WINTER 2022

THE VEGETABLE MAGAZINE

OFFICIAL JOURNAL OF PGRO

2023 Descriptive List

Three varieties added after successful trials

EAMUs - what next?

Finding a way forward in a post-AHDB Horticulture era

Forecasting with accuracy

PGRO yield and maturity tool moves closer

THE VEGETABLE MAGAZINE

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CONTENTS

03 **Grandma and her peas**
Roger Vickers, PGRO Chief Executive

04 **Vining Pea Forecasting System**
PGRO Data Scientist Leah Howells

06 **Vining pea varieties completing evaluation in 2022**
PGRO Senior Technical Officer Dr Chris Judge

11 **Masters of our own destiny**
New from the 2022 Pea and Bean Conference

12 **Virus surveillance in peas**
Dr Aimee Foulkes, FERA

14 **Pest Monitoring Developments in Peas and Beans**
PGRO R&D Manager Dr Becky Howard

DATES FOR THE DIARY

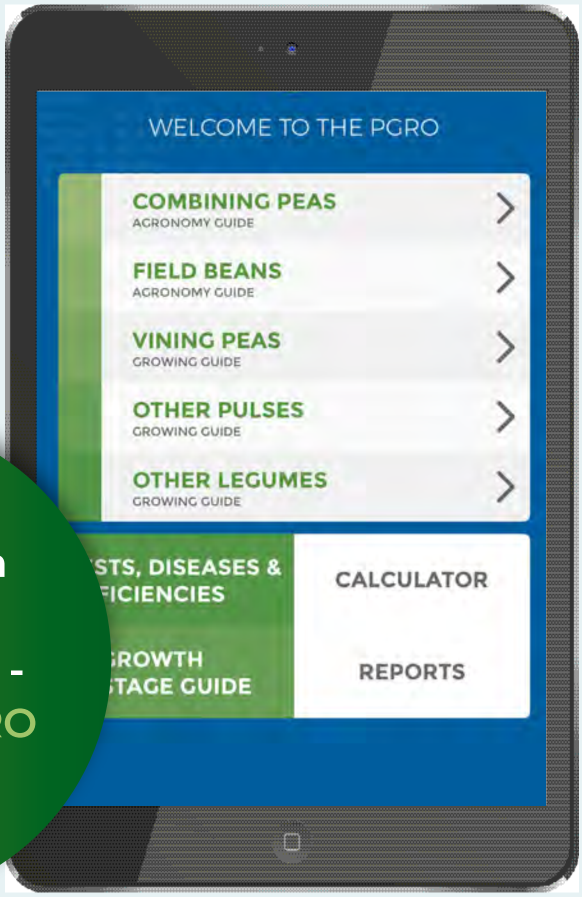
14th February
Pest and Disease Management in Peas and Beans training course, Thornhaugh, Peterborough

June (date TBC)
PGRO Vining Pea Field Day

July (date TBC)
PGRO Pulse Field Day

PGRO Agronomy App tool

The PGRO Pea & Bean App, an agronomy assistant in your pocket. Providing up to date technical backup as well as the DL variety guides and an interactive pest and disease reporting tool via your smartphone or tablet.



Download the App from Apple and Google Stores - search for PGRO Pea and Bean Guide

EDITORIAL

Grandma and her peas

Travelling up the A1 recently I found myself overtaking a boat on a trailer. It being dark and me knowing nothing about boats it might have been unremarkable other than that as I rapidly approached, I was struck by the enormous size of the two outboard engines and the instant overall impression of observing a quality product. It reminded me of the importance of quality for a good first impression and serendipitous surprise.

In 2017 (yes it was that long ago!) during National Pea Week Russell Corfield of Aylsham Growers somehow managed to inveigle a slot on BBC Radio 2's Breakfast Show, then hosted by Chris Evans, to talk peas and testing for maturity. Evans, as you may know, is an effervescent character and quickly latched on to the tenderometer and the underlying importance of pea quality for "Billy Big Pods" as he christened Russell. Though it lasted fewer than four minutes the interview was brilliant, and it is my guess that the humble frozen pea has never had such a positive message broadcast to a larger radio audience.

Not all testing is the same. Different tenderometers are in use and have been trialled and evaluated at PGRO and, of course, in some stages of processing organoleptic tests are also used.

> **AIMED AT TRYING TO GET CHILDREN TO EAT MORE VEG, IT CALLS ON CHILDREN TO CONQUER MARAUDING VEGETABLES BY CONSUMING THEM**

A couple of years later the humorous retrospective TV talk show The Last Leg took a different approach, featuring peas in a musical piece by the Horne Section entitled Grandaddy.

The perhaps unpromising theme for a song was also pea production, and it described the hard work involved on the family farm producing peas and the A to D grading process. It was an irreverent approach, the emphasis being on the importance of grandma, her peas and hard work to produce nothing but the best. They evoke the quality traits of sweetness, freshness, and greenness to enjoy the taste of "A-ness.". It was hilarious and great free publicity for peas.

Since then, cartoons and humour have been used in the Eat Them to Defeat Them campaign. Aimed at trying to get children to eat more veg, it calls on children to conquer marauding vegetables by consuming them. All of which is excellent but, as we all know, if the eating experience is poor then the chance of repeat consumption is seriously reduced. Publicity in its various forms is great, but we as an industry need to focus on ensuring the quality of the eating experience is high if promotion is to have real lasting effect.

While PGRO tends to focus on the agronomics of pea and bean production, the quality element of the harvested product remains critical in research too, crucial in ensuring that the work described in the Descriptive Lists is relevant to grower and eventually consumer experience. A short video guide to pea flowering stages and how we use it to predict quality and plan harvest was released by Dr Chris Judge in July last year. You can find it in the videos section on our website.

Quality has also been key to the work Leah Howells has been devoted to over the past three years. Focused directly on the issue of remotely forecasting harvest date and yield prediction, the research has produced amazing new capabilities which are now being refined into a usable planning tool with the opportunity for groups to trial it in real time during the 2023 season.

More detail on the forecasting model and the annually released Descriptive List are among other features in this publication.

Radio Interview:
www.bbc.co.uk/programmes/p0588gvl

The Last Leg pea song:
www.youtube.com/watch?v=KKDKpQKoilw

Eat Them to Defeat Them example with peas:
www.youtube.com/watch?v=9Jq8zAxv-vE

***Roger Vickers,** PGRO Chief Executive*

RESEARCH

Leah Howells
Data Scientist

PGRO's Vining Pea Forecasting System: a project update

Figure 2. A pea crop in full-flower

Over the past year, PGRO has undertaken exciting advances in the development of a forecasting system for harvest dates and yields in vining peas. Work has continued in model development and refinement, and we can now look ahead to the first tests of an online forecasting tool in 2023.

The need for a complex forecasting system

The UK's climate is undeniably changing, with the Met Office indicating that the ten hottest years since records began have occurred since 2004. This year, the worst of July's record-breaking heatwave was concentrated around the South and East of the UK, which is particularly troubling for the vining pea growing area which corresponds directly to this eastern seaboard hotspot.

While once a reasonable indicator of crop maturity, purely temperature-based prediction methods such as accumulated heat units are no longer accurate enough to reliably predict harvest dates year-on-year. Additionally, increasingly frequent extreme weather events like July's heatwave are wreaking havoc on processors and growers' ability to make advanced estimates of factory throughput.

PGRO would like to make it possible to predict maturity and yield in advance through the use of remotely-sensed earth observation data. By combining this data with a large body of historic commercial crop data, we have developed machine learning models that can be used to predict future harvests.

Also under consideration is the current need to collect tenderometer samples for individual crops multiple times in the approach to harvest. Every sample taken well before the crop is ready is ultimately an unnecessary trip. By narrowing the window of certainty around harvest and therefore knowing in advance an earliest estimated sampling date, processors may see the possibility of more than halving the number of samples that need to be collected per field.

