

A REPORT TO THE HORTICULTURAL DEVELOPMENT COUNCIL
18 LAVANT STREET, PETERSFIELD, HANTS, GU32 3EW

CUCUMBER VARIETIES
REPLANTED CROP

FINAL REPORT

Project Number: PC21d

Project Title: Cucumber Varieties - Replanted Crop

Project Leader: Miles Harriman

Location of Project: Horticulture Research International
Stockbridge House
Cawood
Selby
North Yorkshire
YO8 0TZ

Tel: 0757 268275
Fax: 0757 268996

Project Co-ordinator: Alan Shirley

Report Date: March 1994


Date Project Commenced: June 1993

Date Completion Due: November 1993

Key Words: cucumbers, varieties, shelf life

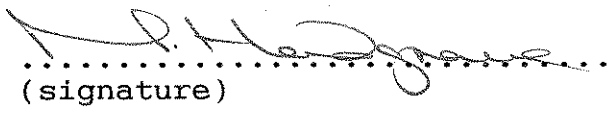
Authentication


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.

Signature 

Miles Harriman
Project Leader

Date 7/4/94

Report authorised by 
(signature)

 M R Bradley
Head of Station
HRI Stockbridge House
Cawood
Selby
North Yorkshire
YO8 0TZ

Date 7/4/94

Contents

	Page
Relevance to Growers and Practical Application	5
Summary	5-6
Financial Benefits	7
Objective	8
Materials and Methods	8-9
Results	10-29
Fruit Yield	
Fruit Quality	
Fruit Size	
Monetary Value	
Plant Growth	
Disease Tolerance	
Shelf Life	
Discussion	30-31
Conclusions	31

Relevance to Growers and Practical Application

- * Varieties 90-0044 and Allure produced high yields of good quality fruit compared to existing standard varieties from a summer planting.
- * Fitness, 90-0044, E863 and Nordica all displayed a high level of tolerance to powdery mildew.

Summary

Seven relatively new selections of cucumber varieties were compared with the control variety Jessica for production from a summer replanted crop.

<u>Varieties</u>	<u>Seed Company</u>
Jessica	Rijk Zwaan
Fitness*	Yates
90-0044*	Daehnfeldt (Yates)
E863*	Enza Zaden
Allure	Rijk Zwaan
Nordica*	Pinetree Vandenberg
Azuro	Breeders
2417	Rijk Zwaan

- * Claimed to be Powdery mildew tolerant.
- * 90-0044 and Allure produced significantly higher fruit yields than Jessica.
- * The mean fruit size of 90-0044, however, was slightly smaller than other varieties, but was still acceptable at 459 g on average.
- * Fruit quality of E863 and Nordica in particular was worse than other varieties in terms of percentage Class I in September.

- * Although 2417 produced a higher percentage of Class I fruit than other varieties in October, the yield and fruit size was generally lower.
- * Nordica was a strong growing variety with thick laterals and mainstem. 2417 was visually less vigorous than other varieties.
- * Fitness, 90-0044, E863 and Nordica with claimed tolerance to powdery mildew exhibited extremely low levels of the disease.
- * The mildew tolerant varieties were more susceptible to stem diseases.
- * Fruit of 90-0044 became slightly paler than other varieties after 6 days in shelf life conditions. Allure tended to loose more weight and become softer than other varieties after 6 days.

Results to the End of the Trial

	Cues/m ² (no.)	Class I (%)	Mean Fruit Weight (g)	Monetary Value (£/m ²)
Jessica	26.2	91	479	6.86
Fitness	28.3	89	485	7.41
90-0044	35.0	91	459	8.75
E863	29.7	90	474	7.63
Allure	31.3	93	469	8.05
Nordica	26.7	88	481	6.97
Azuro	23.9	91	482	6.32
2417	23.1	94	454	5.81
SED 1 (29 df)	1.22	1.0	4.7	0.32
LSD (P = 0.05)	2.5	2	10	0.65
SED 2 (29 df)	1.29	1.0	5.0	0.34
LSD (P = 0.05)	2.6	2	10	0.70
Significance	***	**	***	***

SED 1 To compare varieties with the control Jessica.
 SED 2 To make comparisons between varieties except Jessica.

Practical and Financial Benefits

Choice of variety offers one of the cheapest methods of improving monetary returns for cucumber growers. 90-0044 and Allure both produced high yields of quality fruit, and could therefore be recommended for small scale commercial evaluation by growers. Shelf life of these two varieties requires further investigation as there may be some fruit quality problems. 90-0044 has the added advantage of being tolerant to powdery mildew. Both varieties were fairly susceptible to stem diseases which must be considered in a commercial evaluation.

90-0044 could increase monetary returns by £18,900/hectare compared to Jessica based on this trial. It should be remembered that these results are only one seasons evaluation and would require further investigation before firm recommendations could be made.

EXPERIMENTAL SECTION

Objective

To compare seven relatively new selections of cucumber varieties with the control variety Jessica for production from a summer replanted crop.

Materials and Methods

<u>Varieties</u>	<u>Seed Company</u>
Jessica	Rijk Zwaan
Fitness*	Yates
90-0044*	Daehnfeldt (Yates)
E863*	Enza Zaden
Allure	Rijk Zwaan
Nordica*	Pinetree Vandenberg
Azuro	Breeders
2417	Rijk Zwaan

* Claimed to be Powdery mildew tolerant.

Cultural Details

Sown:	25 June
Planted:	15 July
First Harvest:	6 August
Final Harvest:	28 October
Plant Population:	5625 plants per acre
Plot Size:	16 plants per plot.
Root Zone Warming:	To maintain 24°C in the slab

Crop Nutrition: To standard blueprint for rockwool grown crops.

Environment: 23°C day, 21°C night early establishment, 21°C day, 19°C night during lateral initiation. Varying according to growth.

Ventilation: 24°C

Carbon Dioxide: Maintain 350 vpm.

