety	Fruit Size mm (% Class 1 & 2)						Quality (%)		
	<60	60-65	65-70	70-75	75-80	>80	Class1	Class2	Other
E250-3	22.7	38.3	25.8	7.4	0.0	0.0	65.7	28.5	5.8
E273-55	21.4	30.2	12.2	15.1	4.5	0.0	51.2	32.2	16.6
E303-20	3.9	10.8	10.8	25.3	20.9	18.2	69.4	20.5	10.1
E303-47	7.4	24.7	25.9	28.3	5.7	0.0	81.2	10.8	8.0
E303-71	33.6	46.8	10.5	4.7	0.0	0.0	70.7	22.9	6.4
E403-21	18.2	29.7	30.0	11.6	2.3	0.0	69.8	22.0	8.2
E409-7	50.3	30.4	14.1	0.0	0.0	0.0	77.5	17.3	5.2
Jonagold	2.1	10.6	24.9	27.5	17.6	2.2	59.6	25.3	15.1
Queen Cox	21.3	30.5	33.1	4.7	0.0	0.0	67.0	22.6	10.4
Royal Gala	19.3	35.0	35.8	3.3	0.0	0.0	72.2	21.8	6.0
Smoothie	35.1	33.2	15.2	2.5	3.2	0.0	68.0	21.2	10.8

Table 5: Apple variety trial 41 - Key variables, selection index and rank, 2004

Selection/ Variety	Quality Class1	Size % >70mm	Yield 2004	Selection Index	Rank by Index
E250-3	65.7	33.2	6.27	6.2	11
E273-55	51.2	31.8	10.40	8.6	8
E303-20	69.4	75.2	23.93	34.6	1
E303-47	81.2	59.9	13.19	18.6	3
E303-71	70.7	15.2	7.87	6.8	10
E403-21	69.8	43.9	11.37	12.9	6
E409-7	77.5	14.1	20.27	18.6	3
Jonagold	59.6	72.2	23.27	30.7	2
Queen Cox	67.0	37.8	6.93	7.3	9
Royal Gala	72.2	39.1	11.60	12.9	6
Smoothee	68.0	20.9	16.80	14.9	5

Table 6: Apple variety trial 41 - Storage assessments 2002/2003

Selection/ Variety	Timing	FROM STORE						AFTER 7 DAYS FROM STORE				
		TSS %	Firm Kg	Ripe Score	Eating Score	Juice Score	Texture Score	Firm Kg	Ripe Score	Eating score	Juice Score	Texture Score
E 250/3	Mid Dec.	18.3	11.4	3.0	5	4	3	9.5	3.0	5	5	3
E 273/55	Mid Dec.	13.9	7.6	4.0	7	8	3	7.1	4.5	7	8	3
	Mid Jan.	13.7	7.3	4.0	7	8	3	6.6	4.5	7	8	3
	Erly Feb	14.6	7.5	3.5	6	7	3	7.1	4.5	7	8	3
E 303/20	Mid Dec.	15.6	6.8	5.0	8	8	7	5.9	6.0	6	6	7
	Mid Jan.	15.4	6.7	6.0	5	8	7	5.7	7.0	5	5	7
E 303/47	Mid Dec.	14.6	9.9	2.5	5	8	2	9.7	3.0	5	8	2
	Mid Jan.	14.7	9.7	3.0	5	7	2	9.5	3.0	6	7	2
	Erly Feb	14.6	10.2	2.0	7	8	2	9.5	3.0	7	8	3
E 303/71	Mid Dec.	16.0	8.8	4.5	8	8	3	7.9	5.0	8	8	7
	Mid Jan.	15.7	8.1	4.0	7	7	3	8.3	4.5	7	7	5
	Erly Feb	15.6	8.1	3.0	6	7	3	8.5	4.5	7	7	4
E 403/21	Mid Dec.	14.5	5.8	5.0	7	7	5	5.4	5.5	7	7	5
	Mid Jan.	15.4	5.8	5.5	7	7	7	5.2	7.0	7	7	7
	Erly Feb	14.5	5.3	5.0	8	7	6	4.7	8.0	6	6	6
E 409/7	Mid Dec.	14.4	5.4	5.0	8	7	3	5.3	6.0	7	6	7
	Mid Jan.	15.4	5.6	5.5	8	7	7	5.5	5.5	8	7	7
	Erly Feb	14.4	5.8	5.0	8	7	7	5.2	7.0	6	6	7
Fiesta	Mid Dec.	13.2	7.8	3.5	7	8	3	7.5	4.5	8	8	4
	Mid Jan.	13.6	8.3	4.5	8	8	3	7.0	5.0	8	8	4
Jonagold	Mid Dec.	14.7	6.0	5.0	8	8	4	5.7	5.5	8	8	7
	Mid Jan.	15.1	6.3	5.0	8	8	3	6.2	5.5	8	8	8
	Erly Feb	15.0	7.0	5.0	8	8	7	6.4	5.5	8	8	7
Royal Gala	Mid Dec.	13.0	8.0	4.0	7	8	3	6.8	5.5	8	7	7
	Mid Jan.	14.0	7.5	5.0	7	7	7	6.9	5.0	7	7	7
	Erly Feb	12.9	7.5	5.0	8	8	7	6.6	5.5	7	7	7
Smoothie	Mid Dec.	13.7	5.7	5.0	7	7	7	5.3	5.0	8	8	7
	Mid Jan.	13.2	5.3	5.5	7	7	7	5.5	6.0	7	7	7
	Erly Feb	13.2	5.9	5.0	7	7	7	5.5	6.0	7	7	7

N.B. Fruit Quality Scores; A high score does not necessarily mean a good result.