Recent developments

I recently spoke at the fourth UK Pea & Bean Conference in Boston, giving members of the industry a chance to learn more about the project and introduce a first glimpse of the forecasting tool itself, which will be a web app available through the PGRO website.

In July we were successful in our application to secure further Innovate UK Smart Grant funding. This will enable the project to continue through to completion in February 2024, when we plan for the tool to be launched officially.


Figure 1. Simple field polygons can be created easily in Google MyMaps.

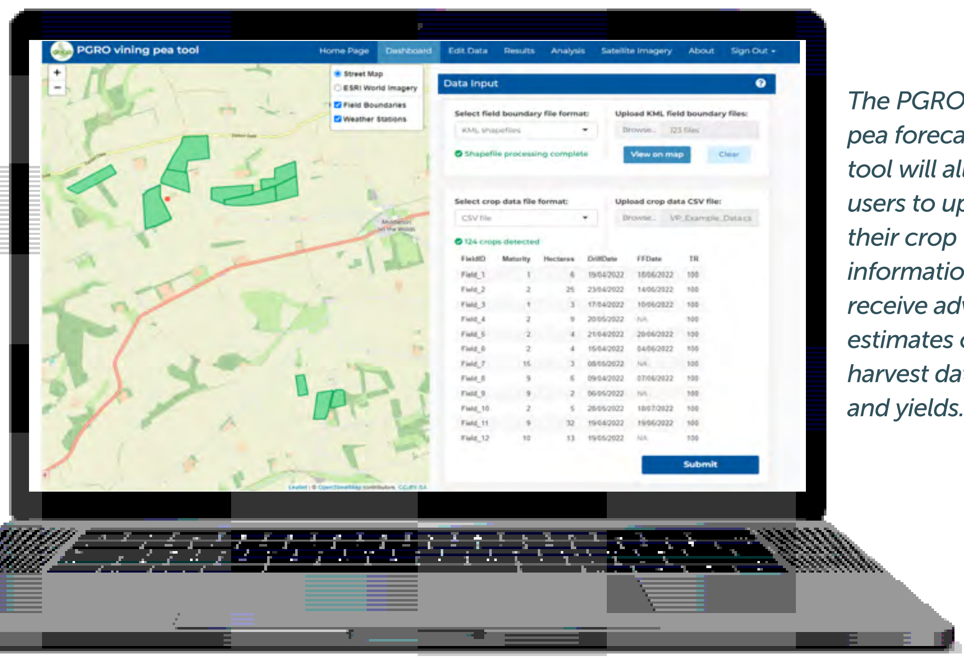
An online forecasting tool

The tool is designed to be as user friendly as possible and require only a small number of inputs from users. These inputs have been selected for convenience, comprising information that is already collected as part of normal monitoring of crop development:

- Unique crop identification numbers or codes
- Drill dates
- Full-flowering dates
- Varieties and maturity indices
- Target TRs
- Field locations in the form of either field boundary shapefiles (Figure 1) or a spreadsheet containing coordinates.

Analysis of over 17,000 historic crops has determined that regardless of variety or location, by far the most important factor when predicting harvest date in vining peas is the date of full-flower. Also known as the 'score-6' date, this is the date on which every plant in a crop has at least one open flower (Figure 2). Monitoring flowering stages and, in particular, making a note of this date is a highly important step that PGRO uses when assessing its vining pea variety trials.

All other information including climatic data, spatial and topographical data relating to field locations, and earth observation data is collected and handled by the forecasting system itself. This results in a simple to use, largely automated system that can be run as often as required throughout the season for continuous crop monitoring. Ongoing automated weather data and satellite-derived canopy reflectance data means users are provided with timely, up-to-date and dynamic forecasts.



The PGRO vining pea forecasting tool will allow users to upload their crop information and receive advanced estimates of harvest dates and yields.

What's next?

The 2023 vining season will present an opportunity for you to participate and test a beta version of the platform in real-time. Processors will be encouraged to run the models alongside current prediction or management methods and compare results of the tool with their own, as well as noting features that were particularly useful, or respond with suggestions for features they would like to see when the final version is launched.

In addition to graphical displays of peaks and troughs in tonnage and factory throughput, the tool will also allow users to view and explore Sentinel-2 satellite imagery of individual crops, giving even greater remote insight into crop development.

We aim for the trial version of the platform to be made available through the PGRO website in early spring next year. Following feedback received during the 2023 testing period, we plan for an official launch at the end of February 2024, ready to be used during the 2024 vining season and beyond.

PGRO is at the forefront of applied vining pea research and we hope that this tool is able to become an integrated management solution for the UK vining pea industry and continue to improve vining pea planning and management for years to come. Watch this space!

Related PhD studies

As part of my ongoing PhD in Agricultural Systems & Management, I'm looking further into the novel use of multispectral earth observation data in the detection of growth stage in peas. Due to the limited spread of vining pea production globally, there is very little current research being done into remote detection, with most related research involving combining peas or field beans. In the coming months I will be assessing the use of high-resolution Planetscope data for remote detection of flowering stage, and whether this represents an interesting avenue of future research.

VARIETY UPDATE

Dr Chris Judge
PGRO Senior Technical Officer

Vining pea varieties completing evaluation in 2022

Three standard varieties completed three years of evaluation in 2022 and these have been added to the Descriptive List (DL) for Vining Pea varieties. Yield data was statistically adjusted for year and number of trials. Weather as usual was variable over the years of evaluation.

Nocton - Standard Trials

Three varieties, Agilar, Contigo and SV5795QE, completed three years of evaluation in 2022. For the trials performed in 2021 and 2022, all varieties were sown without seed treatment due to loss of Wakil XL.

Yields from the yield standard Oasis were lowest at TR100 in 2022 (6.18 t/ha) and highest in 2021 (11.02 t/ha). Maturity of Oasis when compared to Avola was +11 days in all three years.

Sherwood, a possible replacement for Avola, gave higher yields than Avola in both years it was trialled. Maturity of Sherwood relative to Avola was -2 in 2021 and 0 in 2022.

Agilar (ZKI) matured three days earlier than Oasis. Yields were lower than Oasis (67% for both TR100 and TR120). Yields were highest in 2021. Produce was larger in size than Oasis, large size grade. Agilar and Oasis both had the same score for standing ability (3).

Contigo (Syngenta) was semi-leafless and matured two days earlier than Oasis. Yields were lower than Oasis (55% for both TR100 and TR120). Yields were highest in 2022. Produce was similar size to Oasis, medium-large size grade. Standing ability was better than Oasis (5).

SV5795QE (Seminis Vegetable Seeds) matured three days later than Avola. Yields were lower than Oasis (58% at TR100 and 55% at TR120). It produced its highest yield compared to Oasis in 2022, but its overall highest yield in 2021. Produce was smaller than Oasis, medium-small size grade. SV5796QE had the same standing ability as Oasis (3). SV5795QE has a short haulm length (45 cm).

STANDARD PEA SUMMARY, NOCTON – Completion in 2022

		@TR100						@TR120		
Variety	TSW	Maturity	% Yield					% Yield	Haulm length	Downy mildew tolerance
	g	± days		% in size grade						
				L	M	S	VS		cm	
Avola	192	0	51	42	37	17	4	50	55	MS
Sherwood	213	0	61	32	43	20	5	57	57	MFR
SV5795QE	136	+3	58	14	44	36	6	55	45	MFR
Agilar	159	+8	67	51	42	5	2	67	55	MS
Contigo	200	+9	55	29	53	16	2	55	50	MFR
Oasis	189	+11	100	36	53	9	2	100	54	MS
			(7.67 t/ha)					(8.41 t/ha)		
Ambassador	198	+14	83	37	44	16	3	81	65	SS

Downy mildew: GFR = Good field resistance; MFR = Moderate field resistance; SS = Slightly susceptible; MS = Moderately susceptible; S = Susceptible; HR = High resistance; IR = Intermediate resistance.

