Project title	Vining Peas: Extension of variety evaluation trials
Project number:	FV 340
Project leader:	Mr. S. J Belcher
Report:	Annual report, January 2009
Previous report	
Key staff:	Mr. S. J Belcher (project leader) Dr. A. J. Biddle (Pathology trials)
Location of project:	Holbeach, Lincs
Project coordinator:	Mr. T. Mudge, PVGA, 133 Eastgate, Louth, LN11 9QG
Date project commenced:	[1 March 2008]
Date project completed (or expected completion date):	[28 February 2011]
Key words:	Vining peas, varieties

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

AUTHENTICATION

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

[Name] Mr. Salvador Potter
[Position] Chief Executive Officer
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Signature ..... Date: 19th February 2009

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Grower Summary

Headline

New vining pea varieties improve yields, size-grade and uniformity compared to older varieties. Susceptibility to downy mildew was assessed.

Background and expected deliverables

Varietal selection is an important and key element of vining pea crop production to ensure a programmed harvest period and to maintain high quality produce. To this end PGRO evaluates around 15 varieties annually at National List stage funded by Seedsmen and PGRO Levy and the most promising are evaluated in trials for a further two years in the Main Trial. There are no other independent facilities for vining pea evaluation in the UK.

Currently varieties are evaluated at just one site at Thornhaugh with 'petits pois' varieties being evaluated on a silt soil type in South Lincolnshire. The soil type at Thornhaugh is representative of only a proportion of the national pea growing production area and varieties can often perform differently in other soil types and areas. An extension of the PGRO trials system to include an evaluation of the candidate commercial varieties at both Thornhaugh and in South Lincolnshire sites will add to refine the evaluation process, with additional information to supplement data from established trials. Varietal selection is an important and key element of vining pea crop production to ensure a programmed harvest period and to maintain high quality produce. New varieties are chosen by either the processors or by growers in consultation with the processor. The results will provide additional data to be added to the PGRO Variety information leaflet. This will give greater reliability to the results and allow peas to be correctly integrated into drilling and harvesting programmes.

Summary of the project and main conclusions

January and February - were very dry months with temperatures well above average. March – rainfall was well above average with above average temperatures.
April - similar rainfall and temperatures to the average.
May - was wetter than average and temperatures well above average, particularly at the start of the month.
June and July - gave close to average temperatures and below average rainfall.
August - gave close to average temperatures and above average amounts of rainfall.

Variety Performance:

Avola

- The first variety to mature at Thornhaugh site
- Haulm was long and the variety lodged
- Yields were lower than Bikini, significantly so at TR100
- Produce was large-medium size grade and had a good, even colour.

8530702

- Matured one day later than Avola
- Haulm length and standing ability were similar to Avola
- Yields were significantly lower than Bikini at TR100, but higher than Avola
- Yields were similar to Avola at TR120
- Produce was medium-large size grade, a little smaller than Avola and had a good, even colour.

Recital

- Matured 6 days later than Avola and 3 days before Bikini

- Yields were a little higher than the Thornhaugh site, but lower than Bikini
- Haulm was long, but the variety stood well at harvest
- Produce was medium-small size grade at TR100 and had a good, but slightly uneven colour.

Biktop

- Matured at the same time as Bikini in this trial
- It is semi-leafless and semi-fasciated, like Bikini with longer haulm
- Like Bikini it was erect at harvest
- Yields were very high, the highest in this trial and significantly higher than Bikini.
- Produce was medium-large size grade with a dark and even colour.

Bikini

- Was semi-leafless and semi-fasciated, matured 8 days later than Avola and was erect at harvest
- Yields were good and higher than the Thornhaugh trial
- Produce was medium-large size grade with a dark, but slightly uneven colour.

Semi-leafless **Boogie**

- Matured 2 days later than Bikini in this trial
- It had longer haulm than Bikini and stood at harvest, but not as well as Bikini
- Yields were high, significantly higher than Bikini
- Produce was medium-large size grade but rather uneven in colour.

Semi-leafless **DS 89201**

- matured 2 days later than Bikini
- Haulm was longer than Bikini and stood as well as Boogie
- Yields were lower than Bikini, significantly so at TR100. Produce was medium-large size grade with a dark, but slightly uneven colour.