Eating (Taste): 1 = extremely poor, 9 = excellent

Ripeness: 1 = very unripe, 9 = over-ripe

Texture: 1 = extremely coarse, 9 = extremely fine

Juiciness: 1 = very dry, 9 = very juicy
TSS = Total soluble solids (%) Firm = Fruit firmness (kg)

Table 7: Apple variety trial 41 - Storage assessments 2003/04

Selection/ Variety	Sample Time	FROM STORE						AFTER 7 DAYS FROM STORE				
		TSS %	Firm Kg	Ripe Score	Eating Score	Juice Score	Texture Score	Firm kg	Ripe Score	Eating Score	Juice Score	Texture Score
E 250/3	Mid Nov	17.8	11.9	2.0	5	7	1	11.0	3.0	5	7	3
E 273/55	Mid Nov	16.1	8.3	3.0	7	8	3	7.5	4.0	7	8	4
	Mid Dec	15.8	8.0	3.0	7	7	3	7.8	4.5	7	8	3
	Mid Jan	15.6	7.8	4.0	6	7	3	7.4	4.5	7	8	3
E 303/20	Mid Nov	17.8	7.1	5.0	8	8	7	5.7	6.0	6	6	7
	Mid Jan	17.3	7.0	6.0	6	8	7	5.5	7.0	5	5	7
E 303/47	Mid Nov	16.6	9.5	3.0	5	8	3	8.6	4.0	7	8	4
	Mid Jan	16.4	9.3	3.0	5	8	2	9.0	4.0	7	8	3
	Mid Feb	16.0	9.6	3.0	6	7	3	9.3	4.0	7	7	3
E 303/71	Mid Nov	17.8	9.0	3.0	6	8	4	8.4	4.5	8	8	4
	Mid Dec	17.4	8.7	4.0	7	7	3	8.5	5.0	7	7	4
	Mid Jan	17.5	8.6	4.0	6	7	3	8.3	5.0	7	7	4
E 403/21	Mid Nov	16.7	7.0	4.0	8	8	4	5.8	6.0	6	6	7
	Mid Dec	16.6	7.1	4.0	7	7	5	5.6	5.0	7	7	6
	Mid Jan	16.5	7.0	5.0	8	7	5	5.2	7.0	6	7	6
E 409/7	Mid Nov	18.1	6.6	5.5	7	6	7	6.3	7.0	6	6	7
	Mid Dec	18.0	6.4	5.0	7	7	6	6.1	7.0	7	6	7
	Mid Jan	18.3	6.4	5.0	8	7	6	6.2	8.0	7	6	7
Jonagold	Mid Nov	17.0	6.4	5.0	8	8	7	6.2	5.5	8	8	7
	Mid Dec	16.5	6.1	5.0	8	8	6	6.0	5.5	8	8	7
	Mid Jan	17.0	6.3	5.0	8	8	6	6.1	5.5	8	8	7
Queen Cox	Mid Nov	19.6	7.0	6.0	5	6	7	6.5	9.0	4	5	7
Royal Gala	Mid Nov	15.2	8.8	4.0	8	8	4	7.0	5.5	7	7	7
	Mid Dec	14.0	7.9	5.0	7	7	7	6.8	5.5	7	7	7
	Mid Jan	14.3	7.6	5.0	8	7	7	6.8	5.5	7	7	7
Smoothee	Mid Nov	16.9	6.7	4.5	7	8	5	6.8	6.0	6	7	5
	Mid Dec	16.4	6.3	5.0	7	7	6	6.0	6.0	7	7	6
	Mid Jan	16.1	6.5	5.0	7	7	6	5.9	6.0	7	7	6

N.B. Fruit Quality Scores; A high score does not necessarily mean a good result.

Eating (Taste): 1 = extremely poor, 9 = excellent

Ripeness: 1 = very unripe, 9 = over-ripe

Texture: 1 = extremely coarse 9 = extremely fine

Juiciness: 1 = very dry, 9 = very juicy

TSS = Total soluble solids (%) Firm = Fruit firmness (kg)

Table 8: Apple variety trial 41 - Storage assessments 2004/05

Selection/ Variety	Sample Date	FROM STORE						AFTER 7 DAYS FROM STORE				
		TSS %	Firm Kg	Ripe Score	Eating Score	Juice Score	Texture Score	Firm kg	Ripe Score	Eating Score	Juice Score	Texture Score
E 250/3	Mid Nov	16.8	9.1	2	5	7	1	8.9	3	5	7	3
	Mid Dec	15.2	7.8	4	6	7	3	7.5	4	6	7	4
E 273/55	Mid Nov	15.0	8.1	4	7	7	3	7.4	4	7	7	4
	Mid Dec	15.3	7.7	4	7	8	3	7.2	5	7	7	3
	Mid Jan	15.2	7.3	5	6	7	3	6.9	6	6	8	3
E 303/20	Mid Nov	16.8	7.0	6	7	7	7	5.5	6	6	6	7
	Mid Jan	16.3	6.6	6	6	7	7	5.2	7	5	6	7
E 303/47	Mid Nov	15.6	8.1	3	5	7	3	7.8	4	7	7	4
	Mid Jan	15.7	8.3	3	5	7	3	8.1	4	7	8	3
	Mid Feb	15.4	8.2	4	6	7	3	8.3	5	7	7	4
E 303/71	Mid Nov	17.1	8.9	3	6	7	4	7.8	4	8	7	4
	Mid Dec	16.5	8.2	4	7	7	3	7.5	5	7	7	3
	Mid Jan	16.7	8.4	4	6	7	3	7.7	6	7	7	4
E 403/21	Mid Nov	16.1	7.0	4	8	7	5	5.9	6	6	6	6
	Mid Dec	16.2	7.3	4	7	7	5	6.2	5	7	6	6
	Mid Jan	16.6	6.8	5	8	7	5	6.1	7	6	6	6
E 409/7	Mid Nov	17.1	6.2	5	7	6	7	5.9	7	6	6	6
	Mid Dec	17.0	6.5	5	7	7	6	6.0	7	7	6	6
	Mid Jan	17.6	6.1	5	8	7	6	5.6	8	7	6	6
Jonagold	Mid Nov	16.7	6.1	5	8	8	7	5.8	5	8	7	6
	Mid Dec	16.1	5.7	5	8	8	6	5.5	5	8	7	6
	Mid Jan	16.4	6.3	5	8	8	6	5.7	5	8	7	6
Queen Cox	Mid Nov	18.6	7.0	6	5	6	7	6.5	8	4	5	6
	Mid Dec	18.0	6.8	7	6	6	6	6.1	9	5	5	6
Royal Gala	Mid Nov	15.6	8.3	4	6	6	5	7.3	5	6	7	7
	Mid Dec	14.8	7.5	5	7	7	7	6.6	5	7	7	7
	Mid Jan	14.5	7.4	6	8	7	7	6.2	6	7	7	7
Smoothee	Mid Nov	16.7	6.4	4	6	7	5	5.8	5	6	7	5
	Mid Dec	16.5	6.5	5	7	7	6	5.6	6	7	7	6
	Mid Jan	16.1	6.2	5	7	7	6	5.7	6	7	7	6

N.B. Fruit Quality Scores; A high score does not necessarily mean a good result.

