

**Project title** Flageolet and Edamame Beans: developing new crops for the UK processing and fresh market industry.

**Project number:** FV 329

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**Key words:** Flageolet beans, Edamame beans, variety density, yield, maturity and quality

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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

- Trial results suggest that Flageolet and Edamame beans are a suitable crop for UK production - sources of both types of beans are given at the end of the grower summary.
- Flagrano was the earliest and highest yielding of the four varieties of Flageolet tested.
- Edamame beans can be grown successfully. Mechanical shelling remains difficult for fresh market, though suitable podding machines exist in the Far East. For processing, pea viner can be used quite successfully.
- The Edamame varieties ED 5, ED 6 and ED 9 performed the best over the 2 years.
- There are no insecticides or fungicides currently approved for use on Edamame beans

## Background and expected deliverables

The search for new crop opportunities by vegetable growers has been highlighted in a recently commissioned HDC project (CP49 New Crop Opportunities). Recently frozen green soy beans (sans pods) have been marketed in the UK; these are sold as Edamame in the US (within pod). This is a very good idea in terms of bringing high protein, high phytochemical new vegetables to the table.

This project aimed to develop new crops for both the UK processing and fresh market industry by identifying varieties that can be successfully grown in the UK, together with general information on density and harvest timings.

Both Flageolet beans and Edamame soya beans could be of particular interest to:

1. Existing vining pea or combining pea growers and also green bean producers who have the necessary machinery for drilling and harvesting.
2. Existing fresh market growers of legume crops such as green beans and garden peas.
3. Organic growers.

## Summary of the project and main conclusions

In 2007 ten varieties of Edamame varieties and 8 varieties of Flageolet were screened at PGRO. Of these the best 4 varieties of Edamame and 4 varieties of Flageolet were selected for a more intensive trial. Unfortunately one variety of Edamame was not available and was substituted by a Soya variety Elena (ED 30).

Of the two species tested, Edamame soya bean is the one that has proved to be the most difficult to establish as a potential commercial proposition. The crop can be grown successfully in the UK, however harvesting is more challenging. The crop can be harvested by a conventional pea viner as a shelled product. Alternatively the beans can be harvested in their pods, either by hand or with a green bean harvester. These can either be sold as an unshelled or as a podded product. The challenge is to remove the beans from the pod.

In the Far East podding machines are available but not in the UK.

Several varieties of Edamame yielded well at both the pod and shelled stage. Both products have a market and there appears to be further potential for both in-shell and podded Edamame.

In contrast, Flageolet has proved to be relatively easy to produce at all stages of harvest. The crop can be harvested at both green or dry stages and yields are commercially viable at both.

The main conclusions are:-

#### Edamame

- As easy to grow as Green Beans. Some difficulty at harvest
- Populations of 35m<sup>2</sup> probably the best.
- 3 of the varieties tested can be grown successfully
- Do not use a regular Soya Varieties for green harvest!
- Can expect pod yields of up to 6 to 7 tonnes/ha.
- Can expect bean yields of up to 3 to 4 tonnes/ha.
- Possibly market whole plants
- Herbicides for Soya can be used on Edamame.
- No Insecticides or Fungicides are approved for Edamame.
- However in a survey of Soya done by PGRO 9 years ago, only Sclerotinia proved to be a problem.

#### Flageolet

- As easy to grow and harvest as Green Beans.
- Populations of 45m<sup>2</sup> probably the best.
- All 4 varieties tested in 2008 can be grown successfully. Flagrano appears the earliest and the highest yielding.
- Can expect green yields of up to 8 – 9 tonnes/ha.
- Can also be harvested as a dried crop.
- Possibly market whole plants
- The same range of pesticides are available for Flageolet as for Green Beans.

#### **Financial benefits**

- Enabling growers and processors to make informed decisions as to the feasibility of Flageolet or Edamame Soya bean production in the UK.
- Such production will enhance the diversity of production of beans in the UK
- Reduce the import dependence
- Offer new opportunities for production of new types of value added vegetable for several sectors of the UK horticultural industry.