Ambassador

- Ambassador and Oasis were the latest varieties to mature, 6 days later than Bikini.
- Ambassador had very long haulm, but stood partially erect at harvest
- Yields were a little higher than Bikini. Produce was medium-large size grade with a dark, but slightly uneven colour.

Oasis

- Had long haulm and was partially erect at harvest
- Oasis gave high yields, significantly higher than Bikini
- Produce was medium-large size grade, with uneven colour and with blond peas in the sample.

Varietal Susceptibility of Vining Peas to Downy Mildew (*Peronospora viciae*)

Plants were scored for infection on two occasions during the season, to include both primary systemically infected seedlings and secondary infection on the foliage and pods. The data were combined to give an indication of the relative susceptibility to downy mildew on a 1-9 scale of increasing field resistance.

1	3	7	8	9
Very Susceptible	Susceptible	Slightly Susceptible	Moderate Field Resistance	Good Field Resistance
	Boogie DS 89201		DS 89263 Recital	Biktop

Varietal Susceptibility of Vining Peas to Powdery Mildew (*Erysiphe pisi)*

Plants were scored for natural infection at the full pod growth stage. The scores reflected resistance and susceptibility and are shown below:

Resistant	Recital, DS 89201, DS 89263, Boogie
Susceptible	Biktop, 8530702

New varieties are chosen either by the processor or by growers in consultation with their processor. They can provide additional yield and additional reliability. It is particularly important that maturity data will allow new peas to be correctly integrated into drilling and harvesting programmes.

When future trials are complete data from the trial will be incorporated into the PGRO advisory leaflet on vining pea varieties updated each year. This leaflet used extensively by growers, processors and merchants. This leaflet is the only independent source of information for variety data and allows growers to make an informed variety choice.

Financial benefits

- New vining pea varieties in trial represent improvements in yield, size-grade and uniformity compared with older varieties which have been grown for very many years.
- Reliable and accurate information on maturity to enable a sequential and uninterrupted harvest schedule to be followed is of great value to growers.
- Improvements in colour avoid deductions in payment which can be up to 5%. Growers, processors, retailers and consumers are likely to benefit from these improvements.
- Varieties with good field resistance to downy mildew may not need an expensive seed treatment to control the disease.
- Varieties with powdery mildew resistance can avoid quality loss and harvesting difficulties in late sown peas.

Action points for growers

The data will provide additional information for the growers leaflet ‘Vining pea varieties: a descriptive list’. This, together with yearly trials results can be obtained by contacting PGRO or downloaded from the PGRO website www.pgro.org. This leaflet is the only independent source of information for variety data.

Science Section

Introduction

Vining peas are a major vegetable crop grown for processing and for the fresh market and peas for freezing and canning occupy 36,000 ha per annum, with a value of £ 50M.

The PGRO Processed Legume Panel have identified varietal selection is an important and key element of crop production to ensure a programmed harvest period and to maintain high quality produce and require as accurate a guide to the performance of varieties in areas typical of pea production areas as possible

Varietal selection is an important and key element of vining pea crop production to ensure a programmed harvest period and to maintain high quality produce. To this end PGRO evaluates around 15 varieties annually at National List stage funded by Seedsmen and PGRO Levy and the most promising are evaluated in trials for a further two years in the Main Trial. There are no other independent facilities for vining pea evaluation in the UK.

Currently varieties are evaluated at just one site at Thornhaugh with petits pois varieties being evaluated on a silt soil type in South Lincolnshire. The soil type at Thornhaugh is representative of only a proportion of the national pea growing production area and varieties can often perform differently in other soil types and areas. An extension of the PGRO trials system to include an evaluation of the candidate commercial varieties at both Thornhaugh and in South Lincolnshire sites will add to refine the evaluation process, with additional information to supplement data from established trials. The variety treatment is replicated three times and each plot has to be harvested at different stages of maturity to enable yield and size grade data to be presented for the freezing stage Tenderometer Reading (TR) 100 and TR 120.

Several promising new vining pea varieties with improved yield and with more uniform size-grade and colour have been evaluated in PGRO Main and Preliminary Trials. A further factor of vining pea variety evaluation is the use of specialised equipment needed during harvesting and processing. The independent systematic evaluation of varieties is restricted to the PGRO, Thornhaugh site and one site for ‘petits pois’ varieties in a commercial crop. This forms the basis for the selection and development of varieties for the 36,000 ha of commercial crops. In practice, commercial programmes are based on the use of a minimum of 4 varieties and it is more likely that 6 or 7 will be used to give a spread of maturity and to allow production for special markets. On the latter point, these can either be premium ‘petits pois’ or ‘150 minute’ peas or, so called, economy/value packs.
Varietal characteristics affect:

- yield
- quality (colour, flavour, size and texture)
- ease of harvesting
- disease susceptibility
- timeliness
- ease of integration in the harvest programme

Also new ones are being actively sought by growers so that they can meet processors specifications for quality with the most productive, reliable and cost effective varieties.