Eating (Taste): 1 = extremely poor, 9 = excellent

Ripeness: 1 = very unripe, 9 = over-ripe

Texture: 1 = extremely coarse 9 = extremely fine

Juiciness: 1 = very dry, 9 = very juicy

TSS = Total soluble solids (%) Firm = Fruit firmness (kg)

Discussion and conclusions

Trees grew well and some of the selections from the East Malling breeding programme had high yield potential when compared with Jonagold, but with a higher proportion of class 1 fruit.

E250-3 was very low yielding and produced over 60% fruit less than 605mm in size. Selection index in 2003 and 2004 highlighted poor performance, 9th and 11th respectively.

E273-55 gave yields similar to Queen Cox but with only 41 % of fruit class 1 quality. Fruit held firmness and eating quality in store, similar to Royal Gala and showed indications of long storage potential with fruit not fully ripe in February.

E303-20 had a good selection index score but had variable eating quality scores from season to season. Although good to eat directly out of store, the eating quality and fruit firmness decreased in ambient conditions after storage and after December with eating scores dropping from 8 to 5. Fruit size was very good but an appreciable proportion of the crop (18 to 26%) over 85 mm. This variety appears to have a limited storage life with ripeness reaching scores of 6 and 7 in January early February. Fruit firmness drops rapidly once fruit is removed from store (by 1.5kg in 7 days).

E303-47 produced a comparable yield to Royal Gala with a high proportion of fruit in class 1 (>80%). Fruit was firm (over 9 kg) and firmness was held out of store at ambient temperatures but its eating quality may not prove to be acceptable, being only moderate and achieving a similar score to Smoothie rather than being outstanding. The indications are that it has good storage potential as ripeness scores were still low (2/3) into January and February.

E303-71 a high proportion of fruit less than 65mm (circa 80%) in size and low yield (less than half Queen Cox levels) resulted in a low selection index ranking.

E403-21 produced yields comparable to Royal Gala with a reasonably good proportion of yield, about 70% of class 1 quality. Fruit size was disappointing however, with more than 70% of fruit <70 mm in size. Fruit had naturally low firmness (5.8kg in 2002) which dropped when removed from store, although eating quality received good scores of 7 and 8.

E409-7 produced high yields with a high proportion of class 1 fruit, but size was small with over 50% of fruit less than 60mm. This variety would require intensive thinning of fruitlets, similar to that required by Gala, in order to achieve adequate fruit size. It had consistently good eating quality, with scores of 8. However, this is a naturally less firm fruit than Royal Gala, which coupled with its undistinctive bicolour appearance, would inhibit its development for the commercial market.

None of the selections from this trial were considered to be suitable for commercial growing. Whilst not of sufficient merit to warrant commercial development as bi-coloured apples, selections E303-20, E409-7 and E303-47 may provide useful parental material within the breeding programme.

2.3 Apple Variety Trial 42

Materials and Methods

This was planted in April 2001 on M9 rootstock with five single-tree plots in a complete randomised block experiment. The first crop was recorded in 2002 when data from only three replicates were utilised. All numbered selections were received from the East Malling Apple and Pear Breeding Club programme. Fruit was thinned to singles but not spaced. Fruit was picked when easily detached from the tree and the yields of fruit recorded. Fruit was graded for size and quality and placed in cold store. Fruit was stored in air at 3°C and assessed at monthly intervals for quality attributes using the EUFRIN fruit quality protocol (Appendix 1). Where fruit was limited in volume, grading assessments were carried out at the most appropriate period for the selection. To help with direct comparison of variety performance, a selection index was calculated for each cultivar taking account of fruit quality, size and total yield (Appendix 2). Cultivars were then ranked from 1 to 12 according to the selection index. Marketable yield was taken to be the sum of class 1 and class 2 yields.

Treatments (selections/varieties):

E402-16	E403-19	E447-62
E447-79	E500-47	E505-79
E506-244	E506-312	E506-80
G1-27		

Controls (standard varieties):

Queen Cox	Royal Gala
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Results

Fruit set was variable in the spring of 2002 with heavy set in some trees but light set in others. There was considerable variability within a selection. Trees were growing well. The first year crops from East Malling selections compared favourably with the standards, but the low yields limited the grading and storage assessments that could be carried out. In the 2003 season a full crop was recorded.

Table 9: Apple variety trial 42 – Total crop yields 2002- 2003 (kg/tree)

Selection/ Variety	2002	2003	2004	Total
E402-16	4.07	6.20	6.33	16.60
E403-19	2.33	4.50	3.13	9.97
E447-62	0.70	13.33	9.87	23.90
E447-79	1.93	11.37	11.43	24.73
E500-47	1.50	4.70	4.43	10.63
E505-79	2.33	2.43	8.73	13.50
E506-80	2.83	8.80	13.93	25.57
E506-244	4.07	9.00	14.17	27.23
E506-312	2.13	3.90	5.93	11.97
G1-27	0.93	4.27	1.60	6.80
Queen Cox	1.60	5.27	7.27	14.13
Royal Gala	0.60	8.77	11.77	21.13
Significance	0.061	<0.001	<0.001	<0.001
	(22df)	(22df)	(22df)	(22df)
SED	1.360	1.748	2.502	3.989
CV (%)	65.2	25.4	30.5	23.2