Holbeach - Petits Pois Trials

Three varieties, Eloise, Noelle, and Wav 7300, completed three years of evaluation in 2022. The data was collected in the past three years of trialling at Holbeach. Yields from the yield standard Waverex were lowest in 2020 (3.66 t/ha) and highest in 2022 (6.74 t/ha). Waverex is also the standard for maturity.

Eloise (van Waveren) was a semi-leafless variety that matured two days before Waverex. Its yield was 75% of Waverex at TR100 and 88% at TR120. Its highest yield relative to Waverex was 98% at TR120 in 2020. Its standing ability was better than average, scoring a 6 on the 1-9 scale.

Noelle (van Waveren) matured one day after Waverex. It had the same yield as Waverex at TR100 and outperformed it by 7% at TR120. Yields were highest in 2021. Noelle also had the same haulm length as Waverex (55cm). Produce was similar to Waverex with 81% of produce <8.75mm diameter at TR100.

Wav 7300 (van Waveren) matured three days after Waverex. Its yield was close to that of Waverex at TR120 (98%) but lower at TR100 (84%). It had its best yields in 2021, when it also matured one day earlier. It had slightly longer haulm than Waverex (59cm).

PETITS POIS SUMMARY, HOLBEACH – Completion in 2022

		@TR100						@TR120		
Variety	TSW	Maturity	% Yield					% Yield	Haulm length	Downy mildew tolerance
	g	± days		% in size grade					cm	
				L	M	S	VS			
Eloise	100	-2	75	1	18	51	30	88	58	MFR
Waverex	122	0	100	2	21	43	34	100	55	SS
			(5.19 t/ha)					(5.55 t/ha)		
Noelle	115	1	100	1	18	58	23	107	55	MFR
Wav 7300	103	+3	84	2	16	53	29	98	59	MFR

Downy mildew: GFR = Good field resistance; MFR = Moderate field resistance; SS = Slightly susceptible; MS = Moderately susceptible; S = Susceptible; HR High resistance.

"YIELD DATA WAS STATISTICALLY ADJUSTED FOR YEAR AND NUMBER OF TRIALS. WEATHER AS USUAL WAS VARIABLE OVER THE YEARS OF EVALUATION

Full data for comparison against other varieties is available in the PGRO Vining Pea Growers Guide (in this magazine) and as an Excel download from the PGRO website. Yearly data and three yearly summaries are in the Variety Trials Results manual, which can be downloaded from the PGRO website.

Descriptive List of Standard Size Vining Peas, Thornhaugh/Nocton – Data Summary

Data is derived from at least 3 years trials, but not necessarily the same years. Yields are as a percentage of the yield standard Oasis @TR100 and @TR120 and are only indications of comparative yield. Small yield differences should be treated with caution.

Variety	Leaf type	No. trials	Breeder (UK source)	TSW g	@TR 100						@TR 120	Haulm length cm	Disease	
					Maturity to Avola ±days	Yield % of Oasis	% in size grade L	M	S	VS	Yield % of Oasis		Downy mildew	Powdery mildew
Eldorado	C	4	Syn	223	-1	51	24	47	24	5	50	58	MFR[HR]	S
Beverly	C	3	vW (DT)	198	-1	55	26	51	20	3	58	52	MFR	[S]
Pizarro	SL	6	SVS	223	-1	55	31	45	20	4	55	54	SS[IR]	S
Salinero	C	5	SVS	199	0	55	34	43	18	5	54	50	(SS)[IR]	S
Avola	C	47	SVS(GA)	221	0	57	44	42	12	2	59	58	MS	[S]
Bonfire	SL	3	vW (DT)	176	0	61	15	52	29	4	65	49	MFR[IR]	[S]
Tomahawk	SL	3	CS (El)	213	0	65	21	57	19	3	72	47	SS	[R]
Aloha	C	3	vW (DT)	219	0	69	33	50	14	3	69	49	MFR[IR]	[S]
Sherwood	C	13	SVS	197	+1	59	25	49	22	4	63	52	(MFR)[IR]	S
Kiss	C	3	vW (DT)	195	+1	64	30	52	15	3	70	62	MFR[IR]	[S]
Span	C	5	CS (El)	191	+1	65	36	46	15	3	66	43	(SS)	[S]
Anubis	C	6	LUK	224	+1	72	28	46	21	5	75	51	SS	R[S]
Hesbana	SL	6	Nun	187	+2	49	11	50	33	6	50	56	-	R
Ambler	SL	3	CS(El)	213	+2	72	37	51	11	1	75	50	SS	-
Orient	C	3	ZKI	181	+3	30	34	42	19	5	32	55	SS[IR]	-
SV5795QE	C	3	SVS	136	+3	60	14	44	36	6	61	48	MFR	-
Agilar	C	3	ZKI	159	+3	69	51	42	5	2	73	58	MS[IR]	-
Cargo	C	3	vW (DT)	199	+3	72	23	54	20	3	74	50	MFR[IR]	[S]
Stargo	SL	3	Syn	197	+4	60	34	54	10	2	58	50	(MFR)	[IR]
Saltingo	SL	4	Syn	197	+4	67	29	51	17	3	68	56	MFR[HR]	[IR]
Idalgo	SL	3	Syn	201	+4	72	29	52	17	2	74	50	GFR[HR]	[IR]
Romance	SL	6	SVS	175	+4	73	24	50	22	4	73	51	GFR[IR]	S
LG Element	SL	3	LUK	198	+4	75	21	44	28	7	79	45	(MS)	[R]
Belvedere	C	3	vW (DT)	188	+4	81	28	45	23	4	85	50	GFR[IR]	[S]
SV8112QH	SL	3	SVS	157	+5	73	11	42	37	10	74	46	MFR[IR]	[R]
Savannah	SL	3	CS (El)	214	+5	86	58	35	6	1	92	60	MS	[R]
Jubilee	C	3	LUK	192	+6	76	29	50	18	3	78	55	MS	R[R]
Fantastigo	SL	3	Syn	198	+6	85	22	51	24	3	88	55	GFR[HR]	[IR]
Sienna	C	3	vW (DT)	240	+6	94	43	46	9	2	92	43	(MS)	S
Reliance	SL	3	SVS	167	+7	70	15	57	26	2	69	48	(GFR)[IR]	R
Minotaur	SL	3	SVS	171	+7	73	18	57	23	2	76	38	GFR[IR]	R[HR]
Bingo	SL	5	Syn	214	+7	78	34	51	13	2	84	50	(S)	R[IR]
Amalfi	C	3	Syn	138	+7	85	5	39	50	6	85	49	MS	S
Gusty	SL	3	vW (DT)	187	+7	88	31	55	12	2	82	50	(SS)	S
Marimba	C	3	vW (DT)	185	+7	90	12	53	30	5	96	49	MFR[IR]	[IR]
Novella	SL	3	Syn	200	+8	72	30	53	15	2	71	41	MS	R
Bikini	SL	55	Syn	196	+8	76	32	51	15	2	77	44	SS	S
Lyric	C	3	vW (DT)	172	+8	79	27	55	16	2	82	47	MFR	[IR]
Preference	SL	3	PLS(WAC)	208	+8	81	36	47	15	2	81	50	(SS)	[IR]
Ruselago	SL	3	Syn	200	+8	86	33	53	13	1	85	44	MFR[HR]	[IR]
LG Valiant	SL	3	LUK	202	+8	92	19	57	22	2	96	59	SS	[R]
Contigo	SL	3	Syn	200	+9	63	29	53	16	2	65	56	MFR[HR]	[IR]
Ruthless	SL	3	Syn	177	+9	76	26	52	20	2	75	58	(SS)[HR]	R
Boogie	SL	6	vW (DT)	210	+9	78	53	43	4	0	78	50	MS	R[IR]
Spandimo	SL	6	SVS	184	+9	78	31	56	12	1	75	48	(SS)[IR]	S
Geneva	C	7	Nun	167	+9	80	16	51	29	4	83	61	GFR	-
Sabrina	C	3	Syn	183	+9	80	18	60	20	2	80	67	MS	[IR]
Compana	SL	3	Nun	179	+9	82	15	46	33	6	91	58	(MS)	R
Ruler	SL	3	Syn	211	+9	82	32	53	14	1	84	54	(SS)[HR]	R
Ashton	C	6	SVS	183	+9	83	27	58	13	2	83	54	MFR[IR]	R[HR]
Marquis	SL	3	vW(DT)	151	+9	83	13	44	35	8	76	57	MFR[IR]	[S]
SV0957QF	SL	3	SVS	180	+9	86	27	56	16	1	90	50	[IR]	[HR]
Biktop	SL	6	Syn	196	+9	88	29	57	13	1	89	44	SS[HR]	S
D85607	C	3	Syn	180	+9	92	13	49	34	4	97	62	GFR	[S]
Urbana	SL	6	Nun	142	+10	67	12	49	31	8	69	70	MS	[IR]
PFR 15-A10	C	3	PFR(AGIS)	199	+10	77	10	40	44	6	83	56	SS	[R]
SV0823QG	SL	3	SVS	180	+10	89	17	55	25	3	84	65	GFR[IR]	[HR]
Invictus	C	5	PFR(AGIS)	197	+10	90	19	58	21	2	90	54	MFR	[R]
Charlie	SL	3	LUK	188	+10	91	32	57	10	1	89	63	(GFR)	R
Vivado	C	3	Syn	167	+10	91	25	58	16	1	91	63	MFR[HR]	[IR]
CS-464AF	SL	3	CS(El)	196	+10	105	30	51	17	2	103	60	MS	[IR]
Dancer	SL	3	vW (DT)	175	+11	62	18	52	25	5	67	57	MFR[IR]	[IR]
Standana	SL	3	Nun	156	+11	67	18	64	17	1	68	66	-	[R]
PFR 15-PA42	SL	3	PFR(AGIS)	190	+11	72	7	39	48	6	79	53	MFR	[R]
Querida	C	3	vW (DT)	172	+11	80	21	48	25	6	84	48	MFR[IR]	[IR]
Butana	SL	6	Nun	180	+11	81	18	58	22	2	78	63	(MS)	R
Kengo	SL	4	Syn	194	+11	81	24	47	25	4	79	57	GFR[HR]	[IR]
Ibis	SL	6	Syn (El)	173	+11	83	21	46	26	7	88	58	GFR	R
LG Midnight	SL	3	LUK	199	+11	85	27	61	11	1	81	69	SS	[R]
Oasis	C	28	LUK	194	+11	100	33	52	13	2	100	58	MS	S
Maurice	SL	3	SVS	132	+12	75	23	48	23	6	77	63	GFR[IR]	[HR]
Serge	SL	6	PLS (WAC)	173	+12	78	40	45	13	2	77	55	MS	R[IR]
Ambassador	C	40	vW (DT)	204	+12	83	39	48	11	2	82	69	SS	R[IR]
Reflection	SL	3	PLS(WAC)	205	+12	83	29	55	15	1	95	61	(SS)	[R]
Vidor	C	3	vW (DT)	174	+12	85	29	55	14	2	90	63	SS	[IR]
Trinity	C	3	ZKI	177	+12	93	43	39	15	3	92	55	MS	[HR]
Acclaim	C	3	PFR(AGIS)	210	+12	95	19	57	21	3	99	54	(SS)	R
Kenobi	SL	6	Syn	198	+13	85	30	56	13	1	83	59	(SS)	R
Naches	SL	6	CS (El)	198	+13	86	37	52	10	1	81	50	(MS)	R
Hyperion	SL	3	SVS	159	+13	93	14	52	28	6	93	60	GFR[IR]	R[HR]
Cawood	C	3	PFR(AGIS)	216	+13	98	31	55	12	2	97	53	(MS)	R
LG Galileo	SL	3	LUK	192	+14	109	56	33	9	2	116	64	(MFR)	[R]
Terrain	C	3	LUK	219	+15	84	34	50	14	2	81	72	(GFR)	R[R]
LG Infinity	SL	3	LUK	168	+17	101	42	46	10	2	96	58	MFR	[R]

