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Asparagus: Evaluation of cultivars for yield, quality and longevity

FV 183b

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The results and conclusions of this report are based on an investigation conducted over one year. The results obtained have been reported with detail and accuracy.

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Authentication

I declare that his 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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GROWER SUMMARY
FV 183b

Asparagus: Evaluation of cultivars for yield, quality and longevity

Headline

After nine years production, two Dutch cultivars, Geynlim and Backlim (out of a total of 26 cultivars from Europe, USA and New Zealand), were outstanding, in terms of sustained and reliable yield.

Background and expected deliverables

There is an increasing demand for asparagus and this is being met by a continuing influx of new growers and expansion by some existing growers. Cultivar selection is the most important decision growers make in establishing an asparagus crop. Decisions made prior to planting have a marked effect on profitability for the next 10-15 years. Use of cultivars that are inappropriate can lead to an early reduction in crop productivity (asparagus decline) so the crop is no longer profitable to maintain.

An HDC-funded Asparagus Cultivar Trial (FV 183) established in 1995 has provided extremely valuable information on the yield and quality of 20 cultivars from Europe, New Zealand and the USA for the period 1995-2000. Results from an ADAS trial comparing six New Jersey (USA) cultivars are also available for the same period. The trial site was Portwood Farm, Great Ellingham, near Attleborough, Norfolk. The soil, which was well drained, was a sandy loam with some stones (of approximately 30 cm depth) over a sandy clay loam. Data on crop vigour and fern numbers collected for all 26 cultivars in autumn 2002 formed the basis for selection of eight commercially available cultivars to be assessed for medium-term performance after nine years growth in 2003. Records on harvest yield, crop vigour, plant counts and diseases were collected on the following cultivars:

Cultivar origin	Cultivar names	Comments
Holland	Backlim Boonlim Geynlim Horlim Tielim	Other Dutch cultivars performed well but are no longer commercially available.
France	Andreas	French cultivars are currently grown in the UK. Andreas was the best performing of the French cultivars and so was included
USA (New Jersey)	Jersey Jewel	New Jersey cultivars are being planted in the UK. Although their performance in the ADAS trial was poor, Jersey Jewel was the best performing cultivar in the group and so was included
Germany	Vulcan	Provided high fern vigour and total fern numbers in 2002

Summary of the project and main conclusions

Yields in 2003

After nine years, the cultivars that produced the highest total yields were Dutch, with Geynlim yielding 5.3 tonnes per hectare, followed by Backlim with 4.3 tonnes per hectare. The lowest performing cultivars were Jersey Jewel with 1.2 tonnes per hectare and Boonlim at 1.8 tonnes per hectare.

Vulcan produced the greatest proportion of blown and twisted spears at 59% of total yield, which would be unlikely to meet customer specifications. Jersey Jewel also had a significantly higher proportion of blown and twisted spears than the other cultivars. Geynlim and Horlim both had a significantly smaller proportion of blown and twisted spears when compared with the overall mean.

Over the season, Geynlim, Backlim and Horlim produced the highest yields of large spears (over 10 mm in diameter). The cultivars that produced the greatest proportion of large spears over the harvest season were Backlim and Andreas.

Bud tightness is an important quality feature for cultivar selection. The cultivars Backlim and Geynlim recorded the tightest buds with Vulcan producing the most open buds.

Disease assessments in 2003

The cultivars were assessed for diseases in mid-September 2003. One of the major diseases of asparagus is fusarium. All cultivars showed yellowing and dead stems due to fusarium, although the percentage of stems affected did not exceed 10 %. Tielim had the highest percentage of ferns affected (7%), whilst Jersey Jewel had the lowest number (2%).

The cultivars were assessed at the same time for severity of stemphylium and rust on the fern. Disease levels were extremely low, due largely to the very dry conditions this summer, with only a trace of rust and stemphylium observed.

