

Project title: Vining Peas: Variety Evaluation Trials

Project number: FV 462

Project leader: Stephen Belcher, PGRO

Report: Annual Report

Previous report: n/a

Key staff: Steve Belcher PGRO

Location of project: PGRO

Industry Representative: Mr. R. Fitzpatrick
Holbeach Marsh Co-op

Date project commenced: 01/03/2019

Date project completed 28/02/2019

(or expected completion date):

DISCLAIMER

While the Agriculture and Horticulture Development Board seeks to ensure that the information contained within this document is accurate at the time of printing, no warranty is given in respect thereof and, to the maximum extent permitted by law the Agriculture and Horticulture Development Board accepts no liability for loss, damage or injury howsoever caused (including that caused by negligence) or suffered directly or indirectly in relation to information and opinions contained in or omitted from this document.

© Agriculture and Horticulture Development Board 2016. No part of this publication may be reproduced in any material form (including by photocopy or storage in any medium by electronic mean) or any copy or adaptation stored, published or distributed (by physical, electronic or other means) without prior permission in writing of the Agriculture and Horticulture Development Board, other than by reproduction in an unmodified form for the sole purpose of use as an information resource when the Agriculture and Horticulture Development Board or AHDB Horticulture is clearly acknowledged as the source, or in accordance with the provisions of the Copyright, Designs and Patents Act 1988. All rights reserved.

All other trademarks, logos and brand names contained in this publication are the trademarks of their respective holders. No rights are granted without the prior written permission of the relevant owners.

[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.]

CONTENTS

Grower Summary	4
Headline	4
Background	4
Summary.....	Error! Bookmark not defined.
Financial Benefits	Error! Bookmark not defined.
Action Points	Error! Bookmark not defined.
Science Section	Error! Bookmark not defined.
Introduction	Error! Bookmark not defined.
Materials and methods	Error! Bookmark not defined.
Results	Error! Bookmark not defined.
Discussion.....	Error! Bookmark not defined.
Conclusions.....	Error! Bookmark not defined.
Knowledge and Technology Transfer	Error! Bookmark not defined.
Glossary.....	Error! Bookmark not defined.
References.....	Error! Bookmark not defined.
Appendices	Error! Bookmark not defined.

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: Fodyke Bridge, South Lincolnshire.
Lat 52.8664471, Long -0.046672.

P J Duffy & Sons (Farms) Ltd
Majors Farm
Holbeach St Marks
Spalding
Lincs
PE12 8HF

Downy Mildew Trials:
Lodge Farm, Stubton Lincs, NG23 5DA
Lat 53.035, Long -0.687

Estuary Farm, Marsh Road, Kings Lynn PE30 3QJ.
Lat 52.824617, Long 0.424480

Table 1. Varieties, leaf type, source and approximate maturity – 2019

Variety Name	Leaf Type	Source	Maturity (± days Avola)
Aloha	C	van Waveren	0
Tomahawk	SL	Crites Seed	0
Avola	C	Seminis Vegetable Seeds	0
Sherwood	C	Seminis Vegetable Seeds	+ 1
Boston	C	Storm Seeds	+ 2
Anubis	C	Limagrain UK	+ 2
Ebba	SL	Findus	+ 3
Artemia	C	Limagrain UK	+ 5
Selune	C	Storm Seeds	+ 5
Idalgo	SL	Syngenta	+ 6

Boogie	SL	van Waveren	+ 9
Ashton	C	Seminis Vegetable Seeds	+10
Lyric	C	van Waveren	+10
Ida	SL	Findus	+11
Oasis	C	Limagrain UK	+11
Songo	SL	Syngenta	+11
Dancer	SL	van Waveren	+12
Kimberley	SL	Storm Seeds	+13
C=Conventional-leaved; SL=Semi-leafless			

Results of the Variety Trials

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

Variety	@TR100				@TR120		Haulm length cm	Standing Ability 9=erect 1=lodged
	Yield % of Oasis	% in size grades				Yield % of Oasis		
		L	M	S	VS			
Aloha	86	45	44	9	2	81-	61	2.0
Tomahawk	79-	36	55	8	1	87	50	1.0
Avola	76-	67	28	4	1	83-	70	2.0
Sherwood	78-	37	47	14	2	78-	64	2.0
Boston	72-	20	53	22	5	67-	56	2.5
Anubis	92	45	38	14	3	100	64	1.5
Ebba	77-	37	39	18	6	79-	74	2.5
Artemia	28-	1	17	54	28	32-	45	6.5
Selune	35-	0	6	42	52	32-	68	2.0
Idalgo	68-	47	41	11	1	63-	70	2.5
Boogie	121+	52	40	7	1	124+	64	1.5
Ashton	100	30	49	17	4	114	80	2.0
Lyric	101	40	47	11	2	121+	68	1.0
Ida	101	29	56	13	2	111	64	2.0
Oasis	100	37	46	15	2	100	78	1.5
	(10.14t/ha)					(10.87t/ha)		
Songo	88	43	43	12	2	95	60	2.5
Dancer	122+	21	60	17	2	125+	76	3.5
Kimberley	69-	22	56	20	2	71-	84	2.0