Table 10: Apple variety trial 42 - Fruit size & quality 2003

Selection/ Variety	Fruit Size mm (%Class 1 & 2)						Quality (%)		
	<60	60-65	65-70	70-75	75-80	>80	Class1	Class2	Other
E402-16	23.0	32.0	13.5	5.6	1.7	0.0	61.2	14.6	24.2
E403-19	3.1	11.5	16.7	17.7	9.4	3.1	22.9	38.5	38.5
E447-62	6.7	4.9	3.5	13.0	20.5	22.1	44.7	26.0	29.3
E447-79	66.4	21.2	6.1	0.5	0.0	0.0	71.5	22.6	5.8
E500-47	1.1	7.1	21.7	38.0	12.0	2.7	75.5	7.1	17.4
E505-79	30.5	28.8	18.6	3.4	0.0	0.0	61.0	20.3	18.6
E506-244	34.1	25.4	21.5	11.8	1.2	0.0	82.5	11.5	6.0
E506-312	34.2	19.7	20.2	8.3	0.0	0.0	56.0	26.4	17.6
E506-80	37.8	27.7	22.8	7.1	0.0	0.0	76.4	19.1	4.5
G1-27	37.1	34.0	6.2	0.0	0.0	0.0	54.6	22.7	22.7
Queen Cox	41.4	28.3	10.3	0.0	0.0	0.0	50.3	29.7	20.0
Royal Gala	60.0	33.5	3.5	0.0	0.0	0.0	83.1	13.8	3.1

Table 11: Apple variety trial 42 - Fruit size & quality 2004

Selection/ Variety	Fruit Size mm (%Class 1 & 2)						Quality (%)		
	<60	60-65	65-70	70-75	75-80	>80	Class1	Class2	Other
E402-16	14.0	41.1	23.0	5.6	4.9	0.0	68.0	20.6	11.4
E403-19	2.5	12.5	20.6	19.5	12.4	5.0	42.3	30.2	28.5
E447-62	5.6	5.8	5.8	15.6	26.0	20.0	55.0	23.8	21.2
E447-79	40.4	41.5	8.1	4.5	0.0	0.0	70.5	24.0	5.5
E500-47	2.0	9.5	22.5	36.0	12.0	3.6	75.0	10.6	14.4
E505-79	15.6	40.8	23.4	6.6	0.0	0.0	65.0	21.4	13.6
E506-244	24.0	26.4	28.5	12.0	2.1	0.0	80.5	12.5	7.0
E506-312	26.2	22.2	26.6	10.4	1.0	0.0	60.0	25.4	14.6
E506-80	33.8	26.0	23.8	9.2	0.0	0.0	77.4	15.4	7.2
G1-27	35.1	35.0	10.7	0.0	0.0	0.0	56.6	24.2	19.2
Queen Cox	38.9	25.6	12.5	5.5	0.0	0.0	52.3	30.2	17.5
Royal Gala	45.0	30.5	15.5	5.0	0.0	0.0	84.0	12.0	4.0

Table 12: Apple variety trial 42 - Key variables, selection index and rank, 2003

Selection/ Variety	Quality Class1	Size % >70mm	Yield 2003	Selection Index	Rank by Index
E402-16	61.2	20.8	6.20	5.1	7
E403-19	22.9	46.9	4.50	3.1	10
E447-62	44.7	59.1	13.33	13.8	1
E447-79	71.5	6.6	11.37	8.9	4
E500-47	75.5	74.5	4.70	7.1	6
E505-79	61.0	22.0	2.43	2.0	12
E506-244	82.5	34.4	9.00	10.5	2
E506-312	56.0	28.5	3.90	3.3	8
E506-80	76.4	30.0	8.80	9.4	3
G1-27	54.6	6.2	4.27	2.6	11
Queen Cox	50.3	10.3	5.27	3.2	9
Royal Gala	83.1	3.5	8.77	7.6	5

N.B. Total yield used as a measure of the yield potential of each selection.

Table 13: Apple variety trial 42 - Key variables, selection index and rank, 2004

Selection/ Variety	Quality Class1	Size % >70mm	Yield 2004	Selection Index	Rank by Index
E402-16	68.0	33.5	6.33	6.4	8
E403-19	42.3	57.5	3.13	3.1	11
E447-62	55.0	67.4	9.87	12.1	4
E447-79	70.5	12.6	11.43	9.5	5
E500-47	75.0	74.1	4.43	6.6	7
E505-79	65.0	30.0	8.73	8.3	6
E506-244	80.5	42.6	14.17	17.4	1
E506-312	60.0	38.0	5.93	5.8	9
E506-80	77.4	33.0	13.93	15.4	2
G1-27	56.6	10.7	1.6	1.1	12
Queen Cox	52.3	18.0	7.27	5.1	10
Royal Gala	84.0	20.5	11.77	12.3	3

N.B. Total yield used as a measure of the yield potential of each selection.

Table 14: Apple variety trial 42 - Storage assessments 2002/2003

Selection/ Variety	Timing	FROM STORE						AFTER 7 DAYS FROM STORE				
		TSS %	Firm. Kg	Ripe. Score	Eating Score	Juice Score	Text. Score	Firm kg	Ripe Score	Eating Score	Juice Score	Text. Score
E 402/16	Mid Dec.	12.9	7.8	4.5	7	6	7	7.1	5.5	8	8	7
	Mid Jan.	12.0	7.5	5.5	7	7	7	6.9	9.0			
	Early Feb	12.2	7.4	9.0	3	7	7		9.0			
E 447/62	Mid Dec.	12.9	7.0	5.0	8	8	7	6.5	5.5	7	8	8
	Mid Jan.	13.3	7.1	4.5	8	8	4	6.3	5.0	8	8	7
E 447/79	Mid Dec.	14.4	8.4	4.5	7	7	7	7.8	5.0	8	8	7
	Mid Jan.	13.8	8.6	4.0	7	7	5	7.5	4.0	7	7	5
E 500/47	Mid Dec.	14.7	9.0	3.0	7	8	2	7.9	4.5	8	8	7
E 505/79	Mid Dec.	15.2	7.6	5.0	7	7	7	6.4	4.5	5	8	3
	Mid Jan.	12.8	6.5	5.0	7	8	7	6.2	5.5	7	8	7
	Early Feb	13.3	7.1	3.0	5	6	3	6.0	5.0	7	7	7
E 506/244	Mid Dec.	13.6	7.7	4.0	7	8	3	7.3	5.0	8	8	5
	Mid Jan.	13.9	7.5	4.5	7	7	5	7.4	5.0	8	8	7
	Early Feb	13.4	7.5	4.5	7	8	3	6.9	4.5	7	8	4
E 506/80	Mid Dec.	13.6	8.8	3.0	7	7	7	8.6	3.0	7	7	7
	Mid Jan.	13.7	8.6	3.0	5	7	3	8.6	3.0	6	7	3
E506/312	Mid Jan.	14.4	6.9	4.5	7	7	7	6.9	5.0	7	7	7
Queen Cox	Mid Dec.	15.9	6.5	5.5	6	7	5	5.7	6.0	6	7	7
Royal Gala	Mid Dec.	13.6	7.9	4.0	8	8	3	6.8	5.0	8	8	7
	Mid Jan.	13.5	7.1	5.0	7	8	5	6.4	5.0	7	8	5

N.B. Fruit Quality Scores; A high score does not necessarily mean a good result.

