Project title:	Vining Peas: Extension of Variety Evaluation Trials
Project number:	FV 462
Project leader:	Stephen Belcher, PGRO
Report:	Final Report
Previous report:	Annual reports 2019 and 2020
Key staff:	Stephen Belcher, Dr. Chris Judge, John Nash, Dr Lea Herold
Location of project:	
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Date project commenced:	01/03/2019
Date project completed **(or expected completion date):**	28/02/2022

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[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.

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GROWER SUMMARY

Headline

This project will provide vining pea growers with independent, relevant and accurate trials evaluations on vining pea varieties, so that a considered and informed variety choice can be made.

Background

Through funding from seed companies and PGRO vining pea levy, vining pea varieties are evaluated at one site. After year one (Preliminary Trial stage) varieties may progress to the Main Trial Stage, where after two further years of evaluation they may be added to the PGRO Descriptive List of Vining Pea Varieties. In the past a duplicate Main trial (funded by AHDB) has been located on a light-silt soil near Holbeach. For future trialling the Legume Industry Panel requested input into variety selection for this trial, which may include both new and commercially grown varieties. Standard Varieties would include Avola (maturity) and Oasis (yield).

Trial site details

Variety Trial Site: Trevethoe Fram, Holbeach St Marks, S.Lincs PE12 8LR.
Lat 52.86733, Long 0.028455.

Downy Mildew Trials:

Grange Farm, Grange Lane, Nocton Lincs LN4 2AQ
Lat: 53.157731, Long: -0.466427

Bicker, PE11 4FB, Lincs.
Lat 52.901568, Long -0.150341.

Table 1. Varieties, leaf type, source and approximate maturity – 2021

Variety Name	**Leaf Type**	**Source**	**Maturity (± days Avola)**
Avola	C	Seminis Vegetable Seeds	0
Aloha	C	van Waveren	+ 1
Tomahawk	SL	Crites Seed	+ 2
Sherwood	C	Seminis Vegetable Seeds	+ 2
Boston	C	Storm Seeds	+ 2
Anubis	C	Limagrain UK	+ 3
Ebba	SL	Findus	+ 3
Artemia	C	Limagrain UK	+ 6
Selune	C	Storm Seeds	+ 7
Idalgo	SL	Syngenta	+ 8
Boogie	SL	van Waveren	+10
Lyric	C	van Waveren	+10
Ruselago	SL	Syngenta	+10
Ashton	C	Seminis Vegetable Seeds	+11
Ida	SL	Findus	+12
Dancer	SL	van Waveren	+13
Oasis	C	Limagrain UK	+13
Kimberley	SL	Storm Seeds	+14
C=Conventional-leaved; SL=Semi-leafless			

Results of the Variety Trials

Table 2. Percentage yield, Percentage size grade, haulm length and standing ability – 2021

Variety	@TR105					@TR125		
	Yield % of Oasis	% in size grades				Yield % of Oasis	Haulm length cm	Standing Ability 9=erect 1=lodged
		L	M	S	VS			
Aloha	35	42	43	12	3	37	50	5.0
Avola	60-	60	32	7	1	59-	51	2.5
Aloha	69-	28	53	16	3	65-	42	2.5
Tomahawk	48-	21	53	22	4	45-	44	7.0
Sherwood	56-	31	45	18	6	52-	50	5.5
Boston	73-	15	49	30	6	72-	44	2.5
Anubis	73-	30	50	17	3	70-	52	4.0
Ebba	75-	27	52	17	4	69-	60	9.0
Artemia	31-	1	13	46	40	33-	39	3.5
Selune	42-	0	6	46	48	40-	50	2.0
Idalgo	71-	46	39	13	2	65-	58	6.0
Boogie	109	59	35	5	1	103	54	2.0
Lyric	108	31	50	16	3	99	52	2.0
Ruselago	111	43	46	10	1	102	46	2.5
Ashton	106	32	48	17	3	102	59	3.0
Ida	118+	36	52	11	1	109	59	3.0
Dancer	86-	17	53	26	4	91	70	7.0
Oasis	100 (8.03t/ha)	36	48	14	2	100 (8.74t/ha)	58	2.5
Kimberley	61-	23	54	20	3	61-	72	3.0

Table 2. Percentage yield, Percentage size grade, haulm length and standing ability – 2019-2021

Variety	@TR105					@TR125		
	Yield % of Oasis	% in size grades L	M	S	VS	Yield % of Oasis	Haulm length cm	Standing Ability 9=erect 1=lodged
Aloha	64-	47	43	12	3	48-	51	4.8
Tomahawk	58-	31	50	16	3	44-	48	4.5
Avola	57-	65	28	6	1	47-	57	4.6
Sherwood	45-	34	46	16	4	43-	55	4.6
Boston	48-	18	50	26	6	55-	51	4.7
Anubis	68-	36	42	17	5	69-	56	4.5
Ebba	60-	31	44	19	6	56-	62	4.8
Artemia	22-	1	13	51	35	24-	45	4.3
Selune	30-	0	6	40	54	29-	57	4.5
Idalgo	61-	44	39	14	3	56-	60	4.8
Ruselago	101	43	46	10	1	93	46	4.8
Boogie	104	59	34	6	1	103	58	4.6
Lyric	95	34	50	13	3	96	58	4.6
Ashton	94	31	48	17	4	94	65	4.7
Ida	105	36	50	12	2	104	60	4.8
Songo	76-	42	43	14	3	85	58	4.9
Oasis	100 (9.07t/ha)	40	44	14	2	100 (10.05t/ha)	64	4.8
Dancer	97	17	55	24	4	95	67	4.8
Kimberley	71-	25	57	16	2	73-	71	4.8

For full and comprehensive results please refer to the full trials report.