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

Main Conclusions

The yield standard Oasis yielded well, 10.14t/ha at TR105, with a moderate increase to 10.87t/ha at TR125.

Early maturing varieties Aloha and Tomahawk matured at the same time as Avola, and Sherwood matured one day later.

Dancer and Kimberly were the latest to mature, maturing 12 and 13 days later than Avola respectively.

Two varieties, Idalgo (121 & 124%) and Dancer (122 & 125%) gave significantly higher yields than Oasis at TR105 and TR125. Lyric (121%) also gave significantly higher yields than Oasis at TR125.

Tomahawk (70%), Avola (76%), Boston (72%), Ebba (77%), Artemia (28%), Selune (35%), Idalgo (68%) and Kimberly (69%) gave significantly lower yields than Oasis at TR105. Artemia and Selune gave a very low pea:vine ratio (7%) compared to Oasis (22%).

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

At this vigorous growing site most varieties were lodged at harvest. Artemia had the best standing ability (6.5).

Many varieties showed no blond peas in the defrosted samples. Oasis and Lyric showed the most.

Artemia gave the highest Brix score (13.3% at TR102) and Ida the lowest (10.9% at TR105.5)

Selune and Ashton showed good field resistance to downy mildew.

FULL TRIAL REPORT

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, evenness 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.

Varieties and numbered selections included

Table 1. Varieties, leaf type, source and approximate maturity – 2019

Variety Name	Leaf Type	Source	Maturity (± days Avola)
Aloha	C	van Waveren	0
Tomahawk	SL	Crites Seed	0
Avola	C	Seminis Vegetable Seeds	0
Sherwood	C	Seminis Vegetable Seeds	+ 1
Boston	C	Storm Seeds	+ 2
Anubis	C	Limagrain UK	+ 2
Ebba	SL	Findus	+ 3
Artemia	C	Limagrain UK	+ 5
Selune	C	Storm Seeds	+ 5
Idalgo	SL	Syngenta	+ 6
Boogie	SL	van Waveren	+ 9
Ashton	C	Seminis Vegetable Seeds	+10
Lyric	C	van Waveren	+10
Ida	SL	Findus	+11
Oasis	C	Limagrain UK	+11
Songo	SL	Syngenta	+11
Dancer	SL	van Waveren	+12
Kimberley	SL	Storm Seeds	+13

C=Conventional-leaved; SL=Semi-leafless

Variety Trial Site: Fodyke Bridge, South Lincolnshire.
Lat 52.8664471, Long -0.046672.

P J Duffy & Sons (Farms) Ltd
Majors Farm
Holbeach St Marks
Spalding

Lincs
PE12 8HF

Production details

Fertile light silt soil in a commercial crop of Vining Peas

Fungicide seed treatment: Wakil XL

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*.

The following crop protection products were applied

24/04/2019	Stomp Aqua 2.200 L
24/04/2019	Centium 360 CS 0.250 L
21/06/2019	Cleancrop Celeb 1.000 L
21/06/2019	Aphox 0.280 kg
21/06/2019	Hallmark With Zeon Technology 50.000 mL
21/06/2019	Cropsure Manganese DF 2.000 kg
21/06/2019	Cropsure Rape and Pulse Mix 1.500 kg
09/07/2019	Hallmark With Zeon Technology 50.000 mL
09/07/2019	OptE Man 3.000 L

[Tropotox post-emergence was applied to the field crop, but not to the trial]

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 TR100 and TR120 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 2 year average for varieties completing 2 years evaluation.

Trial records and data collected

Sowing date: 24 April 2019

Harvest dates: 10 July – 25 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 @TR100 and @TR120 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*).

Trial Sites:

Downy Mildew Trials:

Lodge Farm, Stubton Lincs, NG23 5DA

Lat 53.035, Long -0.687

Estuary Farm, Marsh Road, North Wooton Kings Lynn PE30 3QJ.