Shelf Life Conditions: 16 hours light, 20°C, 65% RH, assessments taken at day 6.

Design: A 7 row x 7 column plot design with 7 replicates of the control, and 6 replicates of the test varieties.

Records:

- * Fruit yield (number and weight) 3 times per week.
- * Fruit quality (Class I, II), 3 times per week.
- * Fruit size (mean fruit weight, Grade A, B, C, D), 3 times per week.
- * Plant growth:
 - a. Plant vigour
 - b. Mainstem diameter
 - c. Lateral diameter
 - d. Plant height
 - e. Leaf number
- * Shelf life:
 - a. Fruit firmness
 - b. Fruit colour
 - c. Percentage weight loss
- * Fruit length
- * Tolerance to disease

Results

Fruit Yield

The varieties 90-0044 and Allure produced significantly more cucumbers per square metre and weight of marketable fruit in August, September and as a total to the end of the season compared with Jessica. To the end of the trial 90-0044 had out-yielded all varieties in terms of number and weight of marketable fruit (Tables 1 and 2).

Fruit Quality

E863 and Nordica produced less Class I fruit and more Class II fruit in September compared with Jessica.

Average fruit quality for the whole trial was lower from Nordica with less Class I and more Class II fruit than the control variety Jessica (see Tables 3 and 4).

Fruit quality in October was very poor from most varieties due to low light levels. 2417, however, produced significantly more Class I than other varieties in October and less Class II fruit.

Table 1: Marketable Yield (cues/m²).

	Aug	Sep	Oct	Total
Jessica	12.6	10.0	3.6	26.2
Fitness	13.2	10.4	4.7	28.3
90-0044	17.4	12.6	5.0	35.0
E863	14.5	10.4	4.8	29.7
Allure	15.7	11.6	4.0	31.3
Nordica	13.3	8.4	5.0	26.7
Azuro	12.1	7.8	3.9	23.9
2417	10.9	8.7	3.4	23.1
SED 1 (29 df)	0.80	0.58	0.32	1.22
LSD (P = 0.05)	1.6	1.2	0.7	2.5
SED 2 (29 df)	0.84	0.61	0.34	1.29
LSD (P = 0.05)	1.7	1.2	0.7	2.6
Significance	***	***	***	***

SED 1 To compare varieties with the control Jessica
 SED 2 To make comparisons between varieties except Jessica

Table 2: Weight of marketable fruit (kg/m²).

	Aug	Sep	Oct	Total
Jessica	6.2	4.8	1.6	12.5
Fitness	6.5	5.0	2.2	13.7
90-0044	7.9	5.9	2.2	16.1
E863	6.9	4.9	2.2	14.1
Allure	7.6	5.4	1.7	14.7
Nordica	6.4	4.1	2.4	12.9
Azuro	6.0	3.8	1.7	11.5
2417	5.1	4.0	1.4	10.5
SED 1 (29 df)	0.38	0.27	0.14	0.60
LSD (P = 0.05)	0.8	0.6	0.3	1.2
SED 2 (29 df)	0.40	0.29	0.15	0.63
LSD (P = 0.05)	0.8	0.6	0.3	1.3
Significance	***	***	***	***

SED 1 To compare varieties with the control Jessica
 SED 2 To make comparisons between varieties except Jessica

Table 3: Percentage Class I.

	Aug	Sep	Oct	Total
Jessica	97	91	67	91
Fitness	97	89	69	89
90-0044	98	89	70	91
E863	97	86	75	90
Allure	98	92	74	93
Nordica	97	85	71	88
Azuro	98	90	73	91
2417	97	93	88	94
SED 1 (29 df)	0.9	1.8	4.3	1.0
LSD (P = 0.05)	-	4	9	2
SED 2 (29 df)	0.9	1.9	4.5	1.0
LSD (P = 0.05)	-	4	9	2
Significance	NS	**	**	**

SED 1 To compare varieties with the control Jessica
 SED 2 To make comparisons between varieties except Jessica

Table 4: Percentage Class II.

	Aug	Sep	Oct	Total
Jessica	3	9	33	9
Fitness	3	11	31	11
90-0044	2	11	30	9
E863	3	14	25	10
Allure	2	8	26	7
Nordica	3	15	29	12
Azuro	2	10	27	9
2417	4	7	12	6
SED 1 (29 df)	0.9	1.8	4.3	1.0
LSD (P = 0.05)	-	4	9	2
SED 2 (29 df)	0.9	1.9	4.5	1.0
LSD (P = 0.05)	-	4	9	2
Significance	NS	**	**	***

SED 1 To compare varieties with the control Jessica
 SED 2 To make comparisons between varieties except Jessica

Fruit Size

90-0044 and 2417 generally produced a significantly smaller fruit, during the trial, compared to Jessica (Table 5). 2417 tended to produce more small fruit with less Grade C (500-650 g) fruit than Jessica.

90-0044 and Allure generally produced a higher proportion of large fruit (Grade D, 650-800 g) than Jessica (see Tables 6-9).

Fruit Length

Fruit from mainstem was slightly shorter in length from 90-0044 and Allure compared with Jessica and other varieties. Fruit of 90-0044 produced on laterals tended to be slightly longer than other varieties (Table 10).

Monetary Value

90-0044 and Allure produced significantly higher monetary returns than the control variety Jessica. 90-0044 monetary value was higher than all varieties, at £8.75 per square metre (Table 11).

Table 5: Mean fruit weight (g).

	Aug	Sep	Oct	Total
Jessica	494	480	430	479
Fitness	494	480	472	485
90-0044	456	471	440	459
E863	480	471	466	474
Allure	482	467	426	469
Nordica	480	491	472	481
Azuro	490	490	442	482
2417	464	458	412	454
SED 1 (29 df)	5.7	8.0	11.6	4.7
LSD (P = 0.05)	12	16	24	10
SED 2 (29 df)	5.9	8.4	12.2	5.0
LSD (P = 0.05)	12	17	25	10
Significance	***	**	***	***

SED 1 To compare varieties with the control Jessica
 SED 2 To make comparisons between varieties except Jessica

Table 6: Percentage Grade A of Class I (250-400 g).