Crop vigour and plant counts in 2003

Plant vigour and plant counts were assessed in mid-September. The results of the vigour assessments were highly significant with Backlim, Geynlim and Horlim having the highest vigour scores and Jersey Jewel the lowest.

It was informative to compare plant counts in 2003 with the original population of 21,500 plants per ha established in 1995. All of the Dutch cultivars still had very good plant counts with all five above 89 %. Backlim and Geynlim had the highest at 96%. The lowest plant count was recorded for Jersey Jewel with only 69%.

A summary of cultivar characteristics is presented in Table A.

Financial benefits

The financial implication of planting cultivars that provide the best yields and quality over poor yielding and quality cultivars can be as much as £6,000 per hectare, when the crop is in a full cropping season. Coupled with this is a longevity factor. The better performing cultivars are likely to show a production span of span of 10-15 years compared to the poor performing cultivars which may only produce economic yields for 5-7 years. Improved cultivar performance offers growers the potential for higher returns and profit margins.

Action points for growers

- Most growers who plant asparagus crops are looking to produce high yields of good quality spears over as long a period as possible, thereby compensating for the high cost of crop establishment and nil production in the crop's early years.

- When selecting cultivars for new plantings, growers should note that over the nine-year period of this trial, the Dutch cultivars have consistently produced good results with reliable yields of good quality spears. The best of these are notably Geynlim followed by Backlim and Horlim. All of these cultivars have maintained high plant populations and excellent vigour. Both Andreas and Vulcan failed to produce yields to compete with the best Dutch cultivars and Vulcan was of much poorer quality with very open buds. During the trial period, Jersey Jewel has declined dramatically, with extremely poor vigour, low plants counts and low yield.

- In summary, based on the results of this trial over the period 1995-2003, the Dutch cultivars are likely to continue as the mainstay of the UK asparagus industry in the foreseeable future.

Table A. Summary of asparagus cultivar characteristics, based on trial assessments in 2003 (9th season)

Cultivar	Yield		Quality		Disease		Plant vigour	% plant survival
	Tonnes/ha	% large spears	% blown and twisted spears	Bud tightness	Fusarium*	Fern disease		
Backlim	High	High	Low	Good	Low	Nil	Good	Good
Boonlim	Low	Low	Moderate	Moderate	Low	Trace	Moderate	Moderate
Geynlim	High	Moderate	Low	Good	Low	Trace	Good	Good
Horlim	High	Moderate	Low	Good	Low	Nil	Good	Good
Tielim	Moderate	Moderate	Moderate	Moderate	Moderate	Nil	Moderate	Good
Andreas	Moderate	High	Moderate	Moderate	Moderate	Nil	Poor	Moderate
Jersey Jewel	Low	Low	High	Moderate	Very low	Nil	Poor	Poor
Vulcan	Moderate	Low	High	Poor	Low	Trace	Moderate	Good

*No cultivar had more than 10 % stems affected with Fusarium

SCIENCE SECTION

Introduction

Cultivar selection is the most important decision that growers make in establishing an asparagus crop. The crop is expensive to establish and decisions made at this stage have a marked effect on profitability for the next 10-15 years. Use of cultivars that are inappropriate for a particular region can lead to a premature reduction in crop productivity (asparagus decline) such that the crop is no longer profitable to maintain.

An HDC-funded Asparagus Cultivar Trial (FV 183), which was established in 1995, has produced extremely valuable information on the productivity and quality of 20 cultivars from Europe, New Zealand and USA during the period 1995-2000. Data has also been collected for the same period from an ADAS trial comparing six New Jersey (USA) cultivars.

The HDC and Asparagus Growers Association (AGA) recommended that data on yield and performance should be collected in 2003 to provide information on cultivar longevity. Data on vigour and fern number for each of the 26 cultivars in the HDC and ADAS trials were collected in 2002 and used as the basis for selection of cultivars to be assessed for medium-term performance (FV 183a). As a result of this exercise, eight cultivars were recommended for recording of harvest data in 2003. They are as follows:

Dutch cultivars – Geynlim, Backlim, Tielim and Boonlim. (Other Dutch cultivars could have been included because of their good performance but were not included because they are no longer commercially available).