Lat 52.824617, Long 0.424480

Sowing was carried out at a time which was favorable 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 2 - VINING PEA VARIETY EVALUATIONS. Summary of agronomic data Standard Vining Pea AHDB Funded Variety Trial, Holbeach (Fosdyke Bridge) - 2019
 Varieties placed in order of maturity. Standard varieties underlined. All varieties sown on 24 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							@ TR 125							Standing Ability 9=erect 1=lodged	Pea wt. as % of total weight	Raw pea colour 1=pale 6=dark
			Maturity (± days) Avola	Yield % of Oasis	% in size grades L M S VS				Maturity (± days) Avola	Yield % of Oasis	% in size grades L M S VS				Haulm length cm				
Aloha	vW	194	0	86	45	44	9	2	0	81-	58	38	3	1	61	2.0	18	4.9	
Tomahawk	SL	CS	173	0	79-	36	55	8	1	0	87	54	41	4	1	50	1.0	22	4.5
<u>Avola</u>		<u>SVS</u>	<u>220</u>	<u>0(10/7)</u>	<u>76-</u>	<u>67</u>	<u>28</u>	<u>4</u>	<u>1</u>	<u>0(12/7)</u>	<u>83-</u>	<u>85</u>	<u>13</u>	<u>2</u>	<u>0</u>	<u>70</u>	<u>2.0</u>	<u>18</u>	<u>4.8</u>
<u>Sherwood</u>		<u>SVS</u>	<u>183</u>	<u>+1</u>	<u>78-</u>	<u>37</u>	<u>47</u>	<u>14</u>	<u>2</u>	<u>+1</u>	<u>78-</u>	<u>53</u>	<u>40</u>	<u>6</u>	<u>1</u>	<u>64</u>	<u>2.0</u>	<u>17</u>	<u>4.6</u>
Boston		SS	155	+2	72-	20	53	22	5	+2	67-	24	57	16	3	56	2.5	17	4.6
Anubis		LUK	211	+2	92	45	38	14	3	+3	100	57	35	7	1	64	1.5	18	4.6
Ebba	SL	Fin	168	+3	77-	37	39	18	6	+3	79-	52	35	11	2	74	2.5	14	4.8
Artemia		LUK	90	+5	28-	1	17	54	28	+5	32-	2	24	57	17	45	6.5	7	4.5
Selune		SS	92	+5	35-	0	6	42	52	+5	32-	1	9	57	33	68	2.0	7	4.3
Idalgo	SL	Syn	185	+6	68-	47	41	11	1	+6	63-	70	30	0	0	70	2.5	10	4.8
Boogie	SL	vW	127	+9	121+	52	40	7	1	+10	124+	62	33	4	1	64	1.5	23	4.8
Ashton		SVS	172	+10	100	30	49	17	4	+10	114	35	53	9	3	80	2.0	19	4.8
Lyric		vW	170	+10	101	40	47	11	2	+11	121+	47	47	5	1	68	1.0	18	4.8
Ida	SL	Fin	186	+11	101	29	56	13	2	+11	111	48	47	4	1	64	2.0	20	4.9
<u>Oasis</u>		<u>LUK</u>	<u>204</u>	<u>+11</u>	<u>100</u>	<u>37</u>	<u>46</u>	<u>15</u>	<u>2</u>	<u>+11</u>	<u>100</u>	<u>44</u>	<u>44</u>	<u>10</u>	<u>2</u>	<u>78</u>	<u>1.5</u>	<u>22</u>	<u>4.8</u>
					(10.14t/ha)						(10.87t/ha)								
Songo	SL	Syn	199	+11	88	43	43	12	2	+11	95	56	37	6	1	60	2.5	18	4.9
Dancer	SL	vW	174	+12	122+	21	60	17	2	+12	125+	28	71	1	0	76	3.5	20	4.9
Kimberley	SL	SS	184	+13	69-	22	56	20	2	+13	71-	31	61	7	1	84	2.0	14	4.8
Significance @ P=0.05					SD						SD								
LSD @ P=0.05					20.6						15.4								
CV %					11.8						8.4								

KEY: Yield: + Significantly greater than Oasis @ P = 0.05; - Significantly less than Oasis @ 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

TABLE 3 - VINING PEA VARIETY EVALUATIONS. Summary of quality data - Standard Vining Pea AHDB Funded Variety Trial, Holbeach (Fosdyke Bridge) - 2019