	Aug	Sep	Oct	Total
Jessica	20	22	38	23
Fitness	20	21	25	21
90-0044	25	22	34	25
E863	21	20	23	21
Allure	18	24	39	22
Nordica	18	17	21	18
Azuro	19	18	32	20
2417	28	24	47	29
SED 1 (29 df)	2.0	3.4	5.1	1.9
LSD (P = 0.05)	4	-	10	4
SED 2 (29 df)	2.1	3.5	5.4	2.0
LSD (P = 0.05)	4	-	11	4
Significance	***	NS	***	***

SED 1 To compare varieties with the control Jessica
 SED 2 To make comparisons between varieties except Jessica

Table 7: Percentage Grade B of Class I (400-500 g).

	Aug	Sep	Oct	Total
Jessica	36	38	37	37
Fitness	34	37	41	36
90-0044	41	40	44	41
E863	36	42	39	39
Allure	42	40	39	41
Nordica	42	37	37	40
Azuro	34	37	39	35
2417	36	44	40	39
SED 1 (29 df)	2.1	2.3	5.0	1.6
LSD (P = 0.05)	4	5	-	3
SED 2 (29 df)	2.2	2.4	5.2	1.7
LSD (P = 0.05)	4	5	-	3
Significance	***	*	NS	**

SED 1 To compare varieties with the control Jessica
 SED 2 To make comparisons between varieties except Jessica

Table 8: Percentage Grade C of Class I (500-650 g).

	Aug	Sep	Oct	Total
Jessica	34	33	22	32
Fitness	37	35	28	35
90-0044	29	34	19	30
E863	36	33	35	35
Allure	34	30	22	31
Nordica	33	36	33	34
Azuro	37	36	27	35
2417	26	26	13	24
SED 1 (29 df)	1.7	2.7	5.0	1.7
LSD (P = 0.05)	3	6	10	3
SED 2 (29 df)	1.8	2.8	5.2	1.7
LSD (P = 0.05)	4	6	11	3
Significance	***	*	**	***

SED 1 To compare varieties with the control Jessica
 SED 2 To make comparisons between varieties except Jessica

Table 9: Percentage Grade D of Class I (650-800 g).

	Aug	Sep	Oct	Total
Jessica	10.7	6.8	2.8	8.3
Fitness	8.8	7.4	6.3	8.0
90-0044	4.8	4.3	2.7	4.4
E863	7.3	4.9	3.8	6.1
Allure	6.3	6.4	0.6	5.7
Nordica	7.0	9.8	7.9	7.8
Azuro	11.0	9.2	2.9	9.4
2417	10.0	4.7	0.1	6.7
SED 1 (29 df)	1.44	1.46	1.97	0.86
LSD (P = 0.05)	2.9	3.0	4.0	1.8
SED 2 (29 df)	1.52	1.53	2.07	0.91
LSD (P = 0.05)	3.1	3.1	4.2	1.9
Significance	**	**	**	***

SED 1 To compare varieties with the control Jessica
 SED 2 To make comparisons between varieties except Jessica

Table 10: Mean fruit length (cm).

	Mainstem Fruit (25 Aug)	Lateral Fruit (23 Sept)
Jessica	36.8	34.5
Fitness	36.7	34.1
90-0044	35.3	35.7
E863	36.8	33.7
Allure	35.1	33.4
Nordica	35.8	32.8
Azuro	36.9	34.8
2417	37.9	34.6

Table 11: Monetary value in pounds sterling (per m²).

	Total
Jessica	6.86
Fitness	7.41
90-0044	8.75
E863	7.63
Allure	8.05
Nordica	6.97
Azuro	6.32
2417	5.81
SED 1 (29 df)	0.32
LSD (P = 0.05)	0.65
SED 2 (29 df)	0.34
LSD (P = 0.05)	0.70
Significance	***

SED 1 To compare varieties with the control Jessica
 SED 2 To make comparisons between varieties except Jessica

Plant Growth

Allure and Nordica were more vigorous than other varieties at the end of the trial period (Table 12). In September Nordica and Azuro produced stronger lateral growth, but in October, E863 produced the thickest laterals compared to other varieties.

The visual vigour assessment of the whole plant indicated 2417 was noticeably less vigorous than other varieties in September. In October, Jessica, Azuro and 2417 were slightly less vigorous than other varieties (Table 13).

90-0044 and Allure tended to be taller, faster growing with more leaves on both the 23 and 30 July compared to most varieties (Tables 14 and 15).

Table 12: Main stem and lateral diameters (mm).

	Mainstem (2 Nov)	Laterals (16 Sept)	Laterals (15 Oct)
Jessica	9.8	4.6	4.4
Fitness	10.5	4.3	4.8
90-0044	9.8	4.1	4.7
E863	10.4	4.8	5.0
Allure	11.0	4.7	4.5
Nordica	11.1	5.1	4.7
Azuro	9.7	5.0	4.5
2417	8.9	4.3	4.8

Table 13: Vigour assessment (score 0-5)#.

	16 Sept	15 Oct
Jessica	2.7	2.3
Fitness	3.3	2.7
90-0044	3.2	2.8
E863	3.2	2.7
Allure	3.0	2.7
Nordica	3.2	2.9
Azuro	3.3	2.2
2417	2.3	2.4

Score 0-5, where 0 = poor, 5 = vigorous.

Table 14: Plant height (cm).

	23 Jul	30 Jul
Jessica	93.8	162.2
Fitness	101.3	168.1
90-0044	103.1	177.3
E863	96.1	162.7
Allure	102.3	177.6
Nordica	97.6	162.3
Azuro	107.2	170.7
2417	99.2	161.4

Table 15: Leaf number.

