

A REPORT TO THE HORTICULTURAL DEVELOPMENT COUNCIL
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CUCUMBER: VARIETY EVALUATION 1992

FINAL REPORT

Project Number: PC21d

Project Title: Cucumber: Variety Evaluation

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Authentication

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

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Relevance to Growers and Practical Application

- * A range of 6 new cucumber varieties were compared with Jessica (control) for yield, quality and disease tolerance from a late July planting.
- * Two varieties, Flamingo and Tyria had powdery mildew tolerance. These produced equivalent yield and quality of fruit to Jessica but had considerably less infection with powdery mildew.
- * Powdery mildew tolerant varieties are recommended for use in replanted crops if powdery mildew infection pressure is high.

Summary

The following 6 new cucumber varieties were compared with the Jessica (control).

<u>Variety</u>	<u>Seed House</u>
Jessica	RZ
Flamingo*	MOS
Tyria*	ENZ
Pyralis	ENZ
Bronco	BRUI
Dugan	NUN
Bonami	NIZ

* Powdery mildew tolerant

Yield and Quality

Treatment	No. of Cues/m ²	% Class I	Mean Fruit Weight (g)	Value (£/m ²)
Jessica	25.3	87	470	4.84
Flamingo	25.0	84	478	4.96
Tyria	24.9	86	468	4.73
Pyralis	26.3	89	442	4.79
Bronco	23.9	85	462	4.43
Dugan	25.0	86	480	4.86
Bonami	23.8	81	476	4.53
SED (12 df)	1.13	2.4	10.1	0.247
LSD (P = 0.05)	-	-	22	-
Significance	NS	NS	*	NS

Poor weather experienced in July and August meant plants were slow to become established. By the last harvest on 5 November there were no significant difference in yield between the 6 varieties and the control, Jessica. Lateral growth of Bronco appeared slow to develop compared with other varieties, and may have had some influence on subsequent yield.

Fruit quality was high throughout the trial and there were no significant differences between varieties.

Pyralis produced slightly shorter fruit with a lower mean fruit weight than Jessica and other varieties.

Flamingo produced the highest monetary value due to its slightly higher mean fruit weight than Jessica, although this difference was not significant.

Flamingo and Tyria had considerably less powdery mildew than Jessica and other varieties, but were slightly more susceptible to stem botrytis.

Introduction

Cucumber varieties in current use have generally been selected for their high productivity of good quality fruit and speed of first fruit production. Although tolerance to Powdery mildew has also been selected in certain varieties, the dependence on fungicides in general still remains high. Any reduction in the availability of fungicides would require radical changes in the methods of production or selection of tolerant varieties. In either case new varieties require evaluation in as near commercial conditions as possible. As new selections are developed they should be evaluated against existing standard varieties in order to ensure the optimum choice of variety for modern production systems. This trial compares 6 relatively new varieties with the control variety Jessica in terms of yield and fruit quality.

Materials and Methods

Varieties

Jessica	RZ
Flamingo*	MOS
Tyria*	ENZ
Pyralis	ENZ
Bronco	BRUI
Dugan	NUN
Bonami	NIZ

* Powdery mildew tolerant

Cultural Details

Sown:	2 July
Planted (slab contact):	27 July
First Harvest:	17 August
Final Harvest:	5 November
Plot Size:	16 plants per plot
Root Zone Warming:	24°C
Crop Nutrition:	To standard blueprint for rockwool grown crops.
Environment:	To standard blueprint 21°C, 19°C night.
Ventilation:	24°C
Carbon Dioxide:	Maintain 350 ppm

Design

The trial was a 7 x 4 Youlden square to provide 4 replicates of 7 varieties.

Shelf Life Conditions

Fruit was placed in boxes on a shelf with 12 hours illumination and 20°C temperature, 65% relative humidity. Assessments of percentage fresh weight loss, colour and firmness were carried out after 1, 2, 5 and 6 days.