Main Conclusions

2021 Trial

The variety Songo was no longer marketed Syngeta was replaced with Ruselago (also Syngenta).

The trial was sown into good conditions and establishment growth was better than in 2020.

The yield standard Oasis again yielded well, 8.03t/ha at TR105, with a moderate increase to 8.74t/ha at TR120. Several varieties gave higher yields than Oasis, but only Ida gave statistically higher yields at TR105.

Avola was the first to mature and all varieties up to +8 maturity gave significantly lower yields than Oasis.

Cooler conditions extended maturity for most varieties, with Oasis maturing 13 days later than Avola.

Early maturing varieties Aloha and Tomahawk matured one 2 days later than Avola respectively.

As in previous trials Dancer and Kimberly were the latest to mature, maturing 13 and 14 days later than Avola respectively.

Top yielding variety was Ida (118 and 109% of Oasis).

Artemia and Selune were the lowest yielding varieties, giving very low yields.

As in previous trials Artemia and Selune gave a very low pea:vine ratio (11% and 14% respectively) compared to Oasis (25%).

Avola and Boogie gave produce with very large size grade peas. Artemia and Selune gave much smaller produce, Artemia small-small size grade and Selune small- very small size grade.

Brix levels were generally lower than in 2020. As in 2019 and 2020, Artemia gave the highest Brix score (14.6%).

Tomahawk, Ebba and Dancer showed the best standing ability.

Ashton, Idalgo and Selune had the better downy mildew resistance, showing good field resistance.

2019 – 2021 Trial series

Overall Oasis matured 13 days later than Avola, 2 days later than normally seen. Aloha and Tomahawk matured at the same time as Avola. Latest maturing varieties were Dancer and Kimberley, which matured one and 2 days later respectively than Oasis.

Yields from Oasis were similar in all 3 years, but were a little higher in 2019.
2019 - 10.14/10.87 t/ha
2020 - 9.05/10.55 t/ha

2021 – 9.07/10.05 t/ha

All varieties up to +8 in maturity gave statistically lower yields than Oasis. Yields of first and second earlies (0 to +3 maturity) should be compared to the early standards Avola and Sherwood. Statistically there were no significant yield differences between these varieties.

Artemia and Selune gave very low yields compared to Oasis. However, both of these varieties have a very different produce size grade profile to all other varieties. They would be classed as petits pois having more than 85% of the peas in the small and very size grades. There was no petits pois standard in the trial series to compare against.

No variety gave statistically higher yields than Oasis, but overall Boogie (104/103%) and Ida (105/104%) were a little higher yielding. Lyric (96/96%), Ashton (94/94%) and Dancer (97/95%) were a little lower yielding than Oasis. Ruselago (only in trial in 2021) gave similar yields to Oasis (101%) at TR105.

Boogie and Avola gave produce with the largest size grade, large-medium size grade.

Selune and Idalgo had good field resistance to downy mildew. Aloha, Boston, Ebba, Lyric, Ashton, Ida and Dancer had Moderate field resistance.

Standing ability was variable over the 3 years, but Oasis had poor standing ability, while Dancer showed the best.

Brix is an indicator of sweetness and while this can be influenced by year and tenderometer reading, Artemia gave the highest reading in all 3 years.

SCIENCE SECTION

Introduction

The Legume Industry Panel has identified varietal selection as an important and key element of crop production and requires an accurate guide to the performance of varieties in areas typical of pea production. Priorities also include the development of novel products to help mitigate the effects of continued loss of active substances to manage key pests and diseases.

The vining pea industry in the UK has a farm gate value of c.£52M per annum, with estimated retail value of £500M per annum. If improvements are made in yield and quality of just 5%, the value would be £2.6 million at the farm gate. An additional improvement in factory process efficiency of 1% represents around £1.3 million (Calculations based on industry evidence, 2017). Total value could be up to £3.9m per year to growers and processors. Internationally, vining peas are often grown to a lower grade standard than in the UK, giving UK producers competitive advantage in the domestic market and presenting export opportunity. The UK is estimated to produce approximately 30-40% of the vining peas in the EU, most of which are consumed in the domestic market.

Priorities described in the AHDB-Horticulture strategy for legumes are:

1. Realising Genetic Potential (variety trials and resistance breeding),
2. Building Sustainable Plant Health (crop protection work, IPM, resistance management),
3. Managing Resources Sustainably (water, nutrients, energy),
4. Driving Precision Technology into Practice (automation, precision, smart technology),
5. Facilitating Wholesome & Trusted Food in the Supply Chain (improving quality, food safety),
6. Honing Business & Technical Skills (building research & industry capability, LEAN, CPD schemes).