	23 Jul	30 Jul
Jessica	10.0	15.5
Fitness	10.4	16.2
90-0044	10.7	17.0
E863	10.0	15.8
Allure	10.5	16.1
Nordica	10.1	15.6
Azuro	10.3	15.4
2417	10.4	15.6

Disease Tolerance

Fitness, 90-0044, E863 and Nordica which all have claimed powdery mildew tolerance had significantly less powdery mildew compared with Jessica and other varieties (Figure 1).

Those varieties with claimed powdery mildew tolerance tended to have less healthy plants and more dead plants due to stem diseases when assessed on the 25 October (Figure 2). The lower percentage of healthy plants was due to an increased level of infection mainly with mycosphaerella but also botrytis (Figure 3).

Figure 4 shows the severity or level of infection of those plants with stem disease, where a higher figure means more disease. E863, 90-0044 and Nordica were the varieties most severely infected with mycosphaerella.

90-0044 tended to have slightly more serious botrytis infection than other varieties.

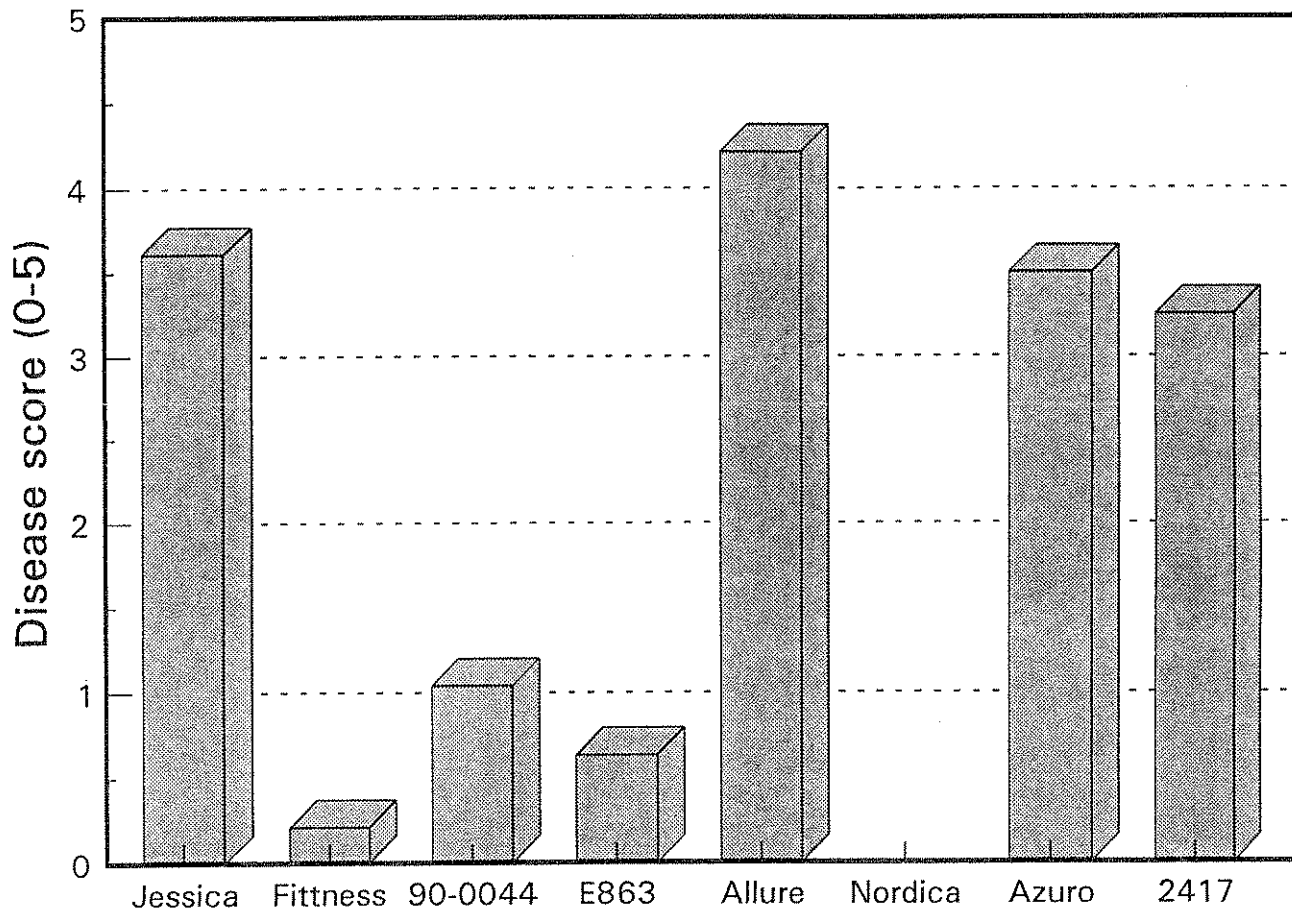
Allure, a powdery mildew susceptible variety tended to have more stem lesions of both mycosphaerella and botrytis than the other powdery mildew susceptible varieties.

The level of stem disease on the variety Allure was only marginally less than on the group of powdery mildew tolerant varieties (Fitness, 90-0044, E863, Nordica).

E863 was particularly susceptible to mycosphaerella, and 90-0044 susceptible to Botrytis compared to other varieties.