DESCRIPTIVE LIST PGRO 2023

Data is derived from at least 2 years trials, but not necessarily the same years. Yields are as a percentage of the yield standard Oasis @TR100 and @TR120 and are only indications of comparative yield. Small yield differences should be treated with caution.

AHDB

Variety	Leaf type	No. trials	Breeder (UK source)	TSW g	@TR 100						@TR 120	Haulm length cm	Disease	
					Maturity to Avola ±days	Yield % of Oasis	% in size grade L	M	S	VS	Yield % of Oasis		Downy mildew	Powdery mildew
Beverly	C	2	vW (DT)	194	-1	60	34	38	23	5	80	54	MFR	[S]
Eldorado	C	2	Syn	235	-1	61	40	50	9	1	67	87	MFR[HR]	S
Avola	C	10	SVS(GA)	216	0	63	54	37	8	1	72	71	MS	[S]
Aloha	C	2	vW (DT)	216	0	64	41	42	13	4	78	63	MFR[IR]	[S]
Sherwood	C	4	SVS	196	0	69	28	48	21	3	82	64	SS[IR]	S
Tomahawk	SL	2	CS (El)	212	0	77	27	52	19	2	99	61	SS	[R]
Span	C	2	CS (El)	185	0	81	38	43	17	2	88	52	(SS)	[S]
Salinero	C	2	SVS	208	+1	91	34	45	18	3	85	67	SS[IR]	S
Kiss	C	2	vW (DT)	183	+2	87	30	48	19	3	80	68	MFR[IR]	[S]
Cargo	C	2	vW (DT)	203	+3	89	30	65	4	1	87	64	MFR[IR]	[S]
LG Element	SL	2	LUK	197	+4	88	20	50	25	5	80	61	(MS)	[R]
Saltingo	SL	2	Syn	204	+5	62	39	45	14	2	63	67	MFR[HR]	[IR]
Idalgo	SL	2	Syn	201	+5	76	41	46	11	2	76	66	GFR[HR]	[IR]
Jubilee	C	2	LUK	180	+5	83	28	47	22	3	79	69	MS	R
Savannah	SL	2	CS (El)	210	+5	95	53	33	12	2	94	68	MS	[R]
Sienna	C	2	vW (DT)	248	+6	116	49	46	4	1	108	64	MS	S
SV8112QH	SL	2	SVS	167	+6	56	21	53	22	4	54	66	(MFR)[IR]	[R]
Reliance	SL	2	SVS	174	+6	89	26	58	13	3	103	69	(GFR)[IR]	R
Gusty	SL	2	vW (DT)	174	+6	97	44	47	8	1	85	69	SS	S
Amalfi	C	2	Syn	133	+7	109	8	33	45	14	103	69	MS	S
Fantastigo	SL	2	Syn	198	+7	79	27	48	21	4	86	71	GFR[HR]	[IR]
Minotaur	SL	2	SVS	171	+7	87	25	51	20	4	100	68	GFR[IR]	R
Bikini	SL	6	Syn	198	+7	87	38	46	13	3	89	55	SS	S
Charlie	SL	2	LUK	203	+8	103	37	53	9	1	99	79	GFR	R
Compana	SL	2	Nun	180	+8	103	28	53	16	3	99	79	MS	R
Biktop	SL	2	Syn	204	+8	109	33	51	14	2	112	54	SS[HR]	S
D85607	C	2	Syn	180	+8	69	18	51	25	6	81	79	GFR	[S]
SV0957QF	SL	2	SVS	176	+8	82	30	51	16	3	92	72	[IR]	[R]
Ruler	SL	2	Syn	215	+8	88	41	41	14	4	86	74	SS[HR]	R
Preference	SL	2	PLS(WAC)	213	+8	99	51	43	5	1	90	63	SS[IR]	R
Boogie	SL	2	vW (DT)	206	+9	105	50	42	7	1	105	60	MS	R[HR]
Sabrina	C	2	Syn	185	+9	79	20	61	17	2	75	90	MS	[IR]
Ruthless	SL	2	Syn	168	+9	90	39	45	13	3	98	79	SS[HR]	R
Geneva	N	2	Nun	174	+9	95	27	51	18	4	101	64	GFR	-
PFR 15-A10	C	2	PFR(AGIS)	195	+10	77	20	41	33	6	78	71	SS	[R]
Oasis	C	10	LUK	196	+11	100	38	48	12	2	100	73	MS	S
Hyperion	SL	2	SVS	171	+11	115	25	59	14	2	108	80	GFR[IR]	R
LG Midnight	SL	2	LUK	202	+11	79	32	57	10	1	81	78	SS	[R]
PFR 15-PA42	SL	2	PFR(AGIS)	181	+11	86	12	45	38	5	97	73	MFR	[IR]
Vivado	C	2	Syn	155	+11	91	30	51	17	2	86	77	MFR[HR]	[IR]
Standana	SL	2	Nun	163	+11	91	19	57	22	2	92	87	-	[R]
Vidor	C	2	vW (DT)	181	+11	91	42	45	11	2	95	72	SS	[HR]
Kengo	SL	2	Syn	187	+12	89	29	45	21	5	93	72	GFR[HR]	[IR]
Cawood	C	2	PFR(AGIS)	217	+12	93	37	50	11	2	90	69	MS	R
Reflection	SL	2	PLS(WAC)	210	+12	94	46	43	9	2	110	73	SS	[R]
Maurice	SL	2	SVS	128	+13	112	28	47	20	5	96	78	GFR[IR]	[R]
Acclaim	C	2	PFR(AGIS)	197	+13	82	20	46	29	5	82	71	(SS)	R
Ambassador	C	10	vW (DT)	209	+13	88	40	43	14	3	84	89	SS	R[IR]
LG Galileo	SL	2	LUK	189	+14	89	53	33	11	3	99	81	(MFR)	[R]
Terrain	C	2	LUK	204	+15	89	42	44	11	3	86	89	(GFR)	R
LG Infinity	SL	2	LUK	165	+18	96	34	50	14	2	88	62	MFR	[R]