Records

Yield and quality 3 times per week

Plant growth - assessment of 28 plants per variety

Disease assessments as appropriate

Shelf life

Fungicide Programme

3 August	Propamocarb hydrochloride (as Filex) applied as a drench.
5 August	Imazalil (as Fungaflor) applied as an ultra low volume spray (1.5 l water).
14 August	Propamocarb hydrochloride (as Filex) applied as a drench.
24 August	Fenarimol (as Rubigan) applied as an ultra low volume spray (1.5 l water).
1 September	Iprodione + Benomyl (as Rovral + Benlate) applied as a stem base spray.
3 September	Imazalil (as Fungaflor) applied as a high volume spray.
4 September	Carbendazim (as Bavistin) applied as a drench.
8 September	Iprodione + Benomyl (as Rovral + Benlate) applied as a post-trimming stem spray.
16 September	Propamocarb hydrochloride (as Filex) applied as a drench.
30 September	Imazalil (as Fungaflor)
1 October	Iprodione + Benomyl (as Rovral + Benlate) applied as a post-trimming stem spray.

Results

Plant Growth

Table 1: Lateral Development and Vigour Assessment

	Development of Laterals (Score 0-5)*		Vigour of Laterals (Score 0-5)*	
	22 Sep	15 Oct	22 Sep	15 Oct
Jessica	3.5	4.5	2.6	2.0
Flamingo	3.8	4.5	2.8	2.7
Tyria	3.5	4.5	2.6	2.2
Pyralis	3.4	4.5	2.5	2.2
Bronco	3.2	3.9	3.1	3.0
Dugan	3.5	4.3	2.5	2.3
Bonami	3.5	4.5	2.8	2.5

* Lateral development score 0-5, where 0 = lateral not initiated, 5 = lateral well elongated and some leaves fully expanded.

* Vigour of lateral score 0-5, where 0 = poor vigour, 5 = very vigorous.

The lateral development of Flamingo was more advanced than the control variety Jessica at the first assessment. Bronco had noticeably slow lateral development on both assessment dates, but generally produced more vigorous lateral growth than other varieties.

Yield and Quality

Table 2: Yield (cucumbers/m²)

Treatment	Aug	Sep	Oct	Total
Jessica	10.5	9.4	5.4	25.3
Flamingo	9.3	9.6	6.2	25.0
Tyria	8.8	10.6	5.5	24.9
Pyralis	10.6	9.9	5.9	26.3
Bronco	9.9	8.5	5.5	23.9
Dugan	9.4	10.0	5.5	25.0
Bonami	9.9	7.9	6.0	23.8
SED (12 df)	0.30	0.86	0.37	1.13
LSD (P = 0.05)	0.7	-	-	-
Significance	***	NS	NS	NS

Pyralis and Jessica produced significantly more cucumbers per square metre in August than other varieties. There was no significant differences in yield later in the trial or total yield for the whole trial between varieties.

Table 3: Weight of Fruit (kg/m²)

Treatment	Aug	Sep	Oct	Total
Jessica	4.9	4.7	2.3	11.9
Flamingo	4.4	4.9	2.7	12.0
Tyria	3.9	5.4	2.4	11.7
Pyralis	4.6	4.7	2.3	11.6
Bronco	4.5	4.3	2.2	11.0
Dugan	4.3	5.4	2.3	12.0
Bonami	4.6	4.2	2.5	11.3
SED (12 df)	0.16	0.42	0.13	0.55
LSD (P = 0.05)	0.3	-	0.3	-
Significance	**	NS	*	NS

In August Pyralis and Bonami produced a similar weight of cucumbers as the control Jessica, and all other varieties produced less. Later in the trial there were few significant differences.