FIGURE 1

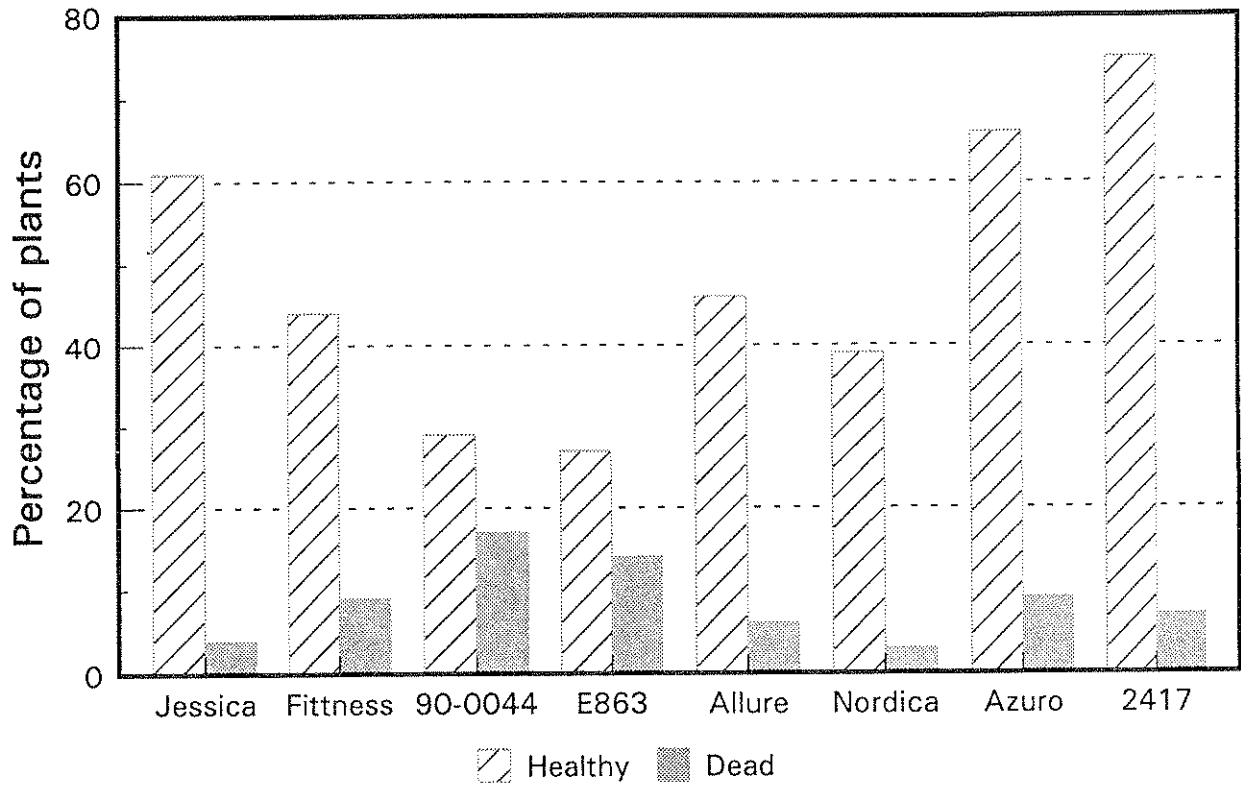
Varietal susceptibility to powdery mildew assessed in September.



Score 0-5; where 5 = severe mildew infection, 0 = no mildew infection.

FIGURE 2

Varietal susceptibility to stem diseases as a percentage of healthy* or dead plants on 25 October.



* Healthy plants had no disease lesions on the stems.

FIGURE 3

Varietal susceptibility to mycosphaerella and botrytis stem diseases expressed as a percentage of plants affected.