KEY

Size grade classifications:
L = large, >10.2mm; M = medium, >8.75-10.2mm; S = small, >7.5-8.7mm; VS = very small, <7.5mm

Diseases: Downy mildew: GFR = Good field resistance; MFR = Moderate field resistance; SS = Slightly susceptible; MS = Moderately susceptible; S = Susceptible; HR High resistance; I = intermediate; [ ] Breeders information. ( ) limited data; - = no data.

Powdery mildew: R = resistant / tolerant; I = Intermediate; S = susceptible; [ ] breeders information; - = no data.

Descriptive List of Petits Pois Vining Peas, Holbeach – Data Summary

Data is derived from at least 3 years trials, but not necessarily the same years. Yields are as a percentage of the yield standard Waverex @TR100 and @TR120 and are only indications of comparative yield. Small yield differences should be treated with caution.

Variety	Leaf type	No. trials	Breeder (UK source)	TSW g	@TR 100						@TR 120	Haulm length cm	Disease	
					Maturity to Waverex ±days	Yield % of Waverex	% in size grade				Yield % of Waverex		Downy mildew	Powdery mildew
							L	M	S	VS				
Natalie	C	3	vW	101	-7	62	1	9	46	44	62	58	MFR[IR]	[S]
Bartesa	C	3	Nun	79	-4	84	1	16	52	31	81	50	(S)	-
Norvert	C	3	Syn	100	-4	89	1	13	50	36	86	66	GFR[HR]	[S]
Eloise	SL	3	vW(DT)	100	-2	79	1	18	51	30	89	62	MFR[IR]	[S]
Noroit	C	3	Syn	96	-2	105	1	17	51	31	101	60	S	R
Legato	C	3	Syn (El)	108	-2	107	3	23	55	19	106	71	SS	S
Trophee	C	3	Syn	118	-2	126	1	18	59	22	124	69	(SS)	S
Judith	C	3	vW (DT)	93	-1	116	0	10	48	42	102	54	MFR[IR]	[S]
Corus	C	5	Syn	88	0	88	1	16	53	30	79	62	GFR	S
Waverex	C	21	vW (DT)	114	0	100	3	22	44	31	100	60	SS	[S]
Tendrilla	SL	3	Vil (LUK)	113	0	109	2	23	56	19	99	80	(S)	S
Katie	SL	3	vW (DT)	88	+1	94	1	9	49	41	86	63	SS	S
Lunanvert	C	3	Syn	101	+1	96	3	26	51	20	100	69	MFR[HR]	[S]
Oracle	C	3	vW (DT)	96	+1	99	1	12	47	40	99	67	-	[IR]
Noelle	C	3	vW(DT)	115	+1	100	1	18	58	23	104	59	MFR[IR]	[IR]
Firenza	C	3	Vil (LUK)	90	+1	104	0	10	50	40	93	64	GFR	S
Rhianna	C	3	vW (DT)	83	+1	113	1	12	49	38	112	65	MFR[IR]	S
Ambience	SL	3	SVS	107	+1	121	2	21	52	25	120	59	GFR[IR]	S
Festivert	SL	4	Syn	87	+2	80	2	18	43	37	88	67	SS	[IR]
SV3946QB	C	3	SVS	112	+2	100	11	45	36	8	86	66	GFR	[S]
Afivert	SL	3	Syn	90	+3	83	0	8	51	41	82	66	GFR[HR]	[S]
Contravert	C	3	Syn	109	+3	87	2	28	53	17	97	82	MFR[HR]	R[IR]
Wav 7300	C	3	vW(DT)	103	+3	87	2	16	53	29	97	63	MFR[IR]	[IR]
SV6064QC	SL	3	SVS	86	+4	94	1	6	41	52	93	66	MFR	[R]

KEY

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Diseases: Downy mildew: GFR = Good field resistance; MFR = Moderate field resistance; SS = Slightly susceptible; MS = Moderately susceptible; S = Susceptible; HR High resistance; I = intermediate; [ ] Breeders information. ( ) limited data; - = no data.

Powdery mildew: R = resistant / tolerant; I = Intermediate; S = susceptible; [ ] breeders information; - = no data.

Key to breeder and source of varieties

AGIS = Karl-H. Schäfer GmbH P.O.Box 1162, D37001 Göttingen Germany.

CS = Crites Seed Inc., Moscow, Idaho, USA.

DT = David Trethewey Seeds, The Seed Store, High Street, Pointon, Sleaford,Lincs, NG34 0LY.

El = Elsoms Seeds Ltd., Pinchbeck Road, Spalding, Lincs., PE11 1QG.

GA = General Availability.

LUK = Limagrain UK Ltd, Rothwell, Market Rasen, Lincs., LN7 6DT.

Nun = Nunhems Netherlands BV, Napoleonsweg 152,6083 AB Nunhem,The Netherlands.

PFR = The New Zealand Institute for Plant & Food Research Ltd., Private Bag 4704 Christchurch, New Zealand.