Table 4: Fruit Quality (Percentage Class I and II by number)

Treatment	Aug	Sep	Oct	Total
<u>Percentage Class I</u>				
Jessica	97	89	67	87
Flamingo	95	80	74	84
Tyria	97	86	67	86
Pyralis	98	88	75	89
Bronco	97	84	64	85
Dugan	98	85	69	86
Bonami	94	79	63	81
SED (12 df)	1.6	5.2	4.8	2.4
LSD (P = 0.05)	-	-	-	-
Significance	NS	NS	NS	NS
<u>Percentage Class II</u>				
Jessica	2.7	10.2	27.9	10.8
Flamingo	4.5	17.8	21.5	14.0
Tyria	2.0	11.1	28.6	11.8
Pyralis	1.8	11.6	23.4	10.4
Bronco	1.8	14.3	30.7	13.0
Dugan	1.6	12.6	26.3	11.5
Bonami	4.5	19.7	31.1	16.3
SED (12 df)	1.46	4.44	4.3	2.1
LSD (P = 0.05)	-	-	-	-
Significance	NS	NS	NS	NS

There were no differences in fruit quality in terms of either Class I and Class II fruit between varieties. Jessica had an average of 87 percent Class I, while Bonami produced 81 percent Class I which was slightly lower than most varieties although not significantly different.

Table 5: Cucumber Mean Fruit Length (cm)

	Main Stem Fruit (26 Aug)	Lateral Fruit (8 Oct)
Jessica	31.7	36.2
Flamingo	31.8	34.5
Tyria	32.9	35.8
Pyralis	31.0	34.4
Bronco	32.5	34.7
Dugan	32.3	34.9
Bonami	31.8	34.8

Although fruit length of all varieties was good, Pyralis produced slightly shorter main stem fruit than Jessica and the other varieties. Tyria produced the longest main stem fruit and also very long lateral fruit.

Table 6: Fruit Size

Treatment	Aug	Sep	Oct	Total
<u>Percentage Grade A of Class I (250-400 g)</u>				
Jessica	19	9	39	19
Flamingo	16	16	40	21
Tyria	20	13	37	20
Pyralis	27	17	57	29
Bronco	18	11	53	22
Dugan	21	11	41	21
Bonami	10	9	33	15
SED (12 df)	3.7	3.4	5.6	2.9
LSD (P = 0.05)	8	-	12	6
Significance	*	NS	**	*
<u>Percentage Grade B of Class I (400-500 g)</u>				
Jessica	44	35	38	40
Flamingo	45	36	37	40
Tyria	56	34	45	45
Pyralis	58	43	36	48
Bronco	53	33	31	42
Dugan	48	34	42	42
Bonami	54	30	48	45
SED (12 df)	4.1	2.6	5.4	2.3
LSD (P = 0.05)	9	6	-	5
Significance	*	*	NS	*

Pyralis produced smaller fruit with a significantly higher percentage of Grade A and B fruit (250-400 g and 400-500 g respectively) and less Grade C and D than the control Jessica and other varieties. Bonami produced larger fruit with less Grade A fruit and more Grade D fruit than other varieties. All varieties had a high proportion of fruit in Grade B and C (400-500 g and 500-650 g).

Table 7: Fruit Size

Treatment	Aug	Sep	Oct	Total
<u>Percentage Grade C of Class I (500-650 g)</u>				
Jessica	36.3	43.4	22.2	36.7
Flamingo	34.2	34.0	19.9	31.1
Tyria	24.3	41.1	16.6	29.9
Pyralis	15.2	33.0	6.2	19.9
Bronco	27.2	40.6	14.6	29.9
Dugan	29.2	40.7	16.2	31.1
Bonami	34.1	44.5	18.7	34.4
SED (12 df)	2.30	4.06	6.51	2.81
LSD (P = 0.05)	5.0	-	-	6.1
Significance	***	NS	NS	**
<u>Percentage Grade D of Class I (650-800 g)</u>				
Jessica	0.8	11.9	1.4	4.9
Flamingo	5.0	14.2	3.3	7.8
Tyria	0.4	11.3	0.8	5.1
Pyralis	0.2	6.9	0.2	2.8
Bronco	1.3	15.9	1.5	6.3
Dugan	1.5	14.1	0.2	6.3
Bonami	1.7	16.3	1.2	6.1
SED (12 df)	1.28	2.46	1.39	0.99
LSD (P = 0.05)	2.8	5.3	-	2.2
Significance	*	*	NS	**