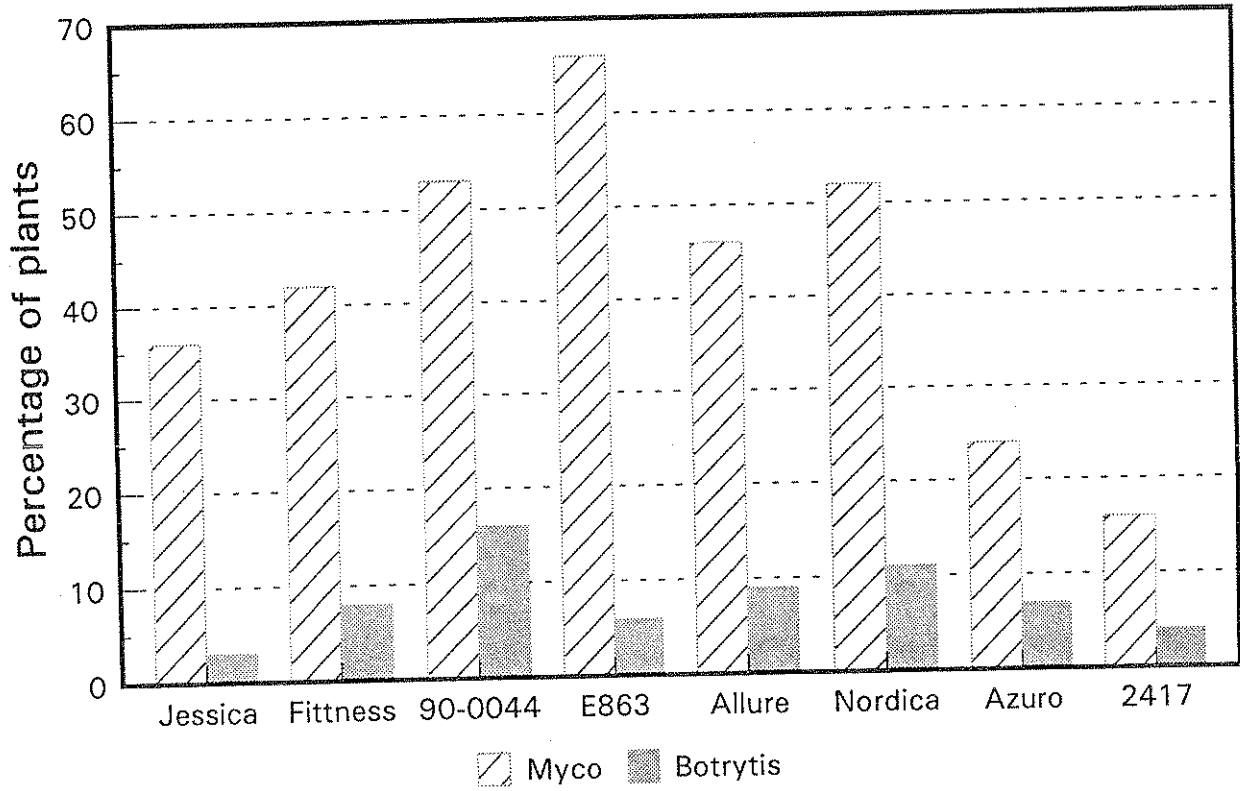
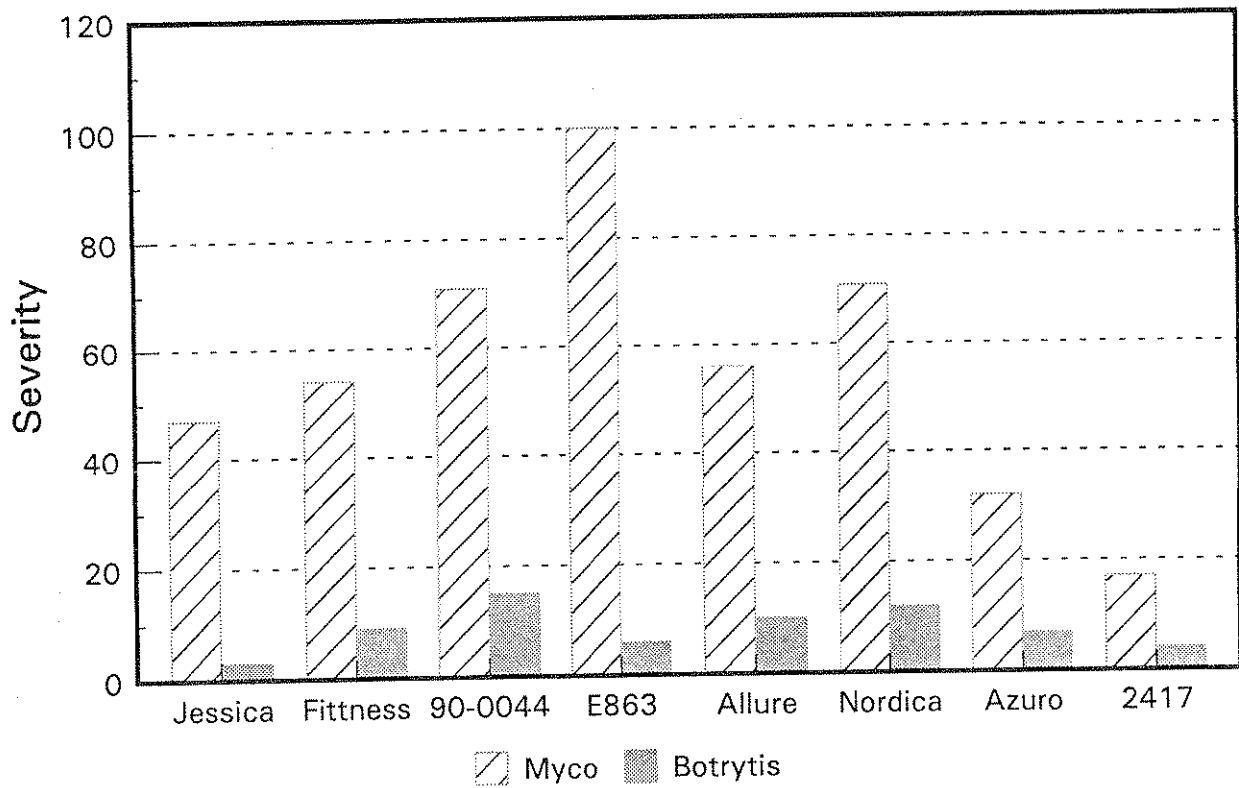


FIGURE 4

Varietal susceptibility to mycosphaerella and botrytis stem diseases expressed as severity.



* Severity of infection was calculated to represent the number of lesions per plant, multiplied by the percentage of plants infected.