PLS = Pure Line Seeds Inc., N2651, County Road V, Lodi, WI, 53555-9423.

Syn = Syngenta CPC4, Capital Park, Fulbourn. CB21 5XE.

SVS = Seminis Vegetable Seeds, Bayer Crop Science, 230 Cambridge Science Park,Milton Road, Cambridge, CB4 0WB.

Vil = Vilmorin SA, RTE du Manoir, 49250 La Menitre, France.

vW = van Waveren Saaten GmbH, Rodeweg 20, D-37081, Göttingen, Germany.

WAC = W.A.Church (Bures) Ltd., Bures, Suffolk, C08 5JQ.

ZKI = ZKI, Zöldségtermesztési Kutató Intézet Zrt.6000 KECSKEMÉT,Mészöly Gyula u. 6.

* All varieties have been evaluated in PGRO trials with funds from seed companies and PGRO levy

Masters of our own destiny

As the industry prepares for AHDB Horticulture to cease operations, a significant hole that needs to be filled has been identified.

Jack Ward from British Growers told delegates at this year's Pea and Ben Conference that historically AHDB Horticulture has handled minor use authorisations (EAMUs), but that this arrangement will come to an end when the organisation is disbanded on 31 March 2023.

"We are facing the situation as of April 2023 where there is no system in place for processing EAMUs and that is potentially a massive issue for the sector," Mr Ward said.

Discussions have taken place over the past nine months to try and find a solution.

"We've eventually arrived at a general consensus that the industry will need to take on responsibility for this fairly vital piece of work," Mr Ward says.

A new company called Horticulture Crop Production Ltd will be created to take over the processing of EAMUs from AHDB Horticulture. The company will be owned by all the various fresh produce growers associations.

"There will be two elements to the way this is funded," Mr Ward said. "We will need to find an annual sum which pays for the running costs of the organisation. We're working to find a fair and equitable way of distributing these costs across the entire fresh produce industry."

The second element is the cost of applying for an EAMU, which varies considerably depending on how much of the information required already exists.

"Every year each crop will look at its requirements and decide which chemicals it wants to put through the process," Mr Ward said.

"The new company will give them a cost and, as growers, you will need to decide if you want to put your hands in your pocket to fund that or not.

"If you don't, then the chemical won't be there. If you do want it, it will need to be funded."

Give peas a chance

The potential for pea and bean protein to secure a significant share of the plant-based food industry is huge, according to experts.

Speaking at the annual Pea and Bean Conference, Clare Otridge from England Marketing outlined the opportunities, informing delegates that the growth rate of the global market for plant-based meat is 18.4%, with an estimated value of $19.3bn by 2027.

Peas have many advantages over other plant-based forms of protein. As well as being easily digestible and sustainable, they're creamier in texture and hypoallergenic.

"The consumer is going to love that peas are grown in the UK without the need to import, they create minimum environmental impact in their processing and can be used to provide the texture to plant based meat products that mimics meat," Ms Otridge says. "In short, they are going to hit the spot for many consumers and it's not being communicated as well as it could be."

At present, consumer awareness of pea protein is very low.

"The latest figures show that 40-50% of consumers have never heard of pea protein," Ms Otridge says.

"In addition, there is a great deal of misinformation about alternative proteins.

The cost of plant-based proteins is also a barrier to success.

"Plant based protein is expensive because so much research and development is going into it," she explains.

If pea protein is to reach its potential and secure a dominant share of market, it needs investment.

"The protein extraction process has not received enough investment to make it scalable so that it can support the rise of plant based products in the UK," Ms Otridge says.

If these issues can be overcome, the potential is huge.

"We're seeing the rise of the 'conscious consumer' which is really driving sales," Ms Otridge says. "They're looking to make more health-based decisions and much more sustainable choices, and this usually involves reducing meat consumption.

"This isn't a trend that is going to go anywhere anytime soon."

DISEASES

Dr Aimee Foulkes
FERA

Bean yellow mosaic virus in peas

Virus surveillance in peas

The AHDB have funded a three-year project to look into the development of a generic surveillance method, with a focus on peas (FV 459). This project has been delivered by staff from Fera Science Ltd and PGRO. As part of the project, PGRO staff collected samples from 60 sites across the three years which were then sent to Fera for virus testing.

Conventional diagnostics require prior knowledge of what viruses could be present in a sample, and when running a test allow us to ask the question 'is this specific virus present?'. High throughput sequencing technologies can identify any nucleic acid (DNA or RNA) in the sample, so the question becomes 'what viruses are present?'. This enables the identification of viruses not known to be present in the host, country or novel viruses.

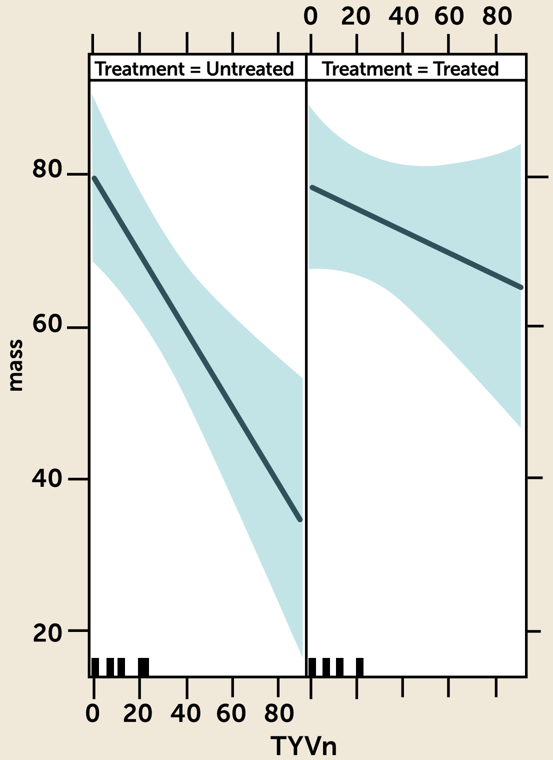
The samples were tested first by high throughput sequencing followed by conventional diagnostics to both confirm the presence of the virus and determine the incidence. Over the three years we identified 10 viruses in the samples, including viruses known to be present in UK peas and first findings. These viruses are predominantly aphid transmitted in either a persistent manner, characterised by a long acquisition time and can be controlled with chemical use, or a non-persistent manner, characterised by a short acquisition time, which are more challenging for chemical control.

Familiar viruses include pea enation mosaic virus, pea seed-borne mosaic virus, bean yellow mosaic virus and bean leaf roll virus. Pea enation mosaic virus is a complex of two different viral species, pea enation mosaic virus-1 (PEMV-1, Genus: *Enamovirus)* and pea enation mosaic virus-2 (PEMV-2, Genus: *Umbravirus*), which have traditionally been thought to only

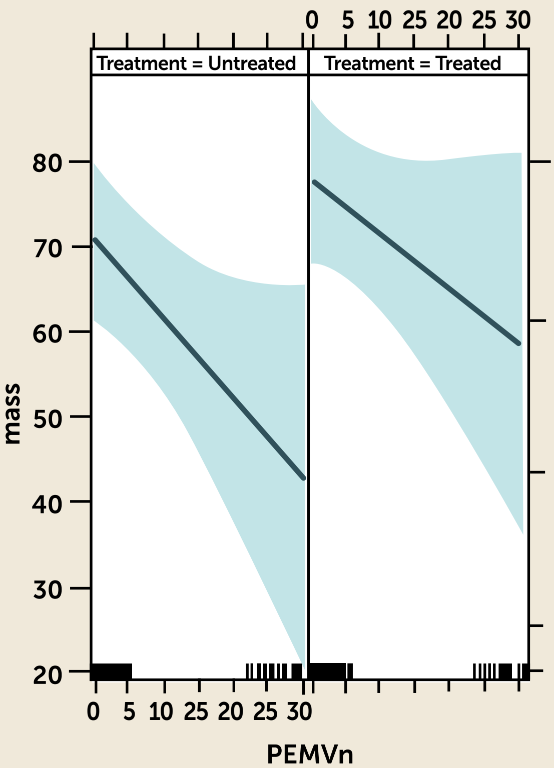
THIS SURVEY HAS PROVIDED A BETTER UNDERSTANDING OF WHAT VIRUSES ARE PRESENT IN UK PEAS, WHICH CAN HELP WITH THEIR MANAGEMENT

Yield effect of virus and treatment

Treatment* TYVn effect plot



Treatment* PEMVn effect plot



occur together as they both take different roles in infection. Both viruses were found throughout the three years, and unexpectedly PEMV-2 was found without PEMV-1. There is limited research on this virus, and it is not known if PEMV-2 can affect pea plants without PEMV-1. Pea enation mosaic virus is persistently transmitted by aphids.