Several promising varieties have been tested in recent years and more information on their performance and relative maturity of varieties on a different soil type is needed. Work is needed over at least three years to gain experience in contrasting seasonal weather conditions

Materials and methods

A duplicate standard pea main trial was sown on a light silt soil to supplement data from the PGRO, Thornhaugh trial.

Vining peas were grown according to best local and commercial practice.

Standard Varieties: Early and maturity Avola, Mid-season and yield Bikini (Oasis also included as a possible future yield standard) and late season Ambassador.

Varieties: 10 varieties of standard size peas (including 4 standards). Avola, 8530702, DS 89263, Rectial, Biktop, Bikini, Boogie, DS 89201, Ambassador and Oasis.

Sown: 11 March 2009
Sown with an Øyjord plot drill to achieve a population of 90 plants/m²

Site: Light silt soil in a commercial crop of Vining Peas, near Holbeach Hurn, South Lincolnshire. OS Grid Ref: TF 410276

Trial layout: Randomised block, 2 replications.
Plot size: 1.83 m x 19 m
Sub-plots: 1.83 m x 4 m for up to three harvests taken at @TR value 100 (range 95-105), @TR 120 Range 115-130) and a third harvest if required.
Sampling areas for TR assessment: 1.83 m x 2 m

Fungicide seed treatment: Wakil XL
Fungicide sprays: applied to control Botrytis and Mycosphaerella.

Weeds: Broad-leaved weeds were controlled pre-emergence.

Insect pests: Aphid and pea moth (*Cydia nigricana*) were controlled (monitored by pea moth traps).

Irrigation: None was applied.

Measurements: Haulm lengths and standing ability were measured just before harvest.
Maturity was assessed from the sampling areas to achieve correct harvest dates for quick-freezing and canning for vined peas using a Martin Pea Tenderometer.

Harvesting and Yields: Sub-plots were harvested when appropriate by hand, vined in a static plot pea viner, sieved and washed. Peas were size-graded with a Mather & Platt size-grader and weighed and total yield measured.
Samples were quick-frozen at @TR100 for quality appraisal and inspection by processors and growers.
Samples were quick-frozen at @TR120, and subsequently canned in a commercial cannery for quality appraisal and inspection by processors and growers.
Quality aspects of the defrosted frozen samples were assessed for colour, evenness of colour, brightness of colour, numbers of blond peas, sweetness and strength of flavour.
Yields were statistically analysed using ANOVA.

Disease observation trials
i). Downy mildew
Varieties that came with untreated seed were planted in a double row plot with two replications at three sites in commercial crops of vining peas with a long history of pea growing where natural infection from soil borne oospores was likely to occur. Infection scores were made on two occasions during the season and these scores converted to a scale of relative field resistance.

ii) Powdery mildew
Varieties were planted in a double row plot with two replications at Thornhaugh in late early June. Natural infection of powdery mildew was assessed after flowering and varieties were scored as susceptible or resistant.

Results – see tables 1 & 2
January and February were very dry months with temperatures well above average. Rainfall in March was well above average and above average temperatures. April gave similar rainfall and temperatures to the average. May was wetter than average and temperatures well above average, particularly at the start of the month. June and July gave close to average temperatures and below average rainfall. August gave close to average temperatures and above average amounts of rainfall.

Yields were very high this year.

Variety DS 89 263 was withdrawn from the trial by the breeder after sowing.

Avola as the Thornhaugh site was the first variety to mature. Haulm was long and the variety lodged. Yields were lower than Bikini, significantly so at TR100. Produce was large-medium size grade and had a good, even colour.

8530702 matured one day later than Avola. Haulm length and standing ability were similar to Avola. Yields were significantly lower than Bikini at TR100, but higher than Avola. Yields were similar to Avola at TR120. Produce was medium-large size grade, a little smaller than Avola and had a good, even colour.