Table 8: Mean Fruit Weight (g)

Treatment	Aug	Sep	Oct	Total
Jessica	459	506	431	470
Flamingo	477	510	434	478
Tyria	443	512	426	468
Pyralis	435	480	391	442
Bronco	454	512	403	462
Dugan	460	535	416	480
Bonami	468	528	422	476
SED (12 df)	8.1	13.3	13.5	10.1
LSD (P = 0.05)	18	29	-	22
Significance	**	*	NS	*

Pyralis produced significantly smaller fruit in August and September than other varieties. The mean fruit size as an average for the whole trial was smaller from Pyralis than other varieties.

Table 9: Monetary Value (£/m²)

Jessica	4.84
Flamingo	4.96
Tyria	4.73
Pyralis	4.79
Bronco	4.43
Dugan	4.86
Bonami	4.53
SED (12 df)	0.247
LSD (P = 0.05)	0.54
Significance	NS

There were no significant differences in monetary value between varieties. Fruit from Jessica had a value of £4.84 per square metre for the whole trial.

Disease Tolerance

Figure 1: Stem Base Lesions of *Mycosphaerella* (7 August)

Pyralis, Bronco and Dugan had fewer stem base lesions of *Mycosphaerella* when they were assessed on the 7 August. Dugan has claimed tolerance to *Mycosphaerella* by the breeders.