Pea seed-borne mosaic virus (PSbMV, Genus: *Potyvirus*) is a seed-transmitted virus, so use of clean seed is a recommended practice. PSbMV is challenging to control through chemical application as it is non-persistently transmitted. Bean yellow mosaic virus (BYMV, Genus: *Potyvirus*, non-persistent transmission) and bean leaf roll virus (BLRV, Genus: *Luteovirus*, persistent transmission) were only found in site samples in 2022.

Turnip yellows virus, (TuYV, Genus: *Polerovirus*) which was not previously known to be in UK peas, was the most common virus found every year. This persistently transmitted virus has a broad host range, known to include legumes and brassicas e.g. oilseed rape. Within this survey a yield loss model was created which looked at the yield obtained from a sub-set of the sampled sites from a 'treated' and 'untreated' area. While no difference was seen between treatments for PEMV-1 in any year, yield loss was associated with the presence of TuYV and was greater where no chemical control was used. For TuYV, these preliminary findings predicted substantial yield loss where no chemical control was used, and this matches with yield loss work looking at TuYV on legumes in Australia. TuYV has been found present at high incidence but with no symptoms on the peas.

Additional viruses found in this survey were pea necrotic yellow dwarf virus (PNYDV, Genus *Nanovirus*), a persistently transmitted virus which has been shown to cause huge yield losses in both pea and faba bean. The first finding of PNYDV in the UK was from one site in year two.

Additionally, soybean dwarf virus (SbDV, Genus *Luteovirus*, persistent transmission), *Trifolium paratense* virus A and *cabbage cytorhabdovirus* (Genus: *cytorhabdovirus*, persistent transmission) were first identified in the UK. Both cytorhabdoviruses have not been previously found in peas and it is unclear what effect they could have.

This survey has provided a better understanding of what viruses are present in UK peas, which can help with their management. It has also highlighted areas that require further investigation, for example what effect is PEMV-2 having on pea plants? We have a model for TuYV yield loss, but can we confirm this? Are there resistant varieties? Where is TuYV present in the wider environment? What effect are these viruses having on the nutritional content of peas?

Turnip yellows virus in peas

RESEARCH

Dr Becky Howard
PGRO R&D Manager

Pest monitoring developments in peas and beans.

There have been several developments over the past two years for systems to monitor insect pests in peas and beans. PGRO, together with PheroSyn and Koppert UK, has been evaluating systems to monitor pea midge and pea and bean weevils. PGRO, Koppert and Metos UK have also been investigating novel trapping technology for pea moth. As temperatures rise and pesticides become more targeted and less available, insect activity changes and it is critically important that growers can monitor in order to make better decisions about pest management.

Pea midge

PGRO, together with Swaythorpe Growers and the Green Pea Company in Yorkshire, has worked to validate the PheroSyn pea midge pheromone using traps supplied by Koppert. Attacks by pea midge larvae result in yield loss, particularly in intensive vining pea growing areas. Pea midge adults emerge from overwintering cocoons, laying eggs in peas from early June onwards. The larvae cause significant damage to flower buds, leading to lack of pod formation and yield reduction (Figures 1 and 2). Damaged tissue may also provide a site for infection by fungi such as *Botrytis* spp.

Traps were tested in 2021 and 2022 for eight weeks between late May and late July (Figure 3).

Large numbers of midge adults were recorded from 18 June in both 2021 and 2022 and high levels of activity continued for four weeks. The threshold for control is 500 midges per trap (Figure 4) and an extended period of activity means that large areas of pea crops are at the susceptible enclosed bud stage during the period of attack, therefore high levels of damage are more likely. A small plot insecticide trial showed that by using the monitoring system we could accurately predict both the need for and time of insecticide applications. Peas that were sprayed at the very first enclosed flower bud stage, followed by a second application seven days later, were better protected from attack (Figure 5). Significant control was only recorded when a threshold was reached and if not, no insecticide was required.

Figure 1: Pea midge larvae feeding in flower bud

Figure 2: Plants showing 'cabbage-head' symptoms due to pea midge larval damage

Figure 3: Pea midge traps in cereal crop (previously peas).

Figure 4: Threshold of 500 midges on a sticky card

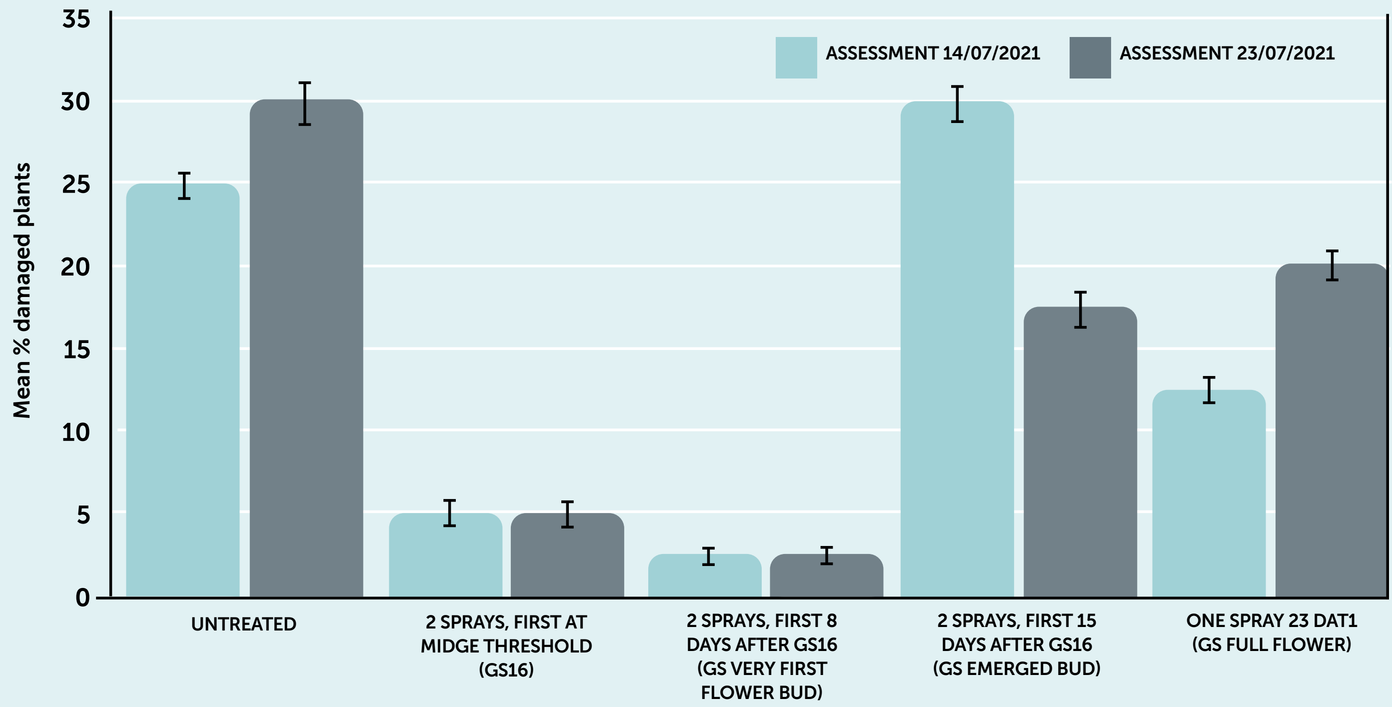


Figure 5: Mean percentage pea midge damaged plants per treatment in a small plot trial in Yorkshire in 2021