German cultivar – Vulcan (Provided high fern vigour and total fern numbers in 2002).

French cultivar – Andreas. (French cultivars are currently grown in the UK. Andreas was the best performing French variety in the trial and so was recommended for further study).

New Jersey cultivar – Jersey Jewel (New Jersey cultivars are being planted in the UK. Although their performance in the ADAS trial was poor, Jersey Jewel was the best performing cultivar in the group and for this reason was recommended for inclusion).

This report presents records of harvest data and other detailed data on the productivity and longevity of selected cultivars in 2003. It is anticipated that growers will use information on crop longevity together with information on cultivar performance from previous trial reports (FV 183, FV 183a) as a basis for selecting cultivars for new plantings.

Materials and methods

Site

The trial was carried out at Portwood Farm, Great Ellingham, near Attleborough, Norfolk. The soil is a sandy loam with some stones, of approximately 30 cm depth over a sandy clay loam. The site is well drained.

Cultivars

Dutch cultivars – Backlim, Boonlim, Geynlim, Horlim and Tielim.

German cultivars – Vulcan

French cultivars – Andreas

New Jersey (USA) cultivars – Jersey Jewel

Experimental design

The trial was a randomised block design with four replicate blocks of each cultivar treatment (three for Jersey Jewel).

The plot size was 7.8 m x 3 m (2 single rows) totalling 23.4 sqm, with the number of plants planted being 52. A guard row was planted on either side of each plot.

The recordable area was 6 m x 3 m (2 single rows) totalling 18 sqm, with the number of plants assessed being 40.

Husbandry

The trial was planted in mid-June 1995, with plants raised under glass in containers. The trial was established in single rows at 1.50 m centres with an in-row spacing of 30 cm giving a plant population of 21,530 per hectare. Irrigation was applied on several occasions to aid establishment. The first harvest was taken in 1997 for a part-season and for a full season to 21 June in 1998 – 2000. The harvesting period in 2003 was from April 24 to June 21.

The trial was sited in the middle of a commercial block of asparagus established at the same time. Cultural operations such as pest, disease and weed control were carried out to a high commercial standard.

Assessments 2003

The eight cultivars were recorded for harvest data during the period 24 April to 21 June. Data collected included spear numbers in different grades (less and greater than 10 mm diameter), totalled for each week and for the whole season. The proportion of blown and twisted spears was also recorded. Bud tightness was recorded on 24 June.

Assessments for fern diseases (rust and stemphylium) were made in September. Fusarium was assessed at the same time.

Vigour scores and plant counts were recorded in September. Vigour scores were based on a 1-9 scoring system (9 = most vigorous), taking account of the amount of fern growth (number and height of stems, and density of fern).

Statistical analysis

Statistical analysis was carried out using ANOVA (analysis of variance) or Friedmans non-parametric test where the data were not suitable for analysis by ANOVA.

Results and discussion

Harvest data

Table 1. Total number of spears ('000/ha) and total yield (t/ha) including blown and twisted spears in 2003

Cultivar	Number of spears ('000/ha)	Yield (t/ha)
Backlim	171.3	4.307
Boonlim	108.9	1.767
Geynlim	299.4	5.260
Horlim	168.2	3.760
Tielim	163.2	3.175
Andreas	158.2	3.295
Jersey Jewel*	96.2	1.249
Vulcan	252.4	3.602
Grand Mean	**177.2**	**3.302**
SED (20(1)d.f)	23.02	0.3987
LSD (20df) (p=0.05)	48.02	0.8317
CV%	18.4	17.1
p-value	<0.001	<0.001

*4th replicate not present so analysed as a "missing value".

Geynlim had a significantly greater yield than all the other cultivars. Boonlim and Jersey Jewel both had significantly lower yields than the overall average (Table 1).