Eating (Taste): 1 = extremely poor 9 = excellent

Ripeness: 1 = very unripe 9 = over-ripe

Texture: 1 = extremely coarse 9 = extremely fine

Juiciness: 1 = very dry, 9 = very juicy

TSS = Total soluble solids (%) Firm = Fruit firmness (kg)

Table 15: Apple variety trial 42 - Storage assessments 2003/04

Selection/ Variety	Timing	FROM STORE						AFTER 7 DAYS FROM STORE				
		TSS	Firm	Ripe	Eating	Juice	Texture	Firm	Ripe	Eating	Juice	Texture
		%	kg	Score	Score	Score	Score	kg	Score	Score	Score	Score
E 402/16	Mid Nov	15.3	8.2	1.0	3	7	3	7.1	5.5	7	7	7
	Mid Dec	13.0	7.9	3.0	5	7	4	7.1	8.0	7	7	7
	Mid Jan	12.2	7.6	4.0	7	7	4	6.8	8.0	7	7	7
	Mid Feb	12.3	7.5	6.0	7	7	4	6.7	8.0	6	7	7
E 403/19	Late Sep	14.0	6.1	8.5	3	4	8					
	Mid Nov	13.6	5.7	9.0	4	5	7					
E 447/62	Mid Nov	17.6	7.6	4.0	7	8	3	7.4	5.5	7	7	7
	Mid Dec	16.5	7.4	5.0	7	7	4	7.0	5.0	7	7	7
	Mid Jan	17.0	7.2	7.0	5	7	4	6.9	7.0	7	7	7
	Mid Feb	17.2	7.0	8.0	3	7	5	6.7	7.0	7	7	7
E 447/79	Mid Nov	18.4	8.8	4.0	6	7	4	8.5	4.5	8	7	4
	Mid Nov	16.0	8.5	4.0	7	7	5	8.0	5.0	7	7	6
	Mid Dec	15.1	8.6	5.0	7	7	5	7.4	4.0	7	7	6
E 500/47	Mid Nov	17.1	8.3	3.0	7	8	3	7.4	7.0	7	8	6
	Mid Dec	15.4	8.0	3.0	7	8	3	7.7	7.0	7	7	6
E 505/79	Mid Nov	16.1	7.4	5.0	8	8	8	7.3	5.0	8	8	8
	Mid Dec	15.8	7.3	5.0	7	8	7	7.0	5.0	7	7	8
	Mid Jan	14.0	7.0	6.0	7	7	7	6.9	6.0	7	7	8
	Mid Feb	14.1	6.8	5.0	6	6	7	6.5	5.0	7	7	7
E 506/244	Mid Nov	16.2	7.8	4.0	8	8	3	7.3	5.0	8	8	5
	Mid Dec	15.6	7.6	4.0	7	7	4	7.3	5.0	7	8	6
	Mid Jan	14.8	7.5	4.0	7	7	3	7.4	5.0	7	8	6
	Mid Feb	14.2	7.5	4.0	7	7	3	6.9	5.0	7	8	5
E506/312	Mid Nov	17.0	8.3	4.0	7	8	3	7.0	5.0	7	8	4
	Mid Dec	16.4	7.1	4.0	7	7	5	6.9	5.0	7	8	5
G1 - 27	Late Sep	14.3	5.4	7.0	3	5	7					
Queen Cox	Mid Nov	18.5	7.3	5.5	6	7	7	6.9	6.5	6	6	7
	Mid Dec	16.0	6.6	5.5	6	7	6	5.8	6.0	6	7	7
Royal Gala	Mid Nov	16.4	8.4	4.0	7	8	3	6.9	6.0	5	7	7
	Mid Dec	14.0	8.0	4.0	8	8	3	6.7	6.0	8	8	7
	Mid Jan	13.7	7.3	5.0	7	8	5	6.4	6.0	7	8	6

N.B. Fruit Quality Scores; A high score does not necessarily mean a good result.

Eating (Taste): 1 = extremely poor, 9 = excellent

Ripeness: 1 = very unripe, 9 = over-ripe

Texture: 1 = extremely coarse 9 = extremely fine

Juiciness: 1 = very dry, 9 = very juicy

TSS = Total soluble solids (%) Firm = Fruit firmness (kg)