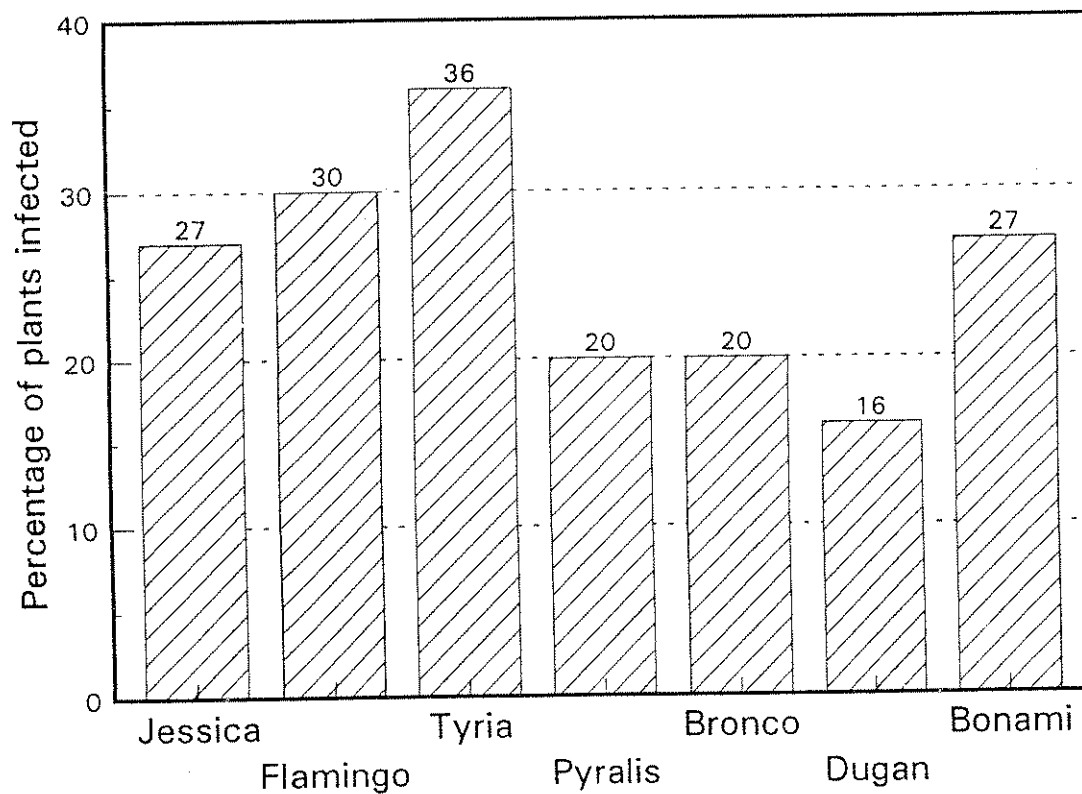


Table 10: Stem Disease Assessment (on 14 October) as percentage of plants infected.

	Percentage of Plants with Lesions of:					
	Botrytis		Mycosphaerella		Penicillium	
	L	S	L	S	L	S
Jessica	0	1.6	32.8	76.6	0	0
Flamingo	0	4.7	26.6	81.3	0	0
Tyria	0	3.1	25.0	85.9	0	0
Pyralis	0	0	31.3	60.9	0	0
Bronco	0	0	37.5	65.6	0	0
Dugan	0	0	31.3	76.6	0	0
Bonami	0	1.6	32.8	70.3	0	0

L = Local Lesions

S = Spreading Lesions

Stem disease levels had increased significantly by the 14 October assessment, despite a full fungicide spray programme. However, there was no plant death due to stem disease at this stage. Botrytis caused spreading lesions affecting the mildew tolerant varieties Flamingo and Tyria slightly more than other varieties. Mycosphaerella was the main stem disease present on a high percentage of plants as spreading lesions as well as local lesions. Pyralis and Bronco had fewer spreading of Mycosphaerella than the control variety Jessica. Penicillium was not present in the crop.

Table 11: Stem Disease Assessment (14 October) as number of lesions per infected plant.

	Number of Lesions per Affected Plant of:					
	Botrytis		Mycosphaerella		Penicillium	
	L	S	L	S	L	S
Jessica	0	1	1.3	2.5	0	0
Flamingo	0	1.3	1.1	3.2	0	0
Tyria	0	1.5	1	4.4	0	0
Pyralis	0	0	1.5	1.3	0	0
Bronco	0	0	1.3	2.1	0	0
Dugan	0	0	1.4	2.3	0	0
Bonami	0	1	1.4	2.4	0	0

L = Local Lesions
S = Spreading Lesions

When assessed on the 14 October, of the plants affected with stem disease, Flamingo and Tyria had marginally more spreading lesions per plant of Botrytis and Mycosphaerella than Jessica and other varieties.

Table 12: Powdery Mildew Levels

	Percentage of Leaves with Mildew		No. of Mildew Lesions per Infected Leaf	Disease Index
	7 Aug	3 Sep	3 Sep	3 Sep
Jessica	43	100	341	100
Flamingo	14	51	16	2
Tyria	4	22	5	0
Pyralis	43	100	388	114
Bronco	43	100	291	85
Dugan	36	100	475	139
Bonami	43	100	239	70

Disease Index - as a percentage of Jessica = 100%.

An early assessment of Powdery mildew on the 7 August showed that Flamingo and Tyria had significantly fewer leaves with mildew compared to the other varieties. A full mildew fungicide spray programme was applied to the whole area, regardless of mildew levels on individual varieties.

When assessed on the 3 September, Flamingo and Tyria had a lower percentage of leaves with mildew, than other varieties which had mildew on every leaf. Of the leaves infected with mildew Flamingo and Tyria, had far fewer lesions developing on leaves than other varieties. The disease index compares the total level of infection of varieties with mildew with Jessica as a percentage. Clearly, Flamingo and Tyria had considerably lower powdery mildew levels than the control Jessica (also see Appendix I - Photograph).

Shelf Life

Figure 2: Percentage weight loss during shelf life conditions.

The varieties Flamingo and Dugan lost a greater percentage of fresh weight than other varieties during shelf life conditions.