Pea and bean weevil

Weevils may cause damage if large numbers appear when plants are small, particularly in cloddy seedbeds and conditions of slow growth. Leaves of attacked plants show characteristic 'U' shaped notches around the edges (Figure 6), but the main damage occurs as larvae feed on the root nodules. The adult weevils are 4-5mm in length, light grey to brown in colour with faint striping along the length of the wing cases (Figure 7). Adults migrate early in spring from over-wintering sites, mainly the grassy uncultivated edges of fields previously cropped with peas or beans, and this often coincides with short periods when the maximum air temperature exceeds 12°C. The adults feed on foliage and eggs laid by female weevils are washed into the soil around the stem bases and produce larvae which feed inside the root nodules. After 3-4 weeks, the larvae pupate, and newly emerged adults return to overwintering sites. If leaf damage is anticipated, early treatment of the crop is necessary to interrupt the egg laying period and reduce root damage.

A monitoring system was developed in the 1980's but has become unavailable to growers in the past five years, so PGRO, PheroSyn and Koppert UK have worked together to ensure that the system is available for the future. The monitoring system detects adults when they begin migrating in the early spring and comprises five cone traps containing a pheromone lure.

Figure 6: Leaf damage to beans caused by pea and bean weevils.

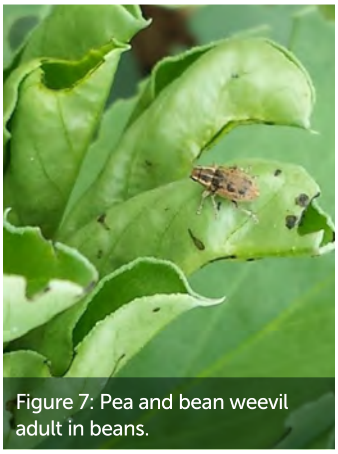


Figure 7: Pea and bean weevil adult in beans.

It can be used as an aid to decision making in the following ways:

- Identifies seasons where weevil numbers are low, and crops do not require treatment
- Identifies the time of peak activity and allows crops to be treated at the optimal time
- Reduces the need for prophylactic spraying
- Allows the selection of drilling time to avoid periods of serious damage (useful in organic crop production systems)
- An aid in integrated pest management systems for crop assurance schemes.

Traps are sited on a single grassy verge or headland of a field which had been cropped with peas or beans the previous year (Figure 8). They should be sited by mid-February and weevils counted three times each week.

A threshold occurs when the average number of weevils per trap exceeds 30 on a single occasion. Monitoring should continue until the number of adults in traps starts to decline, or until the latest sown crops have emerged (whichever is the sooner).

When a threshold has been reached, crops which have just emerged or will emerge during the next 10 days may be at risk. An insecticide can be applied as soon as first signs of notching are observed if previous experience is that weevil damage occurs regularly. During periods of slow growth, a second spray should be applied 10-14 days later. If a threshold is not reached or if it occurs more than 10 days before crop emergence there is no need to spray.

Figure 8: Pea and bean weevil monitoring trap in situ.

Figure 9: iMetos® trap in peas

Pea moth

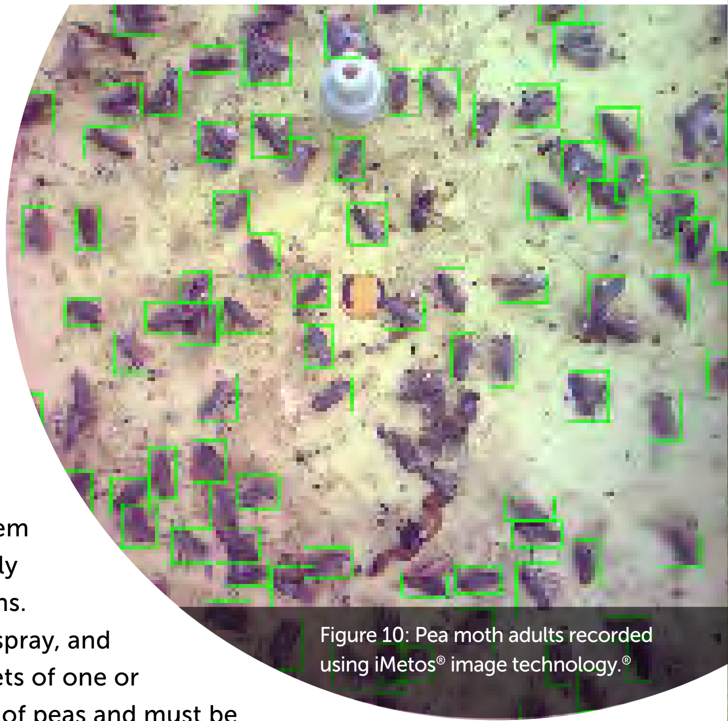


Figure 10: Pea moth adults recorded using iMetos® image technology.®

Pea moth is one of the most damaging pea pests in this country and Europe. The caterpillars feed on peas within the pod and there is a risk of crop rejection because of contamination of the produce by damaged peas which cannot be removed mechanically or reduction of crop value. Although moth damage can reduce quality, yield loss is rarely significant. Spraying is related to the development of the insect rather than to the stage of growth of the crop and insecticides should be applied while the larvae are exposed, from the time of hatching to the time of entering the pods. Application timing is therefore critical for best control. Pea moth can be a localised problem, and overall spraying of peas over a wide area on any one date is not advisable as local conditions influence pest behaviour. A system of accurately timing the application of insecticides is commercially available in the form of pheromone traps which attract male moths. By monitoring catches, growers can decide whether they need to spray, and time any necessary applications effectively. Traps are received in sets of one or two, depending on the supplier. One set is required for each block of peas and must be placed in the pea crop by the middle of May and examined at two-day intervals. Traps can be suspended on pheromone trap pole kits or fence posts in the field and are placed at canopy height.

In combining peas, the threshold for treatment is 10 or more moths caught in a trap on two consecutive occasions. Timing of sprays is related to egg development, and this is affected by temperature. A spray date can be obtained from the PGRO website, www.pgro.org, based on a computer prediction, three to four days after reaching a threshold. On the predicted spray date, crops which are at the first pod set stage or which have flowered should be sprayed, but later crops should only be sprayed when they reach first pod set. Crops with flat pods are susceptible to damage.

A second application should be applied 10-14 days later. In vining peas, where the acceptable level of damage is much lower, the threshold for combining peas is not suitable and therefore the traps should only be used as a guide as to the presence of moths.

More recently there have been developments in automatic trap technology that can record the number and identity of different pest species. Metos UK (with Pessl Instruments) supply such a trap which is integrated into their iMetos® weather station technology, and this has been effectively tested for pea moth monitoring (Figure 9).

iMetos traps can take multiple images per day and ours was programmed to take one image each day for pea moth. The trap was baited with the pheromone lure, and the software was trained to recognise and count pea moths on a sticky card placed inside the trap. This allowed us to reduce the number of field visits from every two days to once every two weeks to change the sticky card. The images can be viewed on a phone app, or from a computer (Figure 10). The technology has also been tested successfully for other pests such as bean seed fly and pea midge.

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