Table 16: Apple variety trial 42 - Storage assessments 2004/05

Variety	Timing	FROM STORE						AFTER 7 DAYS FROM STORE				
		TSS	Firm	Ripe	Eating	Juice	Texture	Firm	Ripe	Eating	Juice	Texture
		%	kg	Score	Score	Score	Score	kg	Score	Score	Score	Score
E 402/16	Mid Nov	15.1	6.9	1.0	3	7	4	6.9	5.5	7	7	7
	Mid Dec	13.0	6.9	4.0	5	7	5	7.0	7.0	7	7	7
	Mid Jan	12.2	6.6	5.0	7	7	5	6.4	8.0	6	7	7
E 403/19	Mid Oct	13.0	6.1	8.5	3	4	8	5.9	9.0	3	3	7
	Mid Nov	12.5	5.6	9.0	3	4	7					
E 447/62	Mid Nov	16.6	7.1	4.0	7	7	4	6.8	5.0	7	7	7
	Mid Dec	15.5	6.9	5.0	7	7	4	6.6	6.0	7	7	6
	Mid Jan	16.4	7.0	7.0	5	7	4	6.4	8.0	7	7	6
E 447/79	Mid Nov	17.4	8.7	3.0	6	6	4	8.2	4.0	8	7	4
	Mid Nov	16.2	8.6	4.0	7	7	5	8.0	5.0	7	7	6
	Mid Dec	15.7	8.4	5.0	7	7	5	7.6	6.0	7	7	5
E 500/47	Mid Nov	16.9	8.1	3.0	7	8	3	7.3	6.0	7	8	5
	Mid Dec	15.0	7.8	5.0	7	8	3	7.1	7.0	7	8	6
E 505/79	Mid Nov	16.0	7.1	5.0	7	7	7	6.8	5.0	8	7	8
	Mid Dec	15.9	7.1	6.0	7	8	7	7.0	5.0	7	7	8
	Mid Jan	14.6	6.8	6.0	7	7	7	6.6	6.0	7	7	8
E 506/244	Mid Nov	16.0	7.4	4.0	8	7	4	7.1	5.0	8	8	6
	Mid Dec	15.4	7.2	4.0	7	7	4	7.1	5.0	7	8	6
	Mid Jan	15.0	6.9	5.0	7	7	4	6.6	6.0	7	8	6
E506/312	Mid Nov	16.0	8.0	4.0	7	7	4	7.3	5.0	7	8	5
	Mid Dec	16.1	7.5	4.0	7	7	5	6.9	5.0	7	8	5
	Mid Jan	15.8	7.2	4.0	8	7	5	6.9	5.0	8	8	5
G1 - 27	Late Sep	14.0	5.6	7.0	3	5	7	5.4	7.0	4	5	6
	Mid Oct	13.8	5.2	8.0	4	4	6					
Queen Cox	Mid Nov	16.5	7.1	5.5	6	7	6	6.6	6.0	6	6	7
	Mid Dec	16.0	6.4	6.0	7	7	6	5.8	7.0	7	7	7
	Mid Jan	15.6	6.0	6.5	7	7	6	5.6	7.0	7	7	7
Royal Gala	Mid Nov	16.2	8.0	4.0	7	8	3	6.9	6.0	6	7	6
	Mid Dec	14.6	7.6	4.0	8	8	4	6.7	6.0	8	8	6
	Mid Jan	14.1	7.0	5.0	7	8	6	6.4	6.0	7	8	7

N.B. Fruit Quality Scores; A high score does not necessarily mean a good result.

Eating (Taste): 1 = extremely poor, 9 = excellent

Ripeness: 1 = very unripe, 9 = over-ripe

Texture: 1 = extremely coarse 9 = extremely fine

Juiciness: 1 = very dry, 9 = very juicy

TSS = Total soluble solids (%) Firm = Fruit firmness (kg)

Discussion and conclusions

The trees grew well and the cropping suggests that some of the selections have good yield potential compared to Royal Gala. However, fruit quality after storage was generally disappointing.

E402-16 gave yields comparable to Queen Cox with acceptable fruit size, predominantly 60 – 70mm and 64% of yield in class 1. Fruit had a relatively short season to December or January at the latest with fruit maturing rapidly when out of store, moving from a ripeness score of 1 to 7 within 7 days in November 2003.

E403-19 was low yielding in this trial, producing lower yields than Queen Cox and with a very low proportion of yield in class 1 (23 and 42% in 2003 and 2004). However, the fruit matured early, by late September it was ripe (ripeness score 8.5) with no shelf life and no storage potential.

E447-62 produced good yields with potential similar to Royal Gala. Fruit size was good (more than 40% over 75mm) although the proportion of class 1 was disappointing with only 44 to 55 % class 1, largely due to lack of colour. This is a mid-season apple of moderate firmness and eating quality, but is not suited for long term storage.

E447-79 gave yields comparable to Royal Gala, with a high proportion (some 70%) of yield in class 1, but fruit size was low with over 80% of fruit below 65mm. Heavy thinning would therefore be required in commercial orchards. Fruit was firm (8.6 kg) after storage and eating scores of 7 comparable to Royal Gala. Ripeness scores in January of 4 indicated longer storage potential in air.

E500-47 produced lower yields than Queen Cox but had fruit of good size with over 50% of fruit in the 65 to 75mm size range. Fruit matured rapidly out of store moving from a ripeness score of 3 to 7 in 7 days. But fruit firmness held reasonably well out of store moving from 8kg to 7.7kg in 7 days in 2003.

E505-79 had a yield potential slightly lower than Queen Cox and poor fruit size (over 55% less than 65mm). A moderately firm, mid-season apple. Acceptable eating quality with scores of 7 and fruit firmness comparable to Royal Gala.

E506-244 had the highest yield potential in this trial, greater than Royal Gala, with a good proportion of yield in class 1 (some 80%+). Although fruit size was small (some 50% below 65mm) it did respond to thinning. Fruit firmness and eating quality were comparable with the standards. Consistently good selection index ranking of 1 or 2.

E506-312 was a lower yielding selection than Queen Cox, which produced fruit over a wide range of sizes and had only a moderate proportion of yield of class 1 fruit (56 to 60%). Whilst firmness and eating quality was acceptable compared to the standard varieties.

E506-80 proved to have a high yield potential, greater than Royal Gala, with a good proportion of class 1 fruit (77%). It would need to be thinned, however, to improve size. Its consistency can be seen in the selection index rankings of 2 or 3) Fruit is firm

and may have good storage potential but it has only moderate eating quality.

G1-27 gave very low yields, half the level of Queen Cox over the 3 years of the trial. Over 70% of fruit were below 65 mm in size. This early season variety also had poor eating attributes giving scores of 3 or 4.

Whilst some selections demonstrated high yield potential in this trial, none had the outstanding fruit quality attributes that are necessary for a new variety to be released into the highly competitive apple market.

2.4 Apple Variety Trial 43

Materials and methods

Trees were planted in April 2002 on M9 rootstock with three single tree plots in a complete randomised block experiment. Fruit was thinned to singles but not spaced. Fruit was picked when easily detached from the tree and the yields of fruit were recorded. Fruit was graded for size and quality and placed in cold store. Fruit was stored in air at 3°C and assessed at monthly intervals for quality attributes using the EUFRIN fruit quality protocol (Appendix 1). From the 2003 crop, fruit volume was limited and so storage assessments were limited. Where fruit was limited in volume, assessments were carried out at the most appropriate period for the selection or variety.

To help direct comparison of variety performance, a selection index was calculated for each cultivar taking account of fruit quality, size and total yield (Appendix 2).

Cultivars were then ranked from 1 to 8 according to the selection index. Marketable yield was taken to be the sum of class 1 and class 2 yields.

Treatments (selections/varieties):

East Malling selections;

E275-14	E505-163	E506-336
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European selections;

Inglin	Karma	Katrina
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Controls (standard varieties):

Royal Gala

Results

The trees established well and the first crop was recorded in 2003. The numbered selections were received from the East Malling Apple and Pear Breeding Club programme.