#### **Action points for growers**

- Explore market potential with customers to obtain production contracts.
- Consider both Edamame and Flageolet beans as a new potential for production.
- Use the information contained in this report to make varietal and density choices.
- Processing growers consider the extension to their viner usage per season by growing these 2 crops.

## Seed Sources for Edamame and Flageolet Bean Varieties

Variety	Name	Address	Country
Source of Edamame varieties			
All Varieties	ProVeg Seeds Ltd	6 Shingay Lane Sawston Cambridge CB3 4SS	UK
Source of Flageolet varieties			
Flaforte	Pop Vriend Seeds B.V	Middenweg 52 P.O. Box 5 1619 ZG Andijk	The Netherlands
Flagrano	Holland-Select B.V.	P.O..Box 27 1619 ZG Andijk	The Netherlands
Univert Flavert	Nickerson-Zwaan B.V.	Schanseind 27 P.O. Box 28 4920 AA Made	The Netherlands

## Science Section

### Introduction

- The results of this project will provide an opportunity for horticultural producers to supply into the traditional markets, to substitute imports and to widen the range of crops available.
- The aim of the project is to evaluate a range of non GM varieties of Flageolet and Edamame beans selected from the first year of the work.
- These will be sown at 2 densities in replicated small plot trials and in small farm trials with commercial growers using commercial harvesting equipment. In addition, if successful, the results will form the basis of developing crop growing and processing guidelines for both fresh market producers and for the processed crops.

### Materials and Methods

- In 2007 ten varieties of Edamame varieties and 8 varieties of Flageolet were screened at the PGRO.  
Of these the best 4 varieties of Edamame and 4 varieties of Flageolet were selected for a more intensive trial. Unfortunately one variety of Edamame was not available and was substituted by a Soya variety Elena (ED 30).
- A series of field studies to determine the feasibility of growing these varieties in replicated trials was set up at 4 locations, 3 of which are field scale and 1 a plot trial series grown at PGRO:-

<b>Trial No:</b>	<b>Drill used</b>
1 and 3	Oyjord drill.
2 and 5	Stanhay Salvo 350
4	Vaderstat
6	Monocem



The site details are as follows:

<b>Trial 1</b>	<b>Address:</b>	PGRO: Great North Road, Thornhaugh, Peterborough, PE8 6HJ
	<b>OS Number:</b>	TF 074 010
	<b>Soil Type:</b>	Sandy clay loam
	<b>Sowing Date:</b>	25.05.08
	<b>Harvest Date:</b>	From 25.09.08
<hr/>		
<b>Trial 2</b>	<b>Address:</b>	Carrington Farms, The Estate Office, Beeches Lane, Carrington, Boston PE22 7JD
	<b>OS Number:</b>	TF 305 543
	<b>Soil Type:</b>	Medium Silt
	<b>Sowing Date:</b>	15.05.09
	<b>Harvest Date:</b>	24.09.08
<hr/>		
<b>Trial 3</b>	<b>Address:</b>	PGRO: Great North Road, Thornhaugh, Peterborough, PE8 6HJ
	<b>OS Number:</b>	TF 074 010
	<b>Soil Type:</b>	Sandy clay loam
	<b>Sowing Date:</b>	25.05.08
	<b>Harvest Date:</b>	From 01.09.08
<hr/>		
<b>Trial 4</b>	<b>Address:</b>	J. Scholes Farms, Green Lane Farm, Nafferton, East Yorkshire YO25 4LF
	<b>OS Number:</b>	TA 981 591
	<b>Soil Type:</b>	Brackish sandy loam
	<b>Sowing Date:</b>	15.05.08
	<b>Harvest Date:</b>	Not harvested due to inclement weather
<hr/>		
<b>Trial 5</b>	<b>Address:</b>	Carrington Farms, The Estate Office, Beeches Lane, Carrington, Boston PE22 7JD
	<b>OS Number:</b>	TF 305 543
	<b>Soil Type:</b>	Medium Silt
	<b>Sowing Date:</b>	19.05.09
	<b>Harvest Date:</b>	02.09.08
<hr/>		
<b>Trial 6</b>	<b>Address:</b>	Crane and Sons (Farms) Ltd, Wood Farm, Marsham, Norfolk NR10 5QQ
	<b>OS Number:</b>	TG 221 209
	<b>Soil Type:</b>	Peaty Loam
	<b>Sowing Date:</b>	19.05.09
	<b>Harvest Date:</b>	From the 01.10.08