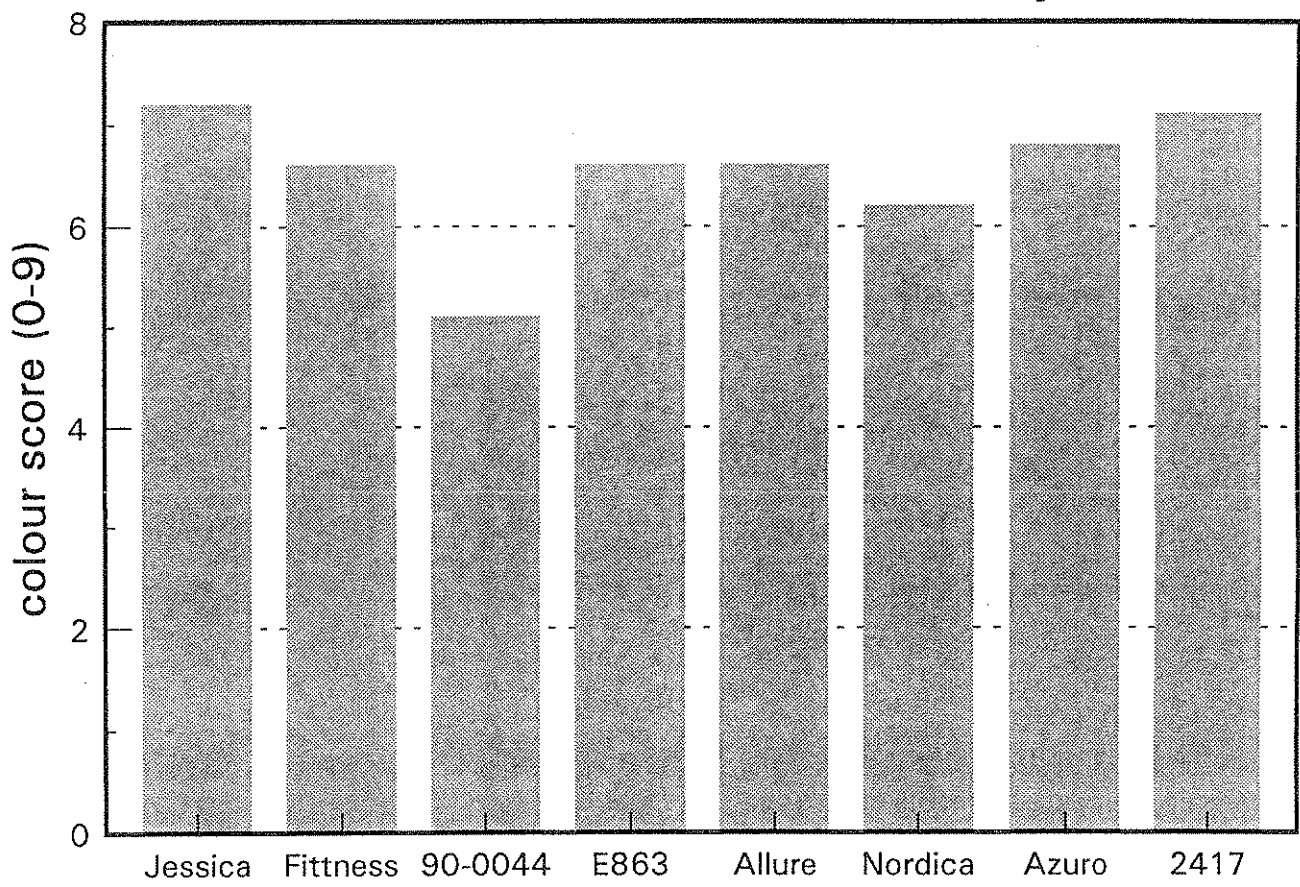
Shelf Life

After harvest, fruit were placed in shelf life conditions for six days, when they were assessed and measured for colour change, fresh weight loss and firmness.

After six days under shelf life conditions fruit of the variety 90-0044 were paler in colour than other varieties (Figure 5). Allure lost the most fresh weight over six days shelf life and was therefore softer in the firmness tests (Figures 6 and 7).