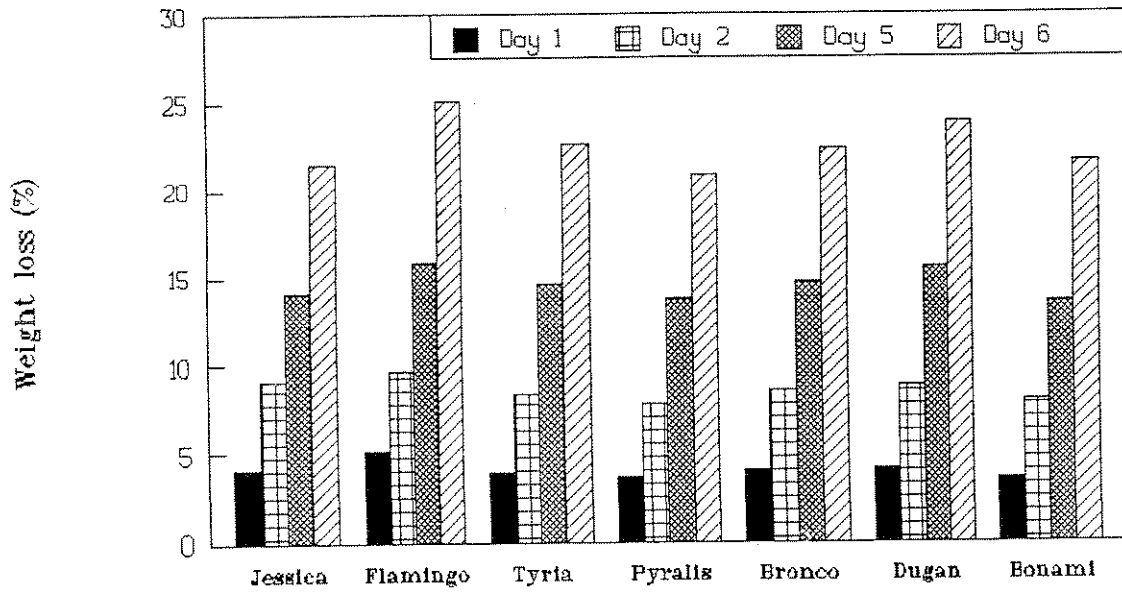


Figure 3: Colour change during shelf life (score 0-9; where 0 = pale green, 9 = dark green).

Bonami and Flamingo were the darkest coloured fruit at the beginning of shelf life compared to other varieties. By the sixth day in shelf life Bonami still remained fairly dark green in colour.