Table 17: Apple variety trial 43 - Crop yields 2003 –2004 (kg/tree)

Selection/Variety	2003	2004	Total
E275-14	1.87	3.67	5.53
E505-163	3.13	12.43	15.57
E506-336	3.30	8.27	11.57
Dalijean	3.00	7.13	10.13
Inglin	2.37	1.80	4.17
Karma	5.83	9.97	15.80
Katrina	4.17	4.07	8.23
Royal Gala	5.07	9.13	14.20
Significance	0.139	<0.001	<0.001
	(14df)	(14df)	(14df)
SED	1.675	1.830	2.985
CV (%)	46.6	25.9	28.0

Table 18: Apple variety trial 43 - Fruit size & quality 2003

Selection/ Variety	Fruit Size mm (% Class 1 & 2)						Quality (%)		
	<60	60-65	65-70	70-75	75-80	>80	Class1	Class2	Other
E275-14	**						**		
E505-163	4.6	31.0	47.1	17.2	0.0	0.0	87.4	12.6	0.0
E506-336	25.6	56.7	12.2	0.0	0.0	0.0	77.8	16.7	5.6
Dalijean	1.3	13.3	32.0	29.3	10.7	0.0	61.3	25.3	13.3
Inglin	64.7	8.8	5.9	0.0	0.0	0.0	41.2	38.2	20.6
Karma	3.4	5.1	20.9	19.8	15.3	3.4	39.5	28.2	32.2
Katrina	28.3	25.8	18.3	6.7	5.0	1.7	73.3	12.5	14.2
Royal Gala	32.4	45.3	17.3	0.0	0.0	0.0	84.9	10.1	5.0

** Insufficient fruit to grade fully.

Table 19: Apple variety trial 43 - Fruit size & quality 2004

Selection/ Variety	Fruit Size mm (% Class 1 & 2)						Quality (%)		
	<60	60-65	65-70	70-75	75-80	>80	Class1	Class2	Other
E275-14	5.5	23.3	41.5	24.7	4.0	1.0	70.0	22.6	7.4
E505-163	6.0	28.0	49.1	15.9	1.0	0.0	89.0	11.0	0.0
E506-336	15.1	49.3	26.6	9.0	0.0	0.0	75.1	20.0	4.9
Dalijean	2.4	15.0	34.0	35.1	13.5	0.0	61.3	25.3	13.0
Inglin	34.0	58.3	7.7	0.0	0.0	0.0	60.1	24.5	15.4
Karma	2.6	6.0	24.7	37.8	18.4	4.5	61.2	25.2	13.6
Katrina	19.1	25.8	54.9	19.7	8.0	2.3	74.5	13.5	12.0
Royal Gala	30.0	40.5	29.5	0.0	0.0	0.0	84.5	11.5	4.0

Table 20: Apple variety trial 43 - Key variables, selection index and rank, 2003

Selection/ Variety	Quality Class1	Size %70>	Yield 2003	Selection Index	Rank by Index
E275-14	**	**	**	**	**
E505-163	87.4	64.4	3.13	4.8	3
E506-336	77.8	12.2	3.30	3.0	6
Dalijejan	61.3	72.0	3.00	4.0	5
Inglin	41.2	5.9	2.37	1.1	7
Karma	39.5	59.3	5.83	5.8	1
Katrina	73.3	31.7	4.17	4.4	4
Royal Gala	84.9	17.3	5.07	5.2	2

N.B. Total yield used as a measure of yield potential.

** Insufficient fruit to grade fully.

Table 21: Apple Variety Trial 43 - Key variables, selection index and rank, 2004

Selection/ Variety	Quality Class1	Size %70>	Yield 2004	Selection Index	Rank by Index
E275-14	70.0	71.2	3.67	5.2	7
E505-163	89.0	66.0	12.43	19.3	1
E506-336	75.1	35.6	8.27	9.2	5
Dalijejan	61.3	82.6	7.13	10.3	4
Inglin	60.1	7.7	1.80	1.2	8
Karma	61.2	85.4	9.97	14.6	2
Katrina	74.5	84.9	4.07	6.5	6
Royal Gala	84.5	29.5	9.13	10.4	3

Table 22: Apple variety trial 43 - Storage assessments 2003/04

Selection/ Variety	Timing	FROM STORE						AFTER 7 DAYS FROM STORE				
		TSS	Firm	Ripe	Eating	Juice	Texture	Firm	Ripe	Eat	Juice	Texture
		%	Kg	Score	Score	Score	Score	Kg	Score	Score	Score	Score
E 505/163	Late Sep	15.5	9.4	3.0	6	6	3					
	Mid Nov	16.4	8.2	4.0	7	8	3	8.1	4.5	8	8	4
E 506/336	Mid Nov	16.2	8.2	4.0	7	8	3	7.3	4.5	8	8	5
Dalijean	Mid Nov	15.3	8.0	4.5	7	7	5	6.7	6.0	6	7	7
Inglin	Late Sep	15.4	6.0	7.0	3	3	7					
	Mid Nov	14.5	5.7	7.0	4	5	7	4.9	9.0	3	5	7
Karma	Mid Nov	19.2	6.7	4.5	7	8	4	5.9	5.5	7	7	5
Katrina	Mid Nov	16.9	7.1	5.0	8	7	7	6.0	5.5	7	7	7
Royal Gala	Mid Nov	17.1	8.4	4.0	7	8	4	6.7	5.5	7	7	5

N.B. Fruit Quality Scores; A high score does not necessarily mean a good result.