Table 2. Total number of spears ('000/ha) and total yield (t/ha) excluding blown and twisted spears in 2003

Cultivar	Number of spears ('000/ha)	Yield (t/ha)
Backlim	98.9	2.842
Boonlim	58.6	1.147
Geynlim	170.4	3.677
Horlim	109.3	2.752
Tielim	77.5	1.845
Andreas	76.7	2.017
Jersey Jewel*	34.3	0.670
Vulcan	76.0	1.512
Grand Mean	**87.7**	**2.058**
SED (20(1)d.f)	12.17	0.2867
LSD (20df) (p=0.05)	25.39	0.5980
CV%	19.6	19.7
p-value	<0.001	<0.001

*4th replicate not present so analysed as a "missing value".

With blown and twisted spears removed, Geynlim was still the cultivar that provided the highest yield (Table 2). It was one of only three cultivars, Backlim, Geynlim and Horlim, to achieve a yield significantly greater than the overall mean. With blown and twisted spears removed, Vulcan's yield was below the overall average. Boonlim and Jersey Jewel yielded significantly less than the other cultivars.

Table 3. Total number ('000/ha), yield (t/ha) and proportion of blown and twisted spears

Cultivar	Number of spears ('000/ha)	% of total number	Yield (t/ha)	% of total yield
Backlim	72.4	42.4	1.470	34.2
Boonlim	50.3	48.4	0.618	37.3
Geynlim	129.0	43.1	1.582	30.2
Horlim	58.9	35.6	1.010	27.2
Tielim	85.7	52.7	1.332	42.5
Andreas	81.5	51.1	1.278	39.1
Jersey Jewel*	61.9	67.0	0.572	52.3
Vulcan	176.4	70.4	2.085	59.2
Grand Mean	**89.5**	**51.3**	**1.243**	**40.3**
SED (20(1)d.f)	14.55	3.8	0.1587	3.6
LSD (20df) (p=0.05)	30.35	8.0	0.3310	7.5
CV%	23.0	10.6	18.0	12.6
p-value	<0.001	<0.001	<0.001	<0.001

*4th replicate not present so analysed as a "missing value".

Vulcan had the highest proportion of blown and twisted spears at 59% (Table 3), and this would be unacceptably high for customer specifications. Jersey Jewel also had a significantly higher proportion of blown and twisted spears than the other cultivars. Geynlim and Horlim both had a significantly smaller proportion of blown and twisted spears when compared with the overall mean.

Geynlim, Backlim and Horlim produced a significantly greater number of large spears (>10 mm diameter) than the overall mean, and consequently had a greater yield of large spears (Table 4). Figure 1 shows the proportion of yield due to large spears (>10 mm diameter) during the 2003 harvesting season. Backlim and Andreas were the cultivars that had the highest percentage of large spears.

Table 4. Total number ('000/ha) and yield (t/ha) of spears over 10 mm diameter (excluding blown and twisted spears) in 2003.

Cultivar	Spears >10 mm diameter	
	Number ('000/ha)	Yield (t/ha)
Backlim	62.8	2.163
Boonlim	19.0	0.533
Geynlim	68.7	2.060
Horlim	57.2	1.845
Tielim	37.8	1.180
Andreas	46.1	1.475
Jersey Jewel*	10.0	0.322
Vulcan	28.1	0.773
Grand Mean	**41.2**	**1.294**
SED (20(1)d.f)	7.24	0.2323
LSD (20df) (p=0.05)	15.10	0.4846
CV%	24.8	25.4
p-value	<0.001	<0.001

*4th replicate not present so analysed as a "missing value".