Variety	Tenderometer Reading	Appearance				Brix %
		Colour (3-8)	Brightness (1-2)	Uniformity (1-5)	No. of blonds (1-5)	
Aloha	100.5	7.0	1.0	5.0	1.0	12.2
Avola	99.5	7.0	1.0	5.0	1.0	12.1
Tomahawk	103.5	7.0	1.0	4.5	1.0	12.4
Sherwood	103.0	6.0	1.0	4.5	1.0	12.3
Boston	103.5	5.0	1.0	5.0	1.0	11.9
Anubis	101.0	6.0	1.0	4.5	1.0	11.9
Ebba	101.5	6.5	1.0	5.0	1.0	12.4
Artemia	102.0	5.0	1.0	5.0	1.0	13.3
Selune	101.0	5.5	1.0	4.5	1.0	11.9
Idalgo	98.0	7.0	1.0	5.0	1.0	12.4
Boogie	96.5	6.0	1.0	4.0	1.3	11.3
Ashton	99.5	5.2	1.0	3.0	2.7	11.0
Lyric	97.0	5.5	1.0	3.0	3.3	11.1
Ida	105.5	5.8	1.0	4.2	1.0	10.9
OASIS	102.0	5.3	1.0	2.3	3.7	11.1
Songo	105.0	6.5	1.0	4.7	1.0	11.1
Dancer	97.5	6.2	1.0	3.8	1.0	12.8
Kimberley	97.5	5.8	1.0	3.7	2.3	12.8

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

Varietal Susceptibility of Vining Peas to Downy Mildew (*Peronospora viciae*) - 2019

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.

Only one site, N. Wooton produced enough downy mildew to give a meaningful assessment. The data from this site is presented below.

Table 6. Downy mildew susceptibility ratings (one site, N. Wooton) – 2019

Susceptible	Moderately Susceptible	Slightly Susceptible	Moderate Field Resistance	Good Field Resistance
	Avola	Tomahawk	Aloha	Selune
	Anubis	Oasis	Boston	Ashton
	Boogie		Ebba	
	Kimberley		Lyric	
			Ida	
			Dancer	

These data after 2 years evaluation will be incorporated in the PGRO Descriptive Lists of Vining Pea Varieties, published in the PGRO Vining Pea Variety Guide.

Discussion

The trial was sown into good conditions with adequate moisture on 24 April. The trial received 109mm of rainfall during 10-13 June, but no adverse effects were seen.

The yield standard Oasis yielded well, 10.14t/ha at TR105, with a moderate increase to 10.87t/ha at TR125.

Early maturing varieties Aloha and Tomahawk matured at the same time as Avola, and Sherwood matured one day later.

Dancer and Kimberly were the latest to mature, maturing 12 and 13 days later than Avola respectively.

Two varieties, Idalgo (121 & 124%) and Dancer (122 & 125%) gave significantly higher yields than Oasis at TR105 and TR125. Lyric (121%) also gave significantly higher yields than Oasis at TR125.

Tomahawk (70%), Avola (76%), Boston (72%), Ebba (77%), Artemia (28%), Selune (35%), Idalgo (68%) and Kimberly (69%) gave significantly lower yields than Oasis at TR105. Artemia and Selune gave a very low pea:vine ratio (7%) compared to Oasis (22%).

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

At this vigorous growing site most varieties were lodged at harvest. Artemia had the best standing ability (6.5).

Many varieties showed no blond peas in the defrosted samples. Oasis and Lyric showed the most.

Artemia gave the highest Brix score (13.3% at TR102) and Ida the lowest (10.9% at TR105.5)

Selune and Ashton showed good field resistance to downy mildew.

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 data was presented in the PGRO Vegetable Magazine winter edition 2018/9, 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