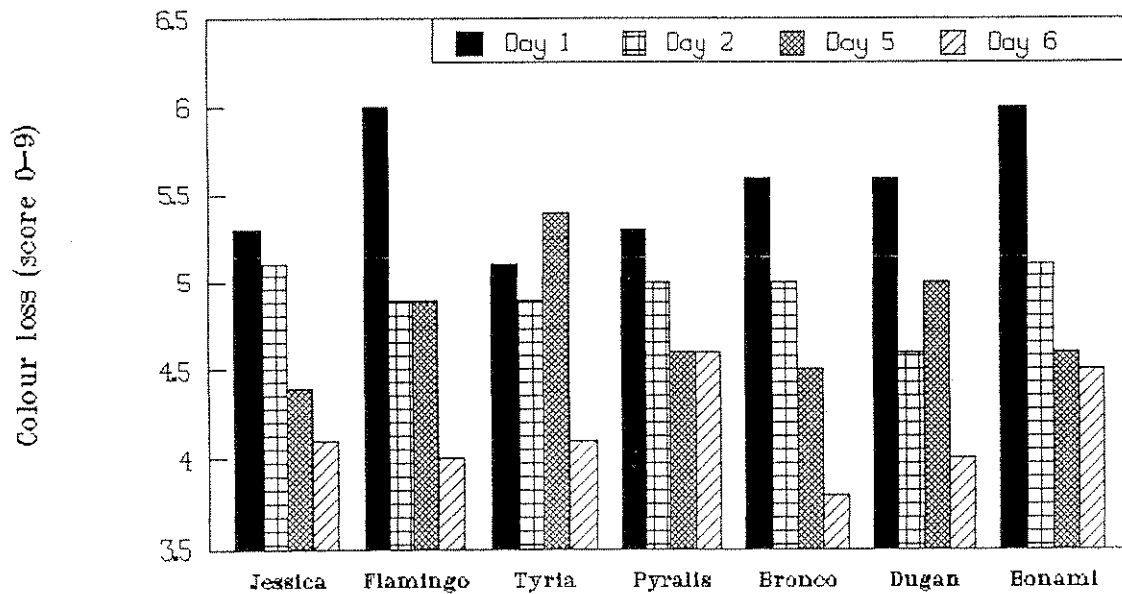
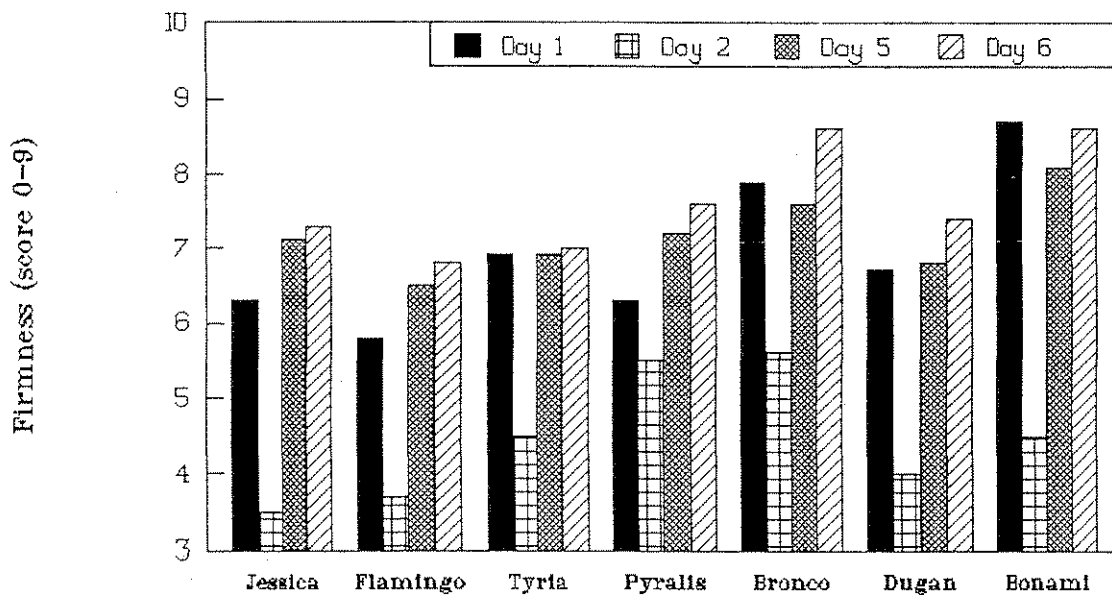


Figure 4: Fruit firmness during shelf life (score 0-9; where a high figure = soft fruit).

All varieties initially became firmer after 2 days shelf life before becoming progressively softer. Flamingo and Tyria were slightly firmer than Jessica by day 6, but Bronco and Bonami, were the softest of all the varieties.



Discussion

Crop Productivity

Jessica and Pyralis were slightly quicker than other varieties to start fruiting but by the end of the trial there was no difference in the total number of cucumbers between all varieties. The average fruit weight for most varieties was similar to the control Jessica at 470 g. Pyralis, however was the exception where the fruit was significantly smaller in weight than that from Jessica at 442 g. The fruit length of Pyralis was shorter than other varieties from the mainstem, although its lateral fruit were of similar length. There were no significant differences in fruit quality throughout the trial, between varieties. Fruit from Jessica produced had a value of £4.84 per square metre for the trial period which was not significantly different to other varieties.