Figure 1. Percentage of cultivar yield due to large spears (>10 mm diameter) in 2003

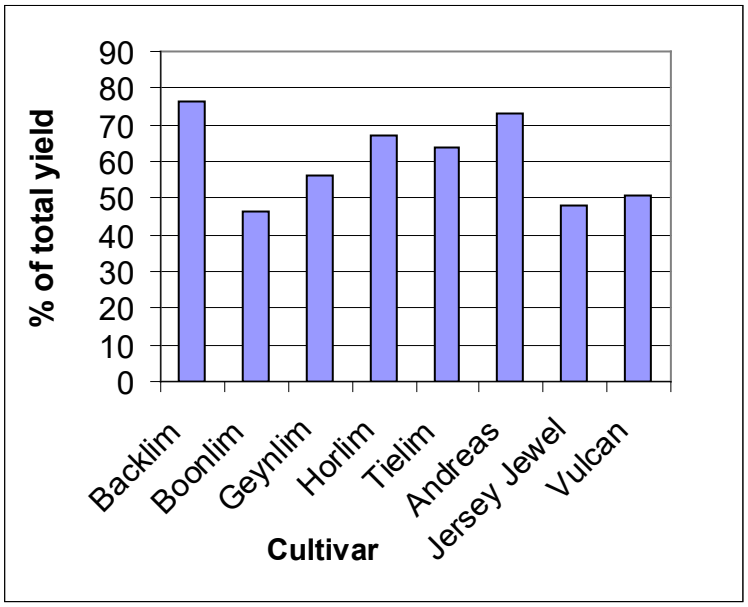
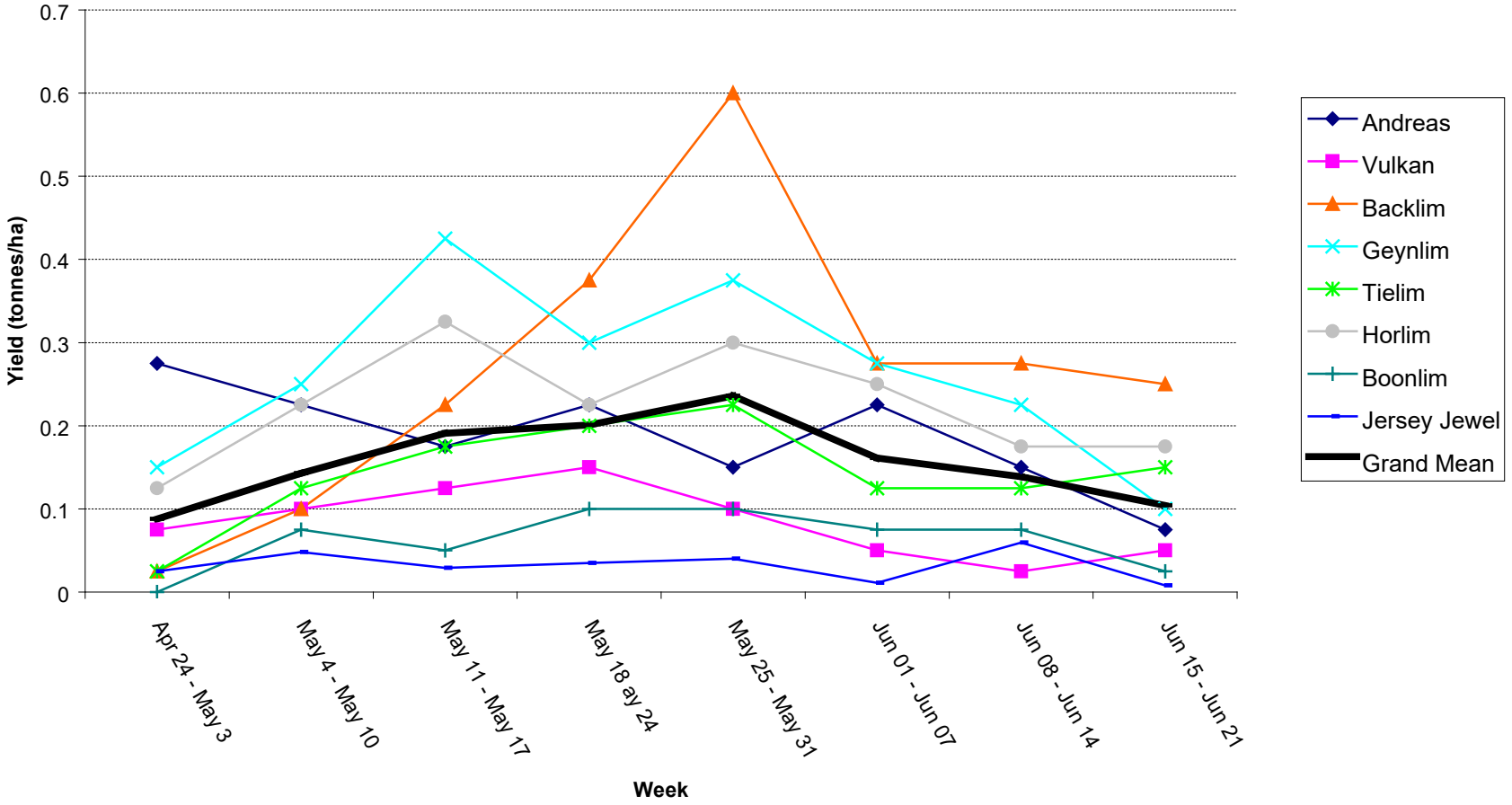