Eating (Taste): 1 = extremely poor, 9 = excellent

Ripeness: 1 = very unripe, 9 = over-ripe

Texture: 1 = extremely coarse, 9 = extremely fine

Juiciness: 1 = very dry, 9 = very juicy

TSS = Total soluble solids (%) Firm = Fruit firmness (kg)

Table 23: Apple variety trial 43 - Storage assessments 2004/05

Selection/ Variety	Timing	FROM STORE						AFTER 7 DAYS FROM STORE				
		TSS %	Firm Kg	Ripe Score	Eating Score	Juice Score	Texture Score	Firm Kg	Ripe Score	Eating Score	Juice Score	Texture Score
E 505/163	Mid Nov	16.6	7.1	4.0	6	7	3	6.5	4.0	7	8	4
	Mid Dec	16.3	6.7	5.0	7	7	4	6.3	5.0	8	7	4
E 506/336	Mid Nov	15.6	7.0	4.0	7	7	3	6.1	4.0	8	7	5
	Mid Dec	14.8	6.5	5.0	7	7	4	5.8	5.0	8	8	4
Dalijean	Mid Nov	14.8	7.1	5.0	7	7	6	6.3	7.0	6	7	7
	Mid Dec	14.5	6.6	6.0	6	6	6	6.1	8.0	6	6	7
Inglin	Mid Nov	15.3	5.7	7.0	4	5	7	4.9	9.0	3	5	7
	Mid Dec	14.6	5.2	9.0	3	5	6					
Karma	Mid Nov	18.9	6.4	4.5	7	8	4	5.7	5.0	7	7	5
	Mid Dec	18.2	5.7	7.0	7	7	5	5.3	7.0	6	6	4
Katrina	Mid Nov	16.8	7.0	4.0	7	6	7	6.5	5.0	7	7	7
	Mid Dec	15.8	6.9	5.0	8	7	7	6.7	6.0	7	7	7
Royal Gala	Mid Nov	16.8	7.7	5.0	7	8	4	6.8	5.0	7	7	5
	Mid Dec	15.6	7.3	6.0	7	8	4	6.5	6.0	7	8	4

N.B. Fruit Quality Scores; A high score does not necessarily mean a good result.

Eating (Taste): 1 = extremely poor, 9 = excellent

Ripeness: 1 = very unripe, 9 = over-ripe

Texture: 1 = extremely coarse 9 = extremely fine

Juiciness: 1 = very dry, 9 = very juicy

TSS = Total soluble solids (%) Firm = Fruit firmness (kg)

From the 2003 crop, fruit volume was limited, therefore storage assessments were limited and no late samples, after November, could be assessed. Karma, Katrina, E505-163 and E506-336 gave initially promising scores for eating quality.

Discussion and conclusions

It was disappointing that many selections and varieties in this trial displayed poor precocity compared with the standard variety, Royal Gala. With the exception of Inglin, eating quality scores were all acceptable from fruit in season.

E 275-14 had a very low yield of large fruit, less than one-third the crop of Royal Gala and did not show any desirable fruit quality attributes.

E505-163 produced yields comparable to Royal Gala and Karma with good fruit size (over 60% greater than 65mm) and over 80% of yield in class 1. Fruit firmness held (8.2kg) and eating quality was good (7), developing to a score of 8 after 7 days in ambient conditions.

E506-336 had a reasonably good yield (11.57kg) although less than that of Royal Gala (14.2kg). 75-77% class 1 fruit was produced, predominantly (over 50%) in the 65 mm in size group. Fruit had acceptable eating quality score of 7 and firmness of 8.2kg. Firmness declined once out of store.

Dalijean produced an acceptable yield although lower than Royal Gala. Some 60% of yield was in Class 1 with a good fruit size distribution between 60 and 80mm with over 60% being 65 to 75mm. Eating quality was acceptable out of store but did decline after 7 days. Fruit firmness declined rapidly out of store in 2003 from 8kg to 6.7kg indicating a probable short product life.

Inglin had very poor crops with a low proportion of class 1 fruit in 2003 (41%) and generally produced small fruit (64% below 60mm in 2003) which, given a low yield, suggests intrinsically low fruit size characteristics. Although eating quality scored reasonably well (7) it declined when held in ambient conditions after storage. Fruit firmness was low (5.2 – 5.9 kg ex-store) and product life was very short after storage.

Karma had a yield comparable with that of Royal Gala, with very good fruit size but a low proportion of yield in class 1 (40 to 60%), principally as a result of russetting. Fruit had a naturally low firmness (6.7kg) but eating quality was reasonably good scoring 7.

Katrina produced a low to moderate yield (8.23kg) with 73-74% of yield in class 1, but small average fruit size in 2003 (over 50% below 65mm) and a wide spread of sizes. Fruit had good eating quality (score 8) but a naturally lower fruit firmness than Royal Gala but not as low as in Inglin. Firmness did not detract from eating quality.

E505-163 may be worth considering for further limited evaluation. Karma could also be considered but fruit skin quality concerns might present challenges for growing this variety successfully. No other varieties had any outstanding attributes required for commercial success.

This trial was terminated after the 2004 crop.

2. 5 Pear Variety Trial 18

Materials and Methods

Maiden trees of six varieties on Quince A rootstock were planted in rows 4 x 1.5 m apart in March 2002. Three replicates of single-tree plots were planted in a randomised block experiment. Guard trees of Beurre Hardy were planted around the trial trees,

Varieties

1. Conference
2. Deloran
3. Homored
4. Anna
5. Rocha
6. P507-21

Guards

Beurre Hardy

Results

No crop was produced in 2003 or 2004. This trial was terminated at the request of HDC after the 2004 growing season.

3. APPENDICES

APPENDIX 1

Storage and Fruit Quality Assessments

A refractometer was used for the measurement of total soluble solids as a measure of fruit sugar levels. Results are expressed as a percentage.

Firmness was measured with an Effegi penetrometer using an 8 mm probe for pears and an 11 mm probe for apples.

Eating Quality (Taste): scored on a 1 to 9 scale;

- 1 = extremely poor
- 5 = intermediate
- 7 = good
- 9 = excellent

Ripeness: scored on a 1 to 9 scale;

- 1 = very unripe
- 5 = peak ripeness
- 7 = just past best ripeness
- 9 = “over” ripe

Texture: scored on a 1 to 9 scale;

- 1 = extremely coarse
- 3 = coarse
- 5 = intermediate
- 7 = fine
- 9 = extremely fine

Juiciness: scored on a 1 to 9 scale

- 1 = very dry
- 3 = dry
- 5 = rather dry
- 7 = juicy
- 9 = very juicy

APPENDIX 2

Selection Index

We have examined a number of potential indices, which integrate a number of measurable attributes of variety performance with a view to producing a means of easily comparing varieties.

The Selection Index we use in this report is:

$$\text{Index} = \frac{\text{Yield} \times (\% \text{Class 1 Fruit} + \% \text{Fruit over 70mm})}{100}$$