Trial designs:

- PGRO Trial 1 - Edamame: 4 varieties were sown and established in randomised 10m x 1.83m plots x 3 replications. Plant establishment was aimed at 2 densities 30 plants m<sup>2</sup> and 45 plants m<sup>2</sup>.
- Carrington Produce Trial 2 - Edamame: 1 variety was sown and established in a 0.5Ha block. 4 sub plots measuring 10m x 1.83m plots were established within this 0.5Ha. Plant establishment was aimed at 45 plants m<sup>2</sup>.
- PGRO Trial 3 - Flageolet: 4 varieties were sown and established in randomised 10m x 1.83m plots x 3 replications. Plant establishment was aimed at 2 densities 30 plants m<sup>2</sup> and 45 plants m<sup>2</sup>.

- Scholes Trial 4 - Flageolet: 3 varieties were sown and established in a 0.5Ha blocks. 4 sub plots measuring 10m x 1.83m plots were established within this 0.5Ha. Plant establishment was aimed at 2 densities 30 plants m<sup>2</sup> and 45 plants m<sup>2</sup>.
- Carrington Trial 5 - Flageolet: 3 varieties were sown and established in a 0.5Ha blocks. 4 sub plots measuring 10m x 1.83m plots were established within this 0.5Ha. Plant establishment was aimed at 2 densities 30 plants m<sup>2</sup> and 45 plants m<sup>2</sup>.
- Aylsham Trial 6 – Flageolet: 3 varieties were sown and established in a 0.5Ha blocks. 4 sub plots measuring 10m x 1.83m plots were established within this 0.5Ha. Plant establishment was aimed at 45 plants m<sup>2</sup>.

## Methods

- As there are no UK approved insecticide seed treatments for Edamame and Flageolet, all seed was treated abroad by the suppliers with chlorpyrifos and thiram seed treatment to control bean seed fly (*Delia platura*) and damping off diseases.
- In both species broad-leaved weeds were controlled with Alpha Trifluralin 48 EC at 1.7 l/Ha pre-crop emergence.
- In all trials of both species, assessments of plant population, evenness and uniformity of emergence where made.
- Just prior to harvest in all 6 trials, 10 plants were sampled from the sub plots and measurements of yield components including pods per plant, seeds per pod, pod length and seed size was recorded. The sub plots were hand harvested and taken back to PGRO.
- Maturity was assessed in the Edamame trials, using a Martin Pea Tenderometer with the aim of harvesting at TR 105.
- Maturity was assessed in the Flageolet trials, using the standard oven method for assessing dry matter content. The ideal dry matter for harvesting is 46%.
- Trial 1 PGRO - the Edamame plots were harvested by hand. Threshed in a Garvie static plot pea viner, washed and total yield measured. Samples of each variety were both processed frozen and canned for later inspection for appearance and flavour.
- Trial 2 Carrington - after the hand removal of the sub plots, the Edamame crop was then harvested by a Ploeger pea viner to test the feasibility of commercial vining of the crop. The plants from the sub plots were threshed in a Garvie static plot pea viner, washed and total yield measured. Samples of each variety were both processed frozen and canned for later inspection for appearance and flavour. had the pods stripped off and pods were weighed, then hand shelled and the beans weighed and processed frozen for later inspection for appearance and flavour.
- Trial 3 PGRO - the Flageolet plots were harvested by hand. Threshed in a Garvie static plot pea viner, washed and total yield measured. Samples of each variety were both processed frozen and canned for later inspection for size, breakdown, gel, texture and flavour.
- Trial 4 Scholes – Unfortunately this trial was aborted 2 months after sowing. The chill factor of the easterly weather patterns in 2008 prevented any real growth in the crop.
- Trial 5 Carrington - after the hand removal of the sub plots, the Flageolet crop was then harvested by a Ploeger pea viner to test the feasibility of commercial vining of the crop. The plants from the sub plots were threshed in a Garvie static plot pea viner, washed and total yield measured. Samples of each variety were both processed frozen and canned for later inspection for size, breakdown, gel, texture and flavour.