Figure 2 shows the weekly yields of large spears (>10 mm diameter) for each cultivar, emphasising that different cultivars gave peak yields of large spears at different stages of the harvest season. Andreas produced the greatest yield of larger spears earlier in the season, but was then overtaken by Geynlim, Horlim and particularly Backlim which produced a peak in yield of large spears later than other cultivars, in the week commencing May 25th. Tielem generally produced average yields of large spears, while Boonlim, Jersey Jewel and Vulcan were below average.

Figure 2. Weekly yield (t/ha) of large (>10mm diameter) spears harvested in 2003



Bud tightness

Bud tightness assessments were made on 24 June, 3 days after the end of the harvesting period. The temperature at the time of assessment was 20°C and followed a run of days at a similar temperature. Buds were assessed at 25 cm above soil level. The general trend from the data in Table 5 suggests that Backlim and Geynlim had the tightest buds, which is an important quality feature, with Vulcan giving the most open buds.

Table 5. Bud tightness scores for asparagus cultivars in 2003

Cultivar	Mean Score (0-5)**
Backlim	2.3
Boonlim	3.3
Geynlim	2.3
Horlim	2.5
Tielim	2.8
Andreas	3.3
Jersey Jewel*	3.0
Vulcan	3.8
Grand Mean	**2.9**
d.f	7
p-value	0.011
S	18.34

*4th replicate not present so analysed as a "missing value".
** 1 = tight bud, 5 = open bud
Analysed using Friedman's non-parametric analysis

Disease assessments

Disease assessments were carried out on 18th September 2003. Percentage stems affected with fusarium did not exceed 10 % for any cultivar. Tielim had the highest percentage of stems damaged due to Fusarium, while Jersey Jewel had the least amount of damage (Table 6). Tielim was the only variety to have significantly greater percentage *Fusarium* than the overall mean figure.

All varieties were also assessed for severity of rust and Stemphylium on ferns. Disease levels were extremely low with only one rust pustule observed in the entire trial due largely to the long spells of dry settled weather. There was a trace of Stemphylium in one plot only for each of Boonlim, Vulcan and Geynlim.

Table 6. Percentage yellowing/dead stems due to *Fusarium* (2003).

Cultivar	Percentage stems affected
Backlim	3.0
Boonlim	4.0
Geynlim	3.5
Horlim	3.8
Tielim	7.3
Andreas	5.5
Jersey Jewel*	1.6
Vulcan	4.0
Grand Mean	**4.1**
SED (20(1)d.f)	1.2
LSD (20df) (p=0.05)	2.5
CV%	42.1
p-value	0.008

*4th replicate not present so analysed as a "missing value"

Crop vigour and plant counts

Crop vigour was assessed and plant counts recorded on 18th September 2003. The crop vigour results were highly significant (Table 7) with Backlim, Geynlim and Horlim having the highest vigour scores and Jersey Jewel, the lowest.