Date	Air Min °C	Air Max °C	Rainfall mm	Date	Air Min °C	Air Max °C	Rainfall mm
01-Apr-19	2.4	11.3	0	01-May-19	4.5	18.2	8.2
02-Apr-19	1.1	8	8.8	02-May-19	8.1	15.2	3
03-Apr-19	0.3	9.3	0	03-May-19	4.2	8.6	0.4
04-Apr-19	-0.4	10.8	0	04-May-19	0.8	9.9	1
05-Apr-19	4.1	13.8	0	05-May-19	3.1	11.1	0
06-Apr-19	3.2	10.5	0	06-May-19	2.2	11.1	0
07-Apr-19	6.8	10.3	0.2	07-May-19	5.3	15.1	0
08-Apr-19	4.5	14	0	08-May-19	7.3	11.8	10.8
09-Apr-19	5.1	9.6	0	09-May-19	6	10.2	0.2
10-Apr-19	4.4	9.4	0	10-May-19	5.2	11.5	3.6
11-Apr-19	2.3	9.1	0	11-May-19	7.1	12.9	0
12-Apr-19	-0.9	9.4	0	12-May-19	2.9	14.4	0
13-Apr-19	-0.1	8.5	0	13-May-19	4.1	17.4	0
14-Apr-19	2.1	8.4	0	14-May-19	5.5	18.3	0
15-Apr-19	2.5	12.9	0	15-May-19	4.5	15.8	0
16-Apr-19	5.7	13.1	0	16-May-19	5.5	16.1	0
17-Apr-19	4	15.4	0	17-May-19	9.7	14.9	0.4
18-Apr-19	4.7	15.2	0	18-May-19	7.4	15.9	1.8
19-Apr-19	4.8	16.7	0	19-May-19	6.4	17.7	0.2
20-Apr-19	2.1	18.7	0	20-May-19	9.5	18.3	0
21-Apr-19	3.2	23.5	0	21-May-19	6	19.3	0
22-Apr-19	3	24	0	22-May-19	5.6	19.7	0
23-Apr-19	7.1	15.8	0	23-May-19	7.5	21.5	0
24-Apr-19	5.5	21.6	0	24-May-19	7.7	21.2	0
25-Apr-19	7	16.4	4.2	25-May-19	8.8	20.7	0
26-Apr-19	5.1	17.4	0	26-May-19	8.8	19.9	0.2

27-Apr-19	6.5	10.3	0.6	27-May-19	9	16.8	0
28-Apr-19	3	13.1	0.2	28-May-19	7.7	14.6	2.2
29-Apr-19	2.7	12.6	0	29-May-19	5.9	16.4	1.8
30-Apr-19	3.3	15.9	0	30-May-19	13.4	22.1	0.2
				31-May-19	11.2	21.2	0

Date	Air Min °C	Air Max °C	Rainfall mm	Date	Air Min °C	Air Max °C	Rainfall mm
01-Jun-19	11.6	25.4	0	01-Jul-19	10.4	20.8	0
02-Jun-19	11.3	26.4	0	02-Jul-19	8.6	20	0
03-Jun-19	9.2	20.1	0	03-Jul-19	8	20.3	0
04-Jun-19	8.5	18.9	3.6	04-Jul-19	9.2	24.9	0
05-Jun-19	9.1	17.6	0.2	05-Jul-19	12.9	24.7	0
06-Jun-19	8.8	20.2	0	06-Jul-19	12.6	18	0.4
07-Jun-19	7.1	17.9	1.4	07-Jul-19	10.2	20.2	0
08-Jun-19	8.5	13.5	0.6	08-Jul-19	12.1	18.3	0
09-Jun-19	6.8	19.6	0	09-Jul-19	13.3	20.4	0
10-Jun-19	9.5	12	35.6	10-Jul-19	16.5	23.7	0
11-Jun-19	9.6	11.1	41.8	11-Jul-19	14.3	25.3	0
12-Jun-19	9.9	14.5	10.4	12-Jul-19	14.3	23.8	0.6
13-Jun-19	10.1	13.2	21.2	13-Jul-19	12.6	19.7	0.4
14-Jun-19	10.5	18.5	3	14-Jul-19	10.4	19.8	3.4
15-Jun-19	8.7	18.5	0.8	15-Jul-19	10.6	20.6	0
16-Jun-19	8.9	19.9	2	16-Jul-19	10.5	26	0
17-Jun-19	11.8	20.4	0	17-Jul-19	13.8	25.7	0
18-Jun-19	10.3	19.3	5.2	18-Jul-19	13.1	23.3	0.4
19-Jun-19	13.3	18.8	0.4	19-Jul-19	10.4	18.4	6.2
20-Jun-19	10.1	18.4	0	20-Jul-19	12.3	22	4.4
21-Jun-19	7.9	19.6	0	21-Jul-19	10.7	22.6	0
22-Jun-19	9	22.5	0	22-Jul-19	16.4	28.1	0
23-Jun-19	9.3	18.9	0.6	23-Jul-19	15.2	28.9	0
24-Jun-19	13.5	23.6	6.8	24-Jul-19	18.2	30.5	3
25-Jun-19	13.8	16.7	5	25-Jul-19	18.1	37.2	0
26-Jun-19	11.8	15.7	0	26-Jul-19	18.3	25.7	0
27-Jun-19	9.8	16	0	27-Jul-19	15.1	18.6	13.4
28-Jun-19	12.1	18.1	0	28-Jul-19	14.1	17.8	9
29-Jun-19	9.8	30.5	0	29-Jul-19	14.2	24.9	0
30-Jun-19	13.6	23.1	0	30-Jul-19	15.5	24.1	1
				31-Jul-19	15.3	19	6.4