This proposal addresses priorities 1, 2, 3 and 5. Variety trialling and harvest scheduling to maximise quality, reduce losses and improve factory efficiency firmly aligns with all priorities; Evaluation of novel products for improved management of diseases and improved quality and crop performance.

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. Vining peas are grown commercially in strict schedules from drilling to harvest and selection of variety is critically important to allow growers and processors to manage programs effectively. This enables a high degree of harvest and processing planning and the spread of workload both agronomically and in the processing factories. Any disruption to factory process leads to large additional costs or losses. The period of harvesting and processing is from mid-June to the end of August in the UK and varies depending on regional differences in environmental conditions.

Through funding from seed houses and PGRO vining pea levy, vining pea varieties are evaluated at one site. After year one (Preliminary Trial stage) varieties may progress to the Main Trial Stage, where after two further years of evaluation they may be added to the PGRO Descriptive List of Vining Pea Varieties. Trials are currently located near Nocton, mid-Lincolnshire, but this represents only one area of the total UK vining pea production area. Funding by AHDB-Horticulture has in the past allowed a duplicate standard size Main Trial to be sown on a different soil type and location near Holbeach, in South Lincolnshire. After two years of evaluation, varieties were added to a Descriptive List of Vining Pea Varieties for this area / soil type. For future trialling the Legume Industry Panel requested input into variety selection which may include both new and commercially grown varieties. Standard Varieties would include Avola (maturity) and Oasis (yield).

Vining pea variety evaluation requires the use of specialised equipment during harvesting and processing and as such, independent systematic evaluation of varieties in the UK is limited to the PGRO, Thornhaugh/ Nocton 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 34,000 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. These include premium ‘petits pois’ or ‘150 minute’ peas or, so called economy and value packs.

Varietal characteristics affect:

- yield
- quality (colour, eveness of colour number of blond peas and size)
- ease of harvesting

- disease susceptibility
- maturity
- ease of integration in the harvest programme

Varieties have been tested in recent years and more information on their performance and the relative maturity of varieties on a different soil type is needed. Trials data is needed over at least one year and preferably over at least 2 years to gain information about the performance of varieties in contrasting seasonal weather conditions.

FV 340c: In each year new varieties including standards were evaluated and the Descriptive List and Vining Pea Variety Guide produced. In 2015, 2016, 2017 and 2018 trials were successfully delivered to harvest and an annual report produced. For 2018 trials the final report will be complete by the project end. In each year a rolling 2 year summary of varieties completing trials has been published.

Table 1. Varieties, leaf type, source and approximate maturity – 2021

Variety Name	**Leaf Type**	**Source**	**Maturity (± days Avola)**
Avola	C	Seminis Vegetable Seeds	0
Aloha	C	van Waveren	+ 1
Tomahawk	SL	Crites Seed	+ 2
Sherwood	C	Seminis Vegetable Seeds	+ 2
Boston	C	Storm Seeds	+ 2
Anubis	C	Limagrain UK	+ 3
Ebba	SL	Findus	+ 3
Artemia	C	Limagrain UK	+ 6
Selune	C	Storm Seeds	+ 7
Idalgo	SL	Syngenta	+ 8
Boogie	SL	van Waveren	+10
Lyric	C	van Waveren	+10
Ruselago	SL	Syngenta	+10
Ashton	C	Seminis Vegetable Seeds	+11
Ida	SL	Findus	+12
Dancer	SL	van Waveren	+13
Oasis	C	Limagrain UK	+13
Kimberley	SL	Storm Seeds	+14
C=Conventional-leaved; SL=Semi-leafless			

Trial site details

Variety Trial Site: Trevethoe Fram, Holbeach St Marks, S.Lincs PE12 8LR.

Lat 52.86733, Long 0.028455.

Production details

Fertile light silt soil in a commercial crop of Vining Peas

Fungicide seed treatment: None

Sown in 15cm rows, with a Wintersteiger/Hege single disc plot drill to achieve a target population of 100 plants/m².

Broad-leaved weeds were controlled with pre-emergence. Aphid and pea moth (Cydia nigricana) were controlled (monitored by pea moth traps).

Fungicide sprays were applied to control Botrytis and Mycosphaerella.

Crop protection products were applied were the same as the surrounding commercial crop

Trial design

Trial layout: Randomised block, 2 replications.

Plot size: 1.83 m x 14 m.

Sub-plots: 1.83 m x 3.5 m. Plots harvested at @TR value 105 (range 95-105), @TR 125 Range 120-130) and a third harvest if required.

Sampling areas for TR assessment: 1.83 m x 1.25 m

Adjustment of yields to TR105 and TR125 using Berry's Model

Statistical analysis of yield data (in t/ha and as % of the control, Oasis) in each year using ANOVA.

Statistical analysis of rolling 3 year average for varieties completing 3 years evaluation.

Trial records and data collected

Sowing date: 28 April 2021

Harvest dates: 11 July – 27 July

Flowering scores and dates of cessation of flowering recorded to aid maturity and harvest assessment.

Haulm lengths measured and standing ability assessed after cessation of flowering and prior to harvest.