- Trial 6 Aylsham - after the hand removal of the sub plots, logistically we were unable to harvest the crop by a Ploeger pea viner to test the feasibility of commercial vining of the crop. The plants from the sub plots were threshed in a Garvie static plot pea viner, washed and total yield measured. Samples of each variety were both processed frozen and canned for later inspection for size, breakdown, gel, texture and flavour.
- Yield data were analysed by Analysis of Variance (Genstat 5)

## Results (see tables 1 to 4 and Appendix 1 to 16)

### Edamame

There were no significant differences between yields in any treatment.

- ED 30 – The earliest variety in the trials, maturing in 120 days at both densities. ED 30 is a traditional Soya variety which was harvested green. Yields were high but final quality was poor in both flavour and colour. Beans were on the small size compared to imported product.
- PVSL ED 5 - Maturing in 124 days and 126 at the higher density, PVSL ED 5 had an attractive field appearance producing good quality pods. It produced the second highest yields of both pods and beans. Flavour and colour were good.
- PVSL ED 6 - Maturing in 124 days and 129 days at the higher density, PVSL ED 6's plants were good and produced a lot of branches. The bottom pods were held high up the plant. Compared to 2007 both the yields of pods and beans were low at both densities.
- PVSL ED 9 – Maturing in 135 days at both densities this was the later of the group in 2008. PVSL ED 9 had a vigorous plant type producing several branches and excellent looking pods and beans. Compared to 2007 both the yields of pods and beans were low at both densities. This variety was the best for appearance of the shelled product of all varieties.

### Flagolet

There were some significant differences in yield between varieties and between densities in two locations. Maturity was the same at both densities and in general yields were significantly higher at the higher density of 45m<sup>2</sup>

- Flagrano - This variety was the earliest and highest yielding variety in all trials. In general the plant habit etc was fairly good, it did however put a lot of it's pods on the soil at Carrington. The quality of the canned sample was judged to be good, beans were large with flavour being good, though one canned sample had some splitting.
- Univert - Yields were good at PGRO though at Carrington not so, plants were average height, producing long slender pods which were held low on the plant. The quality of the canned product was judged to be good, much better than the purchased commercial samples.
- Flavert – Was the tallest variety in all trials and had a good plant habit. The plants had a large number of very slender pods producing a good yields. The flavour quality of the canned sample was judged to be the best in trial.
- Flaforte - Judged to be the earliest variety at this stage of harvest. Flaforte had a average plant habit, with no pods touching the soil at either PGRO or Aylsham sites. Yield was a little disappointing, it being significantly lower in all trials. The canned product was judged to have a reasonable quality.

**TABLE 1 Edamame:** Trials 1 & 2 - summary of agronomic data - 2008

Varieties placed in order of maturity at corrected TR 105.