Recital matured 6 days later than Avola and 3 days before Bikini. Yields were a little higher than the Thornhaugh site, but lower than Bikini. Haulm was long, but the variety stood well at harvest. Produce was medium-small size grade at TR100 and had a good, but slightly uneven colour.

Biktop matured at the same time as Bikini in this trial. It is semi-leafless and semi-fasciated, like Bikini with longer haulm. Like Bikini it was erect at harvest. Yields were very high, the highest in this trial and significantly higher than Bikini. Produce was medium-large size grade with a dark and even colour.

Bikini was semi-leafless and semi-fasciated, matured 8 days later than Avola and was erect at harvest. Yields were good and higher than the Thornhaugh trial. Produce was medium-large size grade with a dark, but slightly uneven colour.

Semi-leafless **Boogie** matured 2 days later than Bikini in this trial. It had longer haulm than Bikini and stood at harvest, but not as well as Bikini. Yields were high, significantly higher than Bikini. Produce was medium-large size grade but rather uneven in colour.

Semi-leafless **DS 89201** matured 2 days later than Bikini. Haulm was longer than Bikini and stood as well as Boogie. Yields were lower than Bikini, significantly so at TR100. Produce was medium-large size grade with a dark, but slightly uneven colour.

Ambassador and Oasis were the latest varieties to mature, 6 days later than Bikini.

Ambassador had very long haulm, but stood partially erect at harvest. Yields were a little higher than Bikini. Produce was medium-large size grade with a dark, but slightly uneven colour.

Oasis had long haulm and was partially erect at harvest. Oasis gave high yields, significantly higher than Bikini. Produce was medium-large size grade, with uneven colour and with blond peas in the frozen sample.

Varietal Susceptibility of Vining Peas to Downy Mildew (*Peronospora viciae*)

Plants were scored for infection on two occasions during the season, to include both primary systemically infected seedlings and secondary infection on the foliage and pods. The data were combined to give an indication of the relative susceptibility to downy mildew on a 1-9 scale of increasing field resistance.

1	3	7	8	9
Very Susceptible	Susceptible	Slightly Susceptible	Moderate Field Resistance	Good Field Resistance
	Boogie DS 89201		DS 89263 Recital	Biktop

Varietal Susceptibility of Vining Peas to Powdery Mildew (*Erysiphe pisi)*

Plants were scored for natural infection at the full pod growth stage. The scores reflected resistance and susceptibility and are shown below

Resistant	Recital, DS 89201, DS 89263, Boogie
Susceptible	Biktop, 8530702

TABLE 1 - VINING PEA VARIETY STUDIES. Summary of agronomic data Standard Vining Pea Main Variety Trial, Holbeach - 2008
Varieties placed in order of maturity. Standard varieties underlined. All varieties sown on 11 March
Results are means of two replicates. Target population 90 plants per m² sown in ten 15 cm rows

Variety		Source	1000 Seed Weight g	@ TR 100 Maturity (± days) Avola	@ TR 100 Yield % of Bikini	@ TR 100 % in size grades L	M	S	VS	@ TR 120 Maturity (± days) Avola	@ TR 120 Yield % of Bikini	@ TR 120 % in size grades L	M	S	VS	Haulm length cm	Standing Ability 9=erect 1=lodged	Pea wt. as % of total weight	Raw pea colour 1=pale 6=dark
Avola		As	212	0(27/6)	65⁻	43	37	17	3	0(30/6)	81	58	33	8	1	71	4	18	5.6
8530702		As	214	+ 1	84⁻	36	43	17	4	0	82	50	35	13	2	71	4	20	5.8
Recital (D 84171)		S&G	151	+ 6	94	17	50	29	4	+ 5	94	23	63	12	2	100	7	16	5.5
Biktop	SLSF	S&G	199	+ 8	148⁺	33	54	12	1	+ 7	154⁺	42	51	6	1	57	8	20	6.0
Bikini	SLSF	S&G	198	+ 8	100 (9.0t/lha)	30	50	17	3	+ 7	100 (9.6t/ha)	45	49	5	1	52	8	18	5.8
Boogie	SL	vW	210	+10	130⁺	57	34	8	1	+10	130⁺	63	30	6	1	65	6	20	5.5
DS 89201	SL	Dan	174	+10	80⁻	41	41	15	3	+10	81	65	26	7	2	72	6	14	5.6
Ambassador		vW	243	+14	107	25	48	21	6	+14	101	40	52	8	0	105	6	18	5.1
Oasis		Sh	211	+14	120⁺	32	50	15	3	+14	139⁺	43	43	11	3	94	6	20	5.5
Significance @ P=0.05					SD						SD								
LSD @ P=0.05					11.4						25.0								
CV %					4.8						9.9								