Maturity assessed from the sampling areas to achieve correct harvest dates for @TR105 and @TR125 harvest stages using a pea tenderometer.

Sub-plots separated and harvested when appropriate by hand.

Whole plots weighed.

Plants vined in a static plot pea viner, sieved and washed in a floatation washer to remove extraneous debris.
Peas size-graded into grades very small (<7.5mm), small (7.5-8.75mm), medium 8.75-10.2mm) and large (>10.2mm) with a Mather & Platt grader.
Each size grade weighed.
Total yield measured.
Fresh pea colour assessed against colour chart
Maturity assessed with a pea tenderometer
Samples frozen (200g) at @TR105 for quality appraisal.
Quality appraisal after defrosting for colour, colour uniformity, colour brightness, number of blond peas and Brix determination.
Calculation of pea weight as a % of the total weight.
Calculation of the % of peas in size grades very small, small medium and large.
Estimation of maturity in days at @TR105 and TR125 compared to the standard (Avola=0 days).

Downy Mildew Trials

Fields were chosen where there has been a long history of pea cultivation and the potential for a high population of downy mildew (Peronospora viciae).

Downy Mildew Trials:

Grange Farm, Grange Lane, Nocton Lincs LN4 2AQ
Lat: 53.157731, Lon: -0.466427

Bicker, PE11 4FB, Lincs.
Lat 52.901568, Long -0.150341.

Sowing was carried out at a time which was favourable to natural infection taking place. Two replicates of 50 seeds of each variety without any fungicidal seed treatment were planted in 1.0m rows, spaced 0.25-0.30m apart. Peas were planted to a depth of 3.5cm to 5.0cm and evenly spaced along the 1.0m row. Plots were rolled with a Cambridge roll to consolidate the seed bed and preserve moisture.

Inputs were managed the same as the adjacent vining pea trials or the same as the surrounding field crop.

On at least two occasions, disease assessments were made. The first at about the 4 node stage (GS 13-16) when the percentage of primary infected seedlings was estimated. The second assessment was an estimate of the percentage plants showing downy mildew infection and an estimate of the percentage leaf area infected (GS 51).

The scores of these assessments were amalgamated and an overall infection level calculated. Based on the level of infection, a resistance score was allocated using a 1-9 scale where 1 is very susceptible and 9 indicates good field resistance.

Table 1. Varietal Susceptibility of Vining Peas to Downy Mildew (Peronospora viciae) - 2021

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.
Data for the mean of two sites is presented below

Susceptible 1/2	Moderately Susceptible 3/4	Slightly Susceptible 5/6	Moderate Field Resistance 7/8	Good Field Resistance 9
	Avola	Anubis	Ebba	Ashton
	Boogie	Ida	Aloha	Idalgo
	Oasis	Colivert	Boston	Selune
		Kimberley	Dancer	
		Tomahawk	Lyric	

These data after 3 years evaluation will be incorporated in the PGRO Descriptive Lists of Vining Pea Varieties, published in the PGRO Vining Pea Variety Guide.

TABLE 2 - VINING PEA VARIETY EVALUATIONS. Summary of agronomic data Standard Vining Pea AHDB Funded Variety Trial, Holbeach (Holbeach St Marks) - 2021
Varieties placed in order of maturity. Standard varieties underlined. All varieties sown on 28 April.
Results are means of three replicates. Target population 100 plants per m² sown in ten 15 cm rows.

Variety		Source	1000 Seed Weight g	@ TR 105 Maturity (± days) Avola	@ TR 105 Yield % of Oasis	@ TR 105 % in size grades L	M	S	VS	@ TR 125 Maturity (± days) Avola	@ TR 125 Yield % of Oasis	@ TR 125 % 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		SVS	213	0(11/7)	60-	60	32	7	1	0(13/7)	59-	70	25	4	1	51	2.5	26	4.5
Aloha		vW	210	+ 1	69-	28	53	16	3	0	65-	35	52	11	2	42	2.5	25	4.5
Tomahawk	SL	CS	173	+ 2	48-	21	53	22	4	+ 2	45-	30	55	13	2	44	7.0	24	4.5
Sherwood		SVS	189	+ 2	56-	31	45	18	6	+ 2	52-	37	47	13	3	50	5.5	23	4.5
Boston		SS	180	+ 2	73-	15	49	30	6	+ 2	72-	19	56	22	3	44	2.5	27	4.4
Anubis		LUK	233	+ 3	73-	30	50	17	3	+ 3	70-	41	47	10	2	52	4.0	23	4.5
Ebba	SL	Fin	239	+ 3	75-	27	52	17	4	+ 3	69-	42	46	10	2	60	9.0	20	4.8
Artemia		LUK	85	+ 6	31-	1	13	46	40	+ 7	33-	1	20	55	24	39	3.5	11	4.3
Selune		SS	92	+ 7	42-	0	6	46	48	+ 7	40-	0	10	56	34	50	2.0	14	4.4
Idalgo	SL	Syn	165	+ 8	71-	46	39	13	2	+ 8	65-	55	37	7	1	58	6.0	19	4.8
Boogie	SL	vW	220	+10	109	59	35	5	1	+ 9	103	65	31	3	1	54	2.0	26	4.5
Lyric		vW	156	+10	108	31	50	16	3	+10	99	39	52	8	1	52	2.0	23	4.4
Ruselago	SL	Syn	186	+10	111	43	46	10	1	+10	102	52	44	4	0	46	2.5	28	4.8
Ashton		SVS	164	+11	106	32	48	17	3	+11	102	42	49	8	1	59	3.0	26	4.7
Ida	SL	Fin	182	+12	118+	36	52	11	1	+12	109	52	43	5	0	59	3.0	26	4.4
Dancer	SL	vW	145	+13	86-	17	53	26	4	+13	91	24	64	12	0	70	7.0	21	4.6
Oasis		LUK	186	+13	100 (8.03t/ha)	36	48	14	2	+13	100 (8.74t/ha)	41	52	6	1	58	2.5	25	4.6
Kimberley	SL	SS	160	+14	61-	23	54	20	3	+14	61-	31	61	8	0	72	3.0	18	4.5
Significance @ P=0.05					SD						SD								
LSD @ P=0.05					11.2						11.2								
CV %					9.0						8.0								