Variety	Source	1000 seed weight (g)	Plants per m <sup>2</sup>	Harvest							Pod characteristics						
				Harvest date	No days to harvest	TR	No days corrected to TR 105	Pod yield Tonnes/Hectare	Bean yield Tonnes/Hectare	% shelled bean to pod ratio	Plant height (cm)	Height bottom pod (cm)	No pods per plant	Length (cm)	Width (cm)	No beans per pod	10 seed length mm
<u>Sown: Trial 1- PGRO 20<sup>th</sup> May 2008</u>																	
Target population 30 plants per m <sup>2</sup> .																	
ED 30	LM & P	220	32.0	25 <sup>th</sup> sept	128	140	120	7.06	2.30	29.0	47.4	9.6	19.2	5.4	1.0	2.6	119
PVSL ED 5	ProVeg	283	28.4	25 <sup>th</sup> sept	128	115	124	5.84	2.34	29.0	35.4	9.8	29.2	6.0	1.4	2.2	150
PVSL ED 6	ProVeg	366	24.5	25 <sup>th</sup> sept	128	116	124	3.44	1.04	37.9	47.4	14.3	22.3	6.1	1.4	2.5	159
PVSL ED 9	ProVeg	333	26.0	29 <sup>th</sup> sept	132	95	135	3.34	1.01	32.7	47.0	12.5	31.9	6.4	1.4	2.9	156
Target population 40 plants per m <sup>2</sup> .																	
ED 30	LM & P	220	38.2	26 <sup>th</sup> sept	129	160	121	8.63	3.21	33.5	48.0	8.4	22.4	4.7	0.9	3.0	114
PVSL ED 5	ProVeg	283	35.0	27 <sup>th</sup> sept	130	114	126	6.73	2.55	26.1	50.6	10.4	30.6	6.6	1.5	2.8	148
PVSL ED 6	ProVeg	366	30.1	27 <sup>th</sup> sept	130	109	129	3.89	1.06	37.9	46.2	11.7	24.2	6.3	1.4	2.8	164
PVSL ED 9	ProVeg	333	29.0	29 <sup>th</sup> sept	132	95	135	3.53	1.21	37.4	46.4	10.7	35.9	6.7	1.4	2.7	165
LSD @ P = 0.05								12.768	4.9660								
Probability								0.240	0.227								
CV%								9.3	9.8								

Variety	Source	1000 seed weight (g)	Plants per m <sup>2</sup>	Harvest date	No days to harvest	TR	No days corrected to TR 105	Pod yield Tonnes/Hectare	Bean yield Tonnes/Hectare	% shelled bean to plant ratio	Plant height (cm)	Height bottom pod (cm)	No pods per plant	Length (cm)	Width (cm)	No beans per pod	10 seed length mm
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Sown: Trial 2 - Carrington 15<sup>th</sup> May 2008

Target population 45 plants per m<sup>2</sup>.

PVSL ED 5	ProVeg	220	48.5	30 <sup>th</sup> sept	138	112	135	11.83	1.32	11.6	54.4	12.4	28.8	4.8	1.1	2.5	143
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**TABLE 2 Flageolet: Trial 3 - Summary of agronomic data – 2008**