KEY: Yield: ⁺ Significantly greater than Bikini @ P = 0.05; ⁻ Significantly less than Bikini @ P = 0.05
Size grades: L = large > 10.2mm; M = medium 8.75 - 10.2mm; S = small 7.5 - 8.75mm; VS = very small < 7.5mm
SL = Semi-leafless; SF = Semi-fasciated
Source of varieties see Appendix 1

TABLE 2 - VINING PEA VARIETY STUDIES. Summary of quality data - Main Variety Trial, Holbeach - 2008

Variety	Tenderometer Reading	Appearance				Flavour		Brix
		Colour	Brightness	Uniformity	No. of blonds	Sweetness	Strength	
		(3-6)	(1-2)	(1-5)	(1-5)	(1-5)	(1-5)	%
Avola	100.0	5.50	1.00	4.00	1.5	4.00	5.00	8.4
8530702	97.0	5.50	1.00	4.00	1.0	4.00	4.50	9.3
Recital (D 84171)	99.0	5.00	1.00	3.00	3.0	4.50	4.00	9.6
Bikini	97.0	4.50	1.00	3.00	3.0	5.00	2.50	8.4
Biktop	97.0	5.00	1.00	4.00	1.5	3.00	4.00	9.4
Boogie	98.0	5.00	1.00	2.50	2.0	4.50	2.00	8.3
DS 89201	99.0	4.50	1.00	3.00	3.0	3.00	3.00	9.3
Ambassador	100.0	5.00	1.00	3.00	3.0	3.00	2.00	8.8
Oasis	105.0	4.50	2.00	2.00	3.5	5.00	2.00	8.3

KEY: Uniformity; Sweetness; Strength; Skin & Flesh Firmness; Flesh mealiness: (1-5) - a high figure indicates that the variety shows the character to a high degree
Colour: a high figure indicates a darker green; Brightness: 1 = bright, 2 = dull; Brix - measured using Atago pocket refractometer PAL-1 and gives an indication of sugar content

Conclusions
New varieties are chosen either by the processor or by growers in consultation with their processor. They can provide additional yield and additional reliability. It is particularly important that maturity data will allow new peas to be correctly integrated into drilling and harvesting programmes.

When future trials are complete data from the trials will be incorporated into the PGRO advisory leaflet on vining pea varieties updated each year. This leaflet is used extensively by growers, processors and merchants. This leaflet is the only independent source of information for variety data and allows growers to make an informed variety choice.

Technology transfer
An informal open day was held at the trial site on the afternoon of 3 July 2008, but the trial was available for viewing at people's convenience.
Results were presented at the PGRO Varieties Day on 10 November 2008.
A summary of results and comparison of results to the Thornhaugh trial were given at the Vegetable Agronomists Association meeting on 11 November 2008

References
PGRO Variety Trial Results: November 2007
PGRO Vining Pea Varieties: advisory leaflet November 2007
PGRO Information Sheet 142: The choice of herbicides for spring peas revised January 2007

Appendices
KEY TO SOURCE OF VARIETIES

CODE	NAME & ADDRESS	COUNTRY
As	Asgrow Research Center PO Box 1235 Twin Falls Idaho. 83303-1235.	USA
Dan	Danisco Seed A/S Højbygårdvej 31 DK-4960 Holeby	Denmark
S&G	Syngenta Seeds SAS. Route de Pouillé B.P. 39 49135 Les Ponts de Cé Cedex	France
Sh	Sharpes, Advanta Seeds UK Ltd. Boston Road Sleaford Lincolnshire NG34 7HA	UK
vW	WAV Industriesaaten GmbH Bordeler Berg 4 D-37127 Dransfield	Germany

APPENDIX 2

PROCESSING DETAILS FOR FROZEN SAMPLES

All samples were sorted to remove damaged or diseased produce and extraneous matter, washed and then blanched in water of 6° hardness. After cooling in tap water and further sorting the samples were packed for freezing.

The processing details for vining peas are given below:-

Blanch:	1.5 min. @ 93°C
Blast frozen	@ -30°C
Stored	@ -18°C