KEY:
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
Source of varieties see Appendix

TABLE 3 - VINING PEA VARIETY EVALUATIONS. Summary of quality data - Standard Vining Pea AHDB Funded Variety Trial, Holbeach (Holbeach St Marks) - 2021

Variety	Tenderometer Reading	Appearance				Brix
		Colour (3-8)	Brightness (1-2)	Uniformity (1-5)	No. of blonds (1-5)	%
Aloha	108.0	6.0	1.0	4.8	1.0	12.1
Avola	104.5	6.0	1.0	3.8	2.0	11.6
Aloha	104.0	6.0	1.0	4.0	1.0	11.8
Boston	99.0	6.5	1.0	4.0	1.0	11.9
Sherwood	97.5	6.0	1.0	4.0	1.0	12.1
Tomahawk	100.5	6.5	1.0	4.5	1.0	12.1
Anubis	101.0	6.0	1.0	4.0	1.0	11.6
Ebba	102.5	6.0	1.0	4.5	1.0	12.9
Artemia	97.0	6.0	1.0	4.5	1.0	14.6
Selune	94.5	6.0	1.0	4.0	1.0	12.1
Idalgo	100.0	6.3	1.0	3.5	1.0	12.1
Boogie	99.0	5.8	1.0	4.5	1.0	10.4
Lyric	104.0	5.5	1.0	3.5	1.0	11.7
Ruselago	101.0	5.8	1.0	3.5	1.0	10.2
Ashton	102.5	5.5	1.0	3.0	2.0	10.0
Ida	98.5	6.0	1.0	4.3	1.0	10.5
Dancer	101.0	6.3	1.0	3.5	1.0	11.5
Oasis	99.5	6.0	1.0	4.0	2.0	11.5
Kimberley	104.5	5.8	1.0	4.3	1.0	12.5

KEY: Uniformity; Uniformity; No. of blonds; (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.

TABLE 4 - VINING PEA VARIETY EVALUATIONS. Vining Pea AHDB Funded Variety Trial, 2019 - 2021
Varieties placed in order of maturity. Standard varieties underlined. Target population 100 plants per m² sown in ten 15 cm rows.

Variety		Source	1000 Seed Weight g	@ TR 105 Maturity (± days) Avola	@ TR 105 Yield % of Oasis	@ TR 105 % in size grades L	M	S	VS	@ TR 125 Maturity (± days) Avola	@ TR 125 Yield % of Oasis	@ TR 125 % 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	Downy Mildew Rating
Aloha		vW	207	0	64-	47	43	12	3	0	48-	46	45	7	2	51	3	19	4.8	MFR
Tomahawk	SL	CS	173	0	58-	31	50	16	3	+1	44-	42	46	10	2	48	5	21	4.5	SS
Avola		SVS	205	0	57-	65	28	6	1	0	47-	77	19	3	1	57	3	19	4.6	MS
Sherwood		SVS	174	+2	45-	34	46	16	4	+2	43-	44	44	10	2	55	6	20	4.6	SS
Boston		SS	172	+2	48-	18	50	26	6	+2	55-	22	56	19	3	51	3	22	4.7	MFR
Anubis		LUK	218	+2	68-	36	42	17	5	+3	69-	49	37	11	3	56	4	19	4.5	SS
Ebba	SL	Fin	199	+3	60-	31	44	19	6	+3	56-	46	39	13	2	62	6	15	4.8	MFR
Artemia		LUK	87	+5	22-	1	13	51	35	+6	24-	1	20	55	24	45	5	9	4.3	-
Selune		SS	92	+6	30-	0	6	40	54	+6	29-	0	8	51	41	57	3	10	4.5	GFR
Idalgo	SL	Syn	172	+8	61-	44	39	14	3	+7	56-	57	34	7	2	60	5	15	4.8	GFR
Ruselago	SL	Syn	186	+10	101	43	46	10	1	+10	93	52	44	4	0	46	2	28	4.8	-
Boogie	SL	vW	185	+11	104	59	34	6	1	+10	103	70	26	3	1	58	4	24	4.6	MS
Lyric		vW	161	+11	95	34	50	13	3	+11	96	44	47	7	2	58	4	22	4.6	MFR
Ashton		SVS	169	+12	94	31	48	17	4	+11	94	38	50	10	2	65	4	22	4.7	MFR
Ida	SL	Fin	183	+12	105	36	50	12	2	+12	104	53	41	5	1	60	4	24	4.8	MFR
Songo	SL	Syn	188	+13	76-	42	43	14	3	+11	85	53	36	9	2	58	5	20	4.9	SS
Oasis		LUK	199	+13	100 (9.07/ha)	40	44	14	2	+12	100 (10.05t/ha)	51	41	7	1	64	2	23	4.8	MS
Dancer	SL	vW	155	+14	97	17	55	24	4	+13	95	29	63	8	0	67	8	20	4.8	MFR
Kimberley	SL	SS	168	+15	71-	25	57	16	2	+14	73-	32	60	7	1	71	4	17	4.8	SS
Significance @ P=0.05					SD						SD									
LSD @ P=0.05					25.2						30.6									
CV %					20.9						25.7									