Table 7. Crop vigour for asparagus cultivars in 2003

Cultivar	Mean Score (1-9)**
Backlim	8.0
Boonlim	6.3
Geynlim	8.0
Horlim	8.6
Tielim	6.6
Andreas	5.4
Jersey Jewel*	2.8
Vulcan	5.4
Grand Mean	**6.4**
d.f	7
p-value	0.001
S	24.67

*4th replicate not present so analysed as a "missing value".
**Score definition: 1=lowest vigour; 9=highest vigour.
Analysed using Friedman's non-parametric analysis

After 9 years growth, Jersey Jewel had the lowest number of plants surviving at (69%) (Table 8). It was the only cultivar with a significantly lower survival rate than the overall mean. Backlim and Geynlim had the highest survival rate at 96%. The five Dutch cultivars all performed well, with percentage plant survival exceeding 89 %

Table 8. Plant counts (‘000/ha) and plant survival rate (%))

Cultivar	Plants counts (‘000/ha)	Plant survival (%)
Backlim	21.39	96.25
Boonlim	19.86	89.37
Geynlim	21.39	96.25
Horlim	20.83	93.75
Tielim	20.69	93.12
Andreas	19.03	85.62
Jersey Jewel*	15.35	69.08
Vulcan	20.56	92.50
Grand Mean	**19.89**	**89.49**
SED (20(1)d.f)	0.715	3.217
LSD (20df) (p=0.05)	1.491	6.712
CV%	5.1	5.1
p-value	<0.001	<0.001

*4th replicate not present so analysed as a “missing value”

Overall conclusions

- After nine years, the cultivars that produced the highest yields were Dutch with Geynlim producing the best yields at 5.3 tonnes per hectare followed by Backlim at 4.3 tonnes per hectare.

- The lowest performing cultivars were the USA cultivar Jersey Jewel with 1.3 tonnes per hectare, followed by the Dutch cultivar Boonlim with 1.8 tonnes per hectare

- The Dutch cultivars Backlim and Geynlim recorded spears with the tightest buds, which is an important quality feature, with the German cultivar Vulcan producing the most open buds.

- All cultivars showed yellowing and dead stems due to fusarium, although the mean percentage of stems affected did not exceed 10 %. The Dutch cultivars had the highest percentage of ferns affected whilst Jersey Jewel had the lowest number (2%).

- Levels of the foliar disease stemphylium and rust were extremely low in 2003 due largely to the very dry conditions during the summer

- Backlim, Geynlim and Horlim produced the best crop vigour and Jersey Jewel the lowest.

- All of the Dutch cultivars still had very good plant counts with all five above 92% in 2003 after nine years of growth. Backlim and Geynlim had the highest at 96%. The lowest plant count was recorded for Jersey Jewel with only 69% of plants surviving.

- Over the nine-year period of this trial, the Dutch cultivars have consistently produced good results with reliable yields of good quality spears. The best of these are notably Geynlim followed by Backlim and Horlim. All of these cultivars have maintained high plant populations and excellent vigour. Both Andreas and Vulcan failed to produce yields to compete with the best Dutch cultivars and Vulcan was of much poorer quality with very open buds. During the trial period, Jersey Jewel has declined dramatically, with extremely poor vigour, low plants counts and low yield.

- In summary, based on the results of this trial over the period 1995-2003, the Dutch cultivars are likely to continue as the mainstay of the UK asparagus industry in the foreseeable future.

Technology transfer

Data from this trial has been presented at the following events:
ADAS Asparagus Growers Conference 1997 and 2000
Asparagus Growers Association Conference 2003
HDC/ ADAS Asparagus Open Days 1992 and 2000
AGA/ADAS Grower Discussion Groups

HDC News – article November 2003
Proposed presentation at future ADAS Conference

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