FIGURE 5

Shelf life colour after 6 days



A higher figure means darker fruit

FIGURE 6

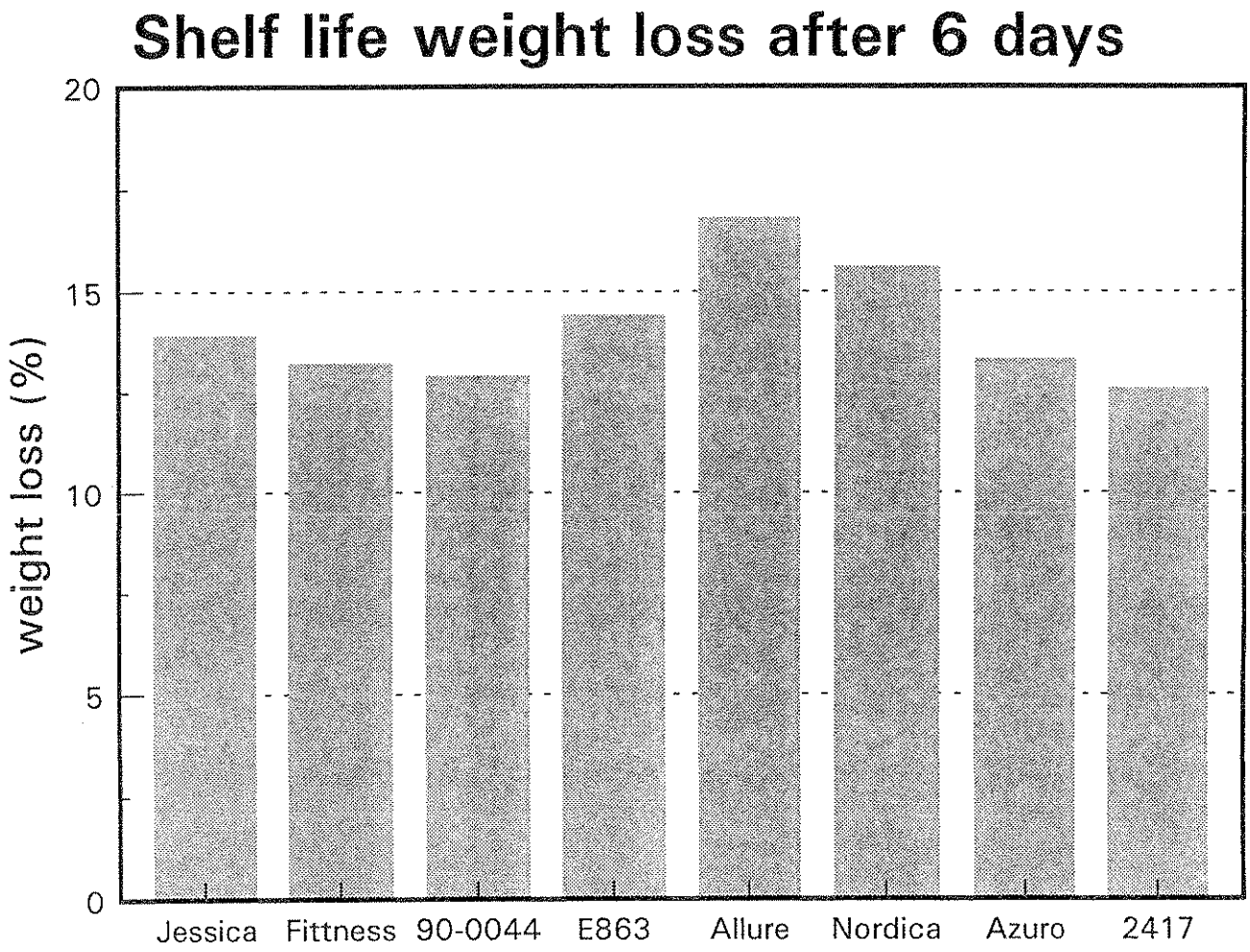
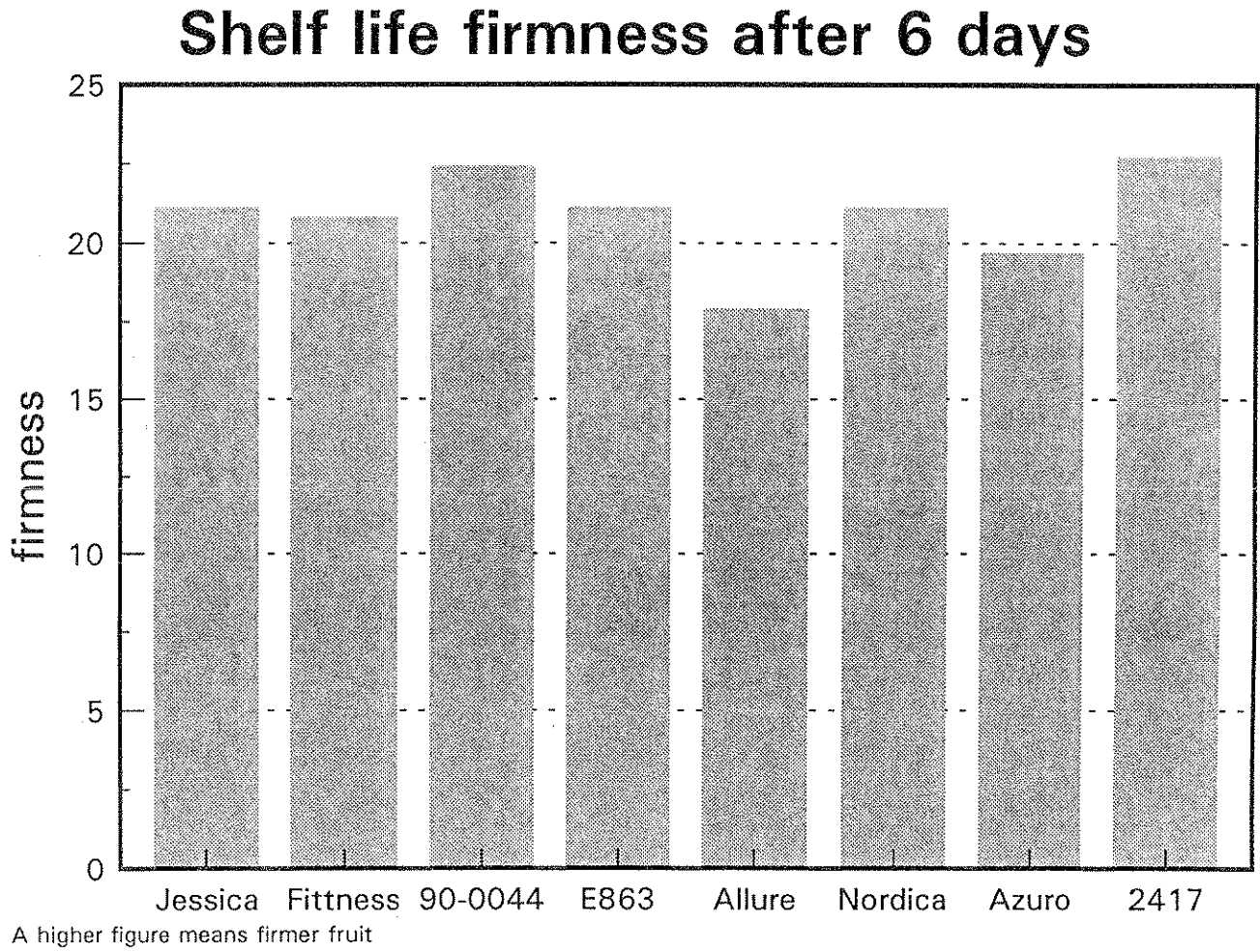


FIGURE 7



Discussion

Fruit Yield and Quality

The varieties 90-0044 and Allure produced high yields of cucumbers particularly in August. The yield of 90-0044 was exceptional, however the mean fruit size was lower than other varieties but still acceptable at 459 g averaged over the trial period.

The fruit quality of E863 and Nordica in particular was worse than other varieties, in terms of percentage Class I in September. 2417 produced a higher percentage of Class I fruit than other varieties in October but was on average lower yielding and had smaller fruit.

Plant Growth

Nordica was a strong growing variety producing thicker laterals and mainstem than other varieties. An assessment of early growth up to the wire showed 90-0044 and Allure to be taller, faster growing varieties. 2417 was visually less vigorous than other varieties in September.

Disease Tolerance

Fitness, 90-0044, E863 and Nordica, all with claims of powdery mildew tolerance, were all significantly less susceptible to the disease than the other varieties.

These four powdery mildew tolerant varieties were found to be significantly more susceptible to stem diseases than the other varieties. E863 appeared to be more susceptible to mycosphaerella. Allure, a non powdery mildew tolerant variety, was also fairly susceptible to stem diseases.

Shelf Life

After 6 days in simulated retail shelf conditions, 90-0044 became slightly paler in colour. Allure tended to lose weight and therefore was slightly softer than other varieties after 6 days.

Conclusions

1. 90-0044 and Allure produced high yield of quality fruit compared with existing standard varieties.
2. Fitness, 90-0044, E863 and Nordica showed good levels of tolerance to powdery mildew.
3. The powdery mildew tolerant varieties were more susceptible to stem diseases such as mycosphaerella and botrytis.