KEY:
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
Downy mildew: S = Susceptible; MS = Moderately susceptible; SS = Slightly Susceptible; MFR = Moderate field resistance; GFR = Good field resistance
Source of varieties see Appendix.

TABLE 5 - VINING PEA VARIETY EVALUATIONS. Summary of quality data – AHDB Funded Variety Trial, 2019 - 2021

Variety	Year	Tenderometer Reading	Appearance				Brix
			Colour (3-8)	Brightness (1-2)	Uniformity (1-5)	No. of blonds (1-5)	%
Aloha	19	100.5	7.0	1.0	5.0	1.0	12.2
	20	108.0	6.0	2.0	4.8	1.0	12.1
	21	104.0	6.0	1.0	4.0	1.0	11.8
Tomahawk	19	103.5	7.0	1.0	4.5	1.0	12.4
	20	103.0	6.2	2.0	4.8	1.0	12.5
	21	100.5	6.5	1.0	4.5	1.0	12.1
Avola	19	99.5	7.0	1.0	5.0	1.0	12.1
	20	102.5	6.0	2.0	4.8	1.0	12.3
	21	104.5	6.0	1.0	3.8	2.0	11.6
Sherwood	19	103.0	6.0	1.0	4.5	1.0	12.3
	20						
	21	97.5	6.0	1.0	4.0	1.0	12.1
Boston	19	103.5	5.0	1.0	5.0	1.0	12.0
	20	134.5	6.0	2.0	4.8	1.0	12.1
	21	99.0	6.5	1.0	4.0	1.0	11.9
Anubis	19	101.0	6.0	1.0	4.5	1.0	12.0
	20	95.0	5.8	2.0	4.5	1.0	13.3
	21	101.0	6.0	1.0	4.0	1.0	11.6
Ebba	19	101.5	6.5	1.0	5.0	1.0	12.5
	20	99.0	6.2	2.0	5.0	1.0	13.7
	21	102.5	6.0	1.0	4.5	1.0	12.9
Artemia	19	102.0	5.0	1.0	5.0	1.0	13.3
	20	98.0	5.8	2.0	5.0	1.0	16.2
	21	97.0	6.0	1.0	4.5	1.0	14.6
Selune	19	101.0	5.5	1.0	4.5	1.0	11.9
	20	105.0	5.3	2.0	4.8	1.0	12.5
	21	94.5	6.0	1.0	4.0	1.0	12.1
Idalgo	19	98.0	7.0	1.0	5.0	1.0	12.5
	20	104.0	6.0	2.0	4.8	1.0	12.6
	21	100.0	6.3	1.0	3.5	1.0	12.1

KEY: Uniformity; Uniformity; No. of blonds: (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

…….contined

TABLE 5 - VINING PEA VARIETY EVALUATIONS. Summary of quality data – AHDB Funded Variety Trial, 2019 - 2021

Variety	Year	Tenderometer Reading	Appearance				Brix %
			Colour (3-8)	Brightness (1-2)	Uniformity (1-5)	No. of blonds (1-5)	
Ruselago	21	101.0	5.8	1.0	3.5	1.0	10.2
Boogie	19	96.5	6.0	1.0	4.0	1.3	11.3
	20	102.5	6.0	2.0	4.8	1.0	11.7
	21	99.0	5.8	1.0	4.5	1.0	10.4
Lyric	19	97.0	5.5	1.0	3.0	3.3	11.2
	20	98.5	5.3	2.0	4.8	1.3	13.3
	21	104.0	5.5	1.0	3.5	1.0	11.7
Ashton	19	99.5	5.2	1.0	3.0	2.7	11.0
	20	100.0	6.0	2.0	4.8	1.0	12.5
	21	102.5	5.5	1.0	3.0	2.0	10.0
Ida	19	105.5	5.8	1.0	4.2	1.0	11.0
	20	103.5	6.0	2.0	4.7	1.3	12.7
	21	98.5	6.0	1.0	4.3	1.0	10.5
Songo	19	105.0	6.5	1.0	4.7	1.0	11.1
	20	100.0	6.5	2.0	4.0	1.0	12.1
Oasis	19	102.0	5.3	1.0	2.3	3.7	11.1
	20	97.5	5.8	2.0	4.0	1.7	12.6
	21	99.5	6.0	1.0	4.0	2.0	11.5
Dancer	19	97.5	6.2	1.0	3.8	1.0	12.8
	20	97.5	6.2	2.0	5.0	1.0	13.7
	21	101.0	6.3	1.0	3.5	1.0	11.5
Kimberley	19	97.5	5.8	1.0	3.7	2.3	12.8
	20	106.5	6.5	2.0	5.0	1.0	12.9
	21	104.5	5.8	1.0	4.3	1.0	12.5

KEY: Uniformity; Uniformity; No. of blonds: (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

Discussion

2021 Trial

The variety Songo was no longer marketed Syngeta was replaced with Ruselago (also Syngenta).