Disease Tolerance

Pyralis, Bronco and Dugan had less *Mycosphaerella* stem base lesions than the other varieties at the first assessment (7 August) and less botrytis at the second assessment (14 October). Botrytis appeared to be more prevalent on the mildew tolerant varieties Flamingo and Tyria than other varieties on the 14 October. *Mycosphaerella* was the main stem disease present at the second assessment on a high percentage of plants as spreading lesions as well as local lesions. Pyralis and Bronco had fewer spreading lesions of *mycosphaerella* than the control variety Jessica at the second assessment.

Plants became infected with powdery mildew at a very early stage, within 2 weeks of planting (7 August). The control variety Jessica had 43 percent of leaves with at least one lesion of powdery mildew and similar levels were found on other varieties except the mildew tolerant varieties Flamingo and Tyria which only had 14 and 4 percent of leaves infected, respectively.

Although a full powdery mildew fungicide programme was applied to all varieties regardless of mildew levels infection levels increased. When assessed on 3 September most leaves of non-tolerant varieties had at least one lesion of mildew. The assessment expressed as a disease index with the control variety Jessica having a 100 percent index, showed that the mildew tolerant varieties Flamingo and Tyria had significantly less mildew with a disease index of 2 and 0 percent, respectively (see Appendix I: Photographs of disease index scores).

Shelf Life

Fruit placed in shelf life conditions was assessed after 1, 2, 5 and 6 days, for weight loss, colour change and firmness. Flamingo and Dugan lost more fresh weight than the control Jessica and other varieties on all assessment dates. Flamingo and Bonami produced the darkest coloured fruit at the beginning of shelf life, with Bonami remaining fairly dark throughout the shelf life period. Bronco and Bonami produced softer fruit than Jessica and other varieties throughout the shelf life period.

Conclusions

1. There were few significant differences in yield or quality between Jessica and the other varieties.
2. Powdery mildew tolerant varieties Flamingo and Tyria had considerably less mildew infection than the control Jessica and other varieties, but equivalent yield and quality so therefore may be preferred as they would require less fungicides.
3. In this trial there was a slight tendency to increased botrytis stem infections on powdery mildew tolerant varieties than other varieties.
4. Pyralis and Bronco were slightly less susceptible to *Mycosphaerella* than other varieties.

APPENDIX I: PHOTOGRAPHS

Powdery mildew assessment 3 September

Disease Index = 100 (Jessica)



Disease Index = 0 (Tyria)



APPENDIX II: WEEKLY MEAN AIR TEMPERATURES

Week Beginning	DAY		NIGHT		24 Hour
	Achieved	Setpoint	Achieved	Setpoint	
27 Jul	25.6	22	20.4	20	23.7
3 Aug	23.8	22	20.0	20	22.4
10 Aug	24.7	22	20.2	20	23.0
17 Aug	24.8	22	19.7	19.5	22.7
24 Aug	24.1	22	19.1	19	22.0
31 Aug	23.4	22	19.3	19	21.6
7 Sep	23.2	22	18.9	19	21.2
14 Sep	23.2	22	19.9	20	21.7
21 Sep	22.6	22	19.8	19	21.2
28 Sep	22.7	22	18.9	19	20.7
5 Oct	22.0	22	18.6	18.5	20.1
12 Oct	22.2	22	18.4	18.5	20.0
19 Oct	22.0	22	18.2	18.0	19.8
26 Oct	21.7	22	18.8	18.5	19.9
2 Nov	21.9	22	18.4	18.5	19.8

APPENDIX III: WEEKLY MEAN RELATIVE HUMIDITY

	DAY	NIGHT
27 July	55	78
3 August	74	82
10	81	84
17	85	85
24	89	86
31	84	85
7 September	87	87
14	89	88
21	91	88
28	88	88
5 October	88	87
12	87	85
19	87	84
26	89	87
2 November	91	90