The trial was sown into good conditions and establishment growth was better than in 2020.

The yield standard Oasis again yielded well, 8.03t/ha at TR105, with a moderate increase to 8.74t/ha at TR120. Several varieties gave higher yields than Oasis, but only Ida gave statistically higher yields at TR105.

Avola was the first to mature and all varieties up to +8 maturity gave significantly lower yields than Oasis.

Cooler conditions extended maturity for most varieties, with Oasis maturing 13 days later than Avola.

Early maturing varieties Aloha and Tomahawk matured one 2 days later than Avola respectively.

As in previous trials Dancer and Kimberly were the latest to mature, maturing 13 and 14 days later than Avola respectively.

Top yielding variety was Ida (118 and 109% of Oasis).

Artemia and Selune were the lowest yielding varieties, giving very low yields.

As in previous trials Artemia and Selune gave a very low pea:vine ratio (11% and 14% respectively) compared to Oasis (25%).

Avola and Boogie gave produce with very large size grade peas. Artemia and Selune gave much smaller produce, Artemia small-small size grade and Selune small- very small size grade.

Brix levels were generally lower than in 2020. As in 2019 and 2020, Artemia gave the highest Brix score (14.6%).

Tomahawk, Ebba and Dancer showed the best standing ability.

Ashton, Idalgo and Selune had the better downy mildew resistance, showing good field resistance.

2019 – 2021 Trial series

Overall Oasis matured 13 days later than Oasis, 2 days later than normally seen. Aloha and Tomahawk matured at the same time as Avola. Latest maturing varieties were Dancer and Kimberley, which matured one and 2 days later respectively than Oasis.

Yields from Oasis were similar in all 3 years, but were a little higher in 2019.
2019 - 10.14/10.87 t/ha
2020 - 9.05/10.55 t/ha
2021 – 9.07/10.05 t/ha

All varieties up to +8 in maturity gave statistically lower yields than Oasis. Yields of first and second earlies (0 to +3 maturity) should be compared to the early standards Avola and Sherwood. Statistically there were no significant yield differences between these varieties.

Artemia and Selune gave very low yields compared to Oasis. However, both of these varieties have a very different produce size grade profile to all other varieties. They would be classed as petits pois having more than 85% of the peas in the small and very size grades. There was no petits pois standard in the trial series to compare against.

No variety gave statistically higher yields than Oasis, but overall Boogie (104/103%) and Ida (105/104% were a little higher yielding. Lyric (96/96%), Ashton (94/94%) and Dancer (97/95%) were a little lower yielding than Oasis. Ruselago (only in trial in 2021) gave similar yields to Oasis (101%) at TR105.

Boogie and Avola gave produce with the largest size grade, large-medium size grade.

Selune and Idalgo had good field resistance to downy mildew. Aloha, Boston, Ebba, Lyric, Ashton, Ida and Dancer had Moderate field resistance.

Standing ability was variable over the 3 years, but Oasis had poor standing ability, while Dancer showed the best.

Brix is an indicator of sweetness and while this can be influenced by year and tenderometer reading Artemia gave the highest reading in all 3 years.

Technology transfer

The PGRO publication 'Vining Pea Variety Guide' was produced and distributed and contains two year summaries for varieties completing trials in 2008/9 or 2009/10, 2010/11, 2011 & 2013, 2013/14, 2014/15, 2015/16 and 2016/17 from the light silt-land sites near Holbeach, S. Lincolnshire. Data from other PGRO trials are also presented. This publication is available free of charge via a hard copy, download from the PGRO website or by the PGRO app (Android and iOS). For varieties completing trials in 2017/18/19/20/21 data was presented in the PGRO Vegetable Magazine winter editions, the PGRO websites and PGRO app.

Appendices

KEY TO SOURCE OF VARIETIES

CS	Crites Seed Inc., USA
Fin	Findus, Sweden
LUK	Limagrain UK Ltd, UK
SVS	Seminis Vegetable Seeds, UK
SS	Storm Seeds, Belgium
Syn	Syngenta Seeds, UK
vW	van Waveren, Germany

Meteorological Data - Holbeach St Marks, 1 April to 27 July 2021

Date	Air Max °C	Air Min °C	Rainfall mm
01/04/2021	9.1	1.2	0
02/04/2021	13.3	3.9	0
03/04/2021	11.6	3.3	0
04/04/2021	15.9	2.7	0
05/04/2021	20.1	5.9	0
06/04/2021	16.5	7.7	0
07/04/2021	18.1	3.7	0
08/04/2021	19.1	5.9	0
09/04/2021	13.5	6.9	0
10/04/2021	21.9	6.7	0
11/04/2021	23.6	7.1	0
12/04/2021	19.6	8.3	0
13/04/2021	8.5	5.7	0.2
14/04/2021	11.9	2.9	0
15/04/2021	17.7	3.2	0
16/04/2021	14.2	4.1	0
17/04/2021	10.2	7.2	0
18/04/2021	9.9	7.0	0.6
19/04/2021	11.7	4.4	0
20/04/2021	11.5	7.8	0
21/04/2021	12.2	8.9	0
22/04/2021	12.9	7.3	0
23/04/2021	16.4	7.1	0
24/04/2021	13.9	3.9	0
25/04/2021	13.8	6.9	0
26/04/2021	20.7	4.5	0
27/04/2021	12.7	8.5	0.4
28/04/2021	9.2	7.2	13
29/04/2021	11.8	6.8	1
30/04/2021	11.5	6.8	6.2

Date	Air Max °C	Air Min °C	Rainfall mm
01/05/2021	13.7	6.7	0
02/05/2021	16.1	5.9	0
03/05/2021	14.0	5.9	0
04/05/2021	12.7	6.8	0
05/05/2021	11.5	5.7	0
06/05/2021	12.5	3.0	0
07/05/2021	20.4	4.9	0
08/05/2021	21.4	9.7	0
09/05/2021	21.8	9.5	0
10/05/2021	14.3	6.1	0
11/05/2021	9.6	2.3	0
12/05/2021	11.6	0.7	0
13/05/2021	9.7	3.1	0
14/05/2021	11.3	0.8	0
15/05/2021	16.7	3.4	0
16/05/2021	15.8	5.8	0
17/05/2021	19.3	8.6	0
18/05/2021	20.7	11.4	0
19/05/2021	23.1	13.0	0
20/05/2021	26.7	12.3	0
21/05/2021	24.1	13.3	0
22/05/2021	20.3	12.3	0
23/05/2021	18.2	10.6	0
24/05/2021	18.7	11.4	0
25/05/2021	23.8	8.1	0
26/05/2021	21.9	11.3	0
27/05/2021	22.0	10.7	0
28/05/2021	19.9	8.3	0
29/05/2021	18.2	8.9	0
30/05/2021	19.5	9.1	0
31/05/2021	21.1	10.3	0

Date	Air Max °C	Air Min °C	Rainfall mm	Date	Air Max °C	Air Min °C	Rainfall mm
01/06/2021	18.4	9.5	0	01/07/2021	19.8	14.7	0
02/06/2021	20.0	8.2	0	02/07/2021	16.7	11.5	0
03/06/2021	15.2	10.7	0.4	03/07/2021	18.9	12.0	0
04/06/2021	13.5	9.5	0.4	04/07/2021	20.3	15.5	0
05/06/2021	13.1	7.8	4.4	05/07/2021	19.9	13.7	0
06/06/2021	15.3	7.0	1	06/07/2021	18.6	10.0	0
07/06/2021	13.3	6.9	3.6	07/07/2021	17.7	8.8	6.4
08/06/2021	13.0	7.3	0	08/07/2021	15.0	12.5	10.6
09/06/2021	15.5	4.3	0	09/07/2021	16.0	12.6	5.2
10/06/2021	14.1	10.4	5	10/07/2021	18.0	11.2	2
11/06/2021	15.4	10.9	6.6	11/07/2021	18.8	9.3	0
12/06/2021	15.7	12.9	1.2	12/07/2021	21.5	7.8	0
13/06/2021	21.6	13.4	0	13/07/2021	21.7	11.8	0
14/06/2021	17.7	13.2	0	14/07/2021	18.1	10.6	0
15/06/2021	19.6	12.4	0	15/07/2021	17.2	8.9	0
16/06/2021	20.4	13.2	0	16/07/2021	21.6	14.8	0
17/06/2021	21.0	12.1	0.8	17/07/2021	25.2	15.0	0
18/06/2021	19.0	13.2	27.8	18/07/2021	20.9	15.8	0
19/06/2021	17.4	11.1	0	19/07/2021	18.9	11.9	17.6
20/06/2021	21.6	10.4	0	20/07/2021	18.4	9.4	0
21/06/2021	20.6	11.5	3.4	21/07/2021	18.5	8.9	0
22/06/2021	22.7	9.4	0	22/07/2021	22.9	12.1	0
23/06/2021	26.3	13.3	0	23/07/2021	22.9	12.6	0
24/06/2021	28.8	13.6	0	24/07/2021	23.6	14.0	0
25/06/2021	26.9	16.5	0	25/07/2021	23.4	13.3	2.4
26/06/2021	29.6	15.8	0	26/07/2021	22.0	12.0	0
27/06/2021	21.3	13.5	9.2	27/07/2021	21.3	11.8	3.8
28/06/2021	19.3	11.5	0	28/07/2021	18.8	10.8	0
29/06/2021	16.2	12.0	0	29/07/2021	21.1	10.2	0
30/06/2021	20.2	13.3	0				