Varieties placed in order of maturity at % Dry Matter

Variety	Source	1000 seed weight (g)	Plants per m <sup>2</sup>	Plant height (cm)	Harvest					Pod Characteristics								
					No days to harvest 45% dry matter	% dry matter	Haulm and pods Tonnes/ Hectare	Bean net yield Tonnes/ Hectare	% bean to haulm ratio	Height bottom pod (cm)	Pods touching soil (1-5)	Number per plant	Average shape (1-5)	Average length (cm)	Average Width (mm)	Number beans per pod	10 seed length mm	
<u>Sown: trial 3 PGRO 20th May 2008.</u>		<u>Harvest: 2nd September 2008.</u>																
Target population 30 plants per m <sup>2</sup> .																		
Flagrano	HS	204	27.4	26.2	104	44.5	18.67	4.83	25.8	12.3	4.8	10.7	4.5	11.6	8.1	6.1	152	
Univert	NiZ	200	27.3	29.4	105	41.9	17.93	3.51	20.2	10.7	3.5	15.3	3.8	13.5	7.7	6.2	143	
Flavert	NiZ	179	26.3	31.4	106	38.2	19.93	4.28	21.5	11.4	3.6	17.3	4.0	11.7	7.6	6.4	137	
Flaforte	PV	200	28.3	23.8	107	36.3	14.87	1.83	12.3	11.8	4.0	15.0	3.5	11.7	8.0	6.7	145	
Target population 45 plants per m <sup>2</sup> .																		
Flagrano	HS	204	45.4	24.1	106	43.8	24.80	6.11	24.6	12.6	4.0	8.8	4.3	11.7	7.8	6.2	157	
Univert	NiZ	200	29.4	26.5	107	39.6	21.87	4.66	21.6	10.2	3.4	13.5	4.5	12.9	7.8	6.2	147	
Flavert	NiZ	179	47.1	26.6	107	40.3	24.80	5.38	21.7	12.0	4.8	13.3	4.5	11.3	7.5	6.5	145	
Flaforte	PV	200	30.7	25.1	108	38.0	22.13	3.63	16.4	13.0	4.6	11.0	4.3	11.6	7.8	6.6	148	
LSD @ P = 0.05							3.711	0.555										
Probability							0.145	< .001										
CV%							11.2	8.1										

Note. Pod Shape: 1 = v. curved, 5 = straight. Pods on soil: 1 = most, 5 = none

**TABLE 3 Flageolet:** Trials 5 & 6 - Summary of agronomic data – 2008

Varieties placed in order of maturity at % Dry Matter

Variety	Source	1000 seed weight (g)	Plants per m <sup>2</sup>	Plant height (cm)	Harvest					Pod Characteristics							
					No days to harvest 45% dry matter	% dry matter	Haulm and pods Tonnes/Hectare	Bean net yield Tonnes/Hectare	% bean to haulm ratio	Height bottom pod (cm)	Pods touching soil (1-5)	Number per plant	Average shape (1-5)	Average length (cm)	Average Width (mm)	Number beans per pod	10 seed length mm
<u>Sown: trial 3 – Carrington 16th May 2008</u>					<u>Harvest: 2nd September 2008.</u>												
Target population 30 plants per m <sup>2</sup> .																	
Flagrano	HS	204	45.8	19.6	110	39.6	21.11	2.83	13.3	8.8	2.7	13.4	3.0	12.0	8.2	6.2	163
Flaforte	PV	200	48.0	23.0	110	39.2	20.11	2.40	11.9	9.7	4.0	19.0	4.0	12.2	7.7	6.6	145
Univert	NiZ	200	33.1	22.9	111	38.2	15.72	1.68	10.5	9.8	3.3	14.6	3.8	12.7	7.8	6.1	145
Target population 45 plants per m <sup>2</sup> .																	
Flagrano	HS	204	53.8	23.5	110	40.8	26.94	4.20	15.8	9.7	3.0	15.3	4.0	12.2	8.1	6.1	162
Flaforte	PV	200	51.3	27.0	110	40.1	15.72	2.13	11.3	9.4	4.0	14.2	3.9	12.7	8.3	6.6	133
Univert	NiZ	200	37.8	22.8	111	38.2	13.56	1.47	11.1	8.6	3.0	13.2	3.8	12.7	8.1	6.2	139
LSD @ P = 0.05							6.172	0.9178									
Probability							0.028	0.006									
CV%							18.5	21.6									
<u>Sown: Trial 6 - Aylsham 11th June 2008</u>					<u>Harvest: 1st October 2008</u>												
Target population 45 plants per m <sup>2</sup> .																	
Flagrano	HS	204	44.2	47.3	106	39.2	38.70	8.61	22.3	19.2	5.0	15.7	4.5	13.0	12.2	6.1	165
Flaforte	PV	200	27.1	42.7	107	37.3	29.74	5.05	16.9	14.9	5.0	27.1	4.8	13.5	12.9	6.7	163
Flavert	NIZ	200	43.7	49.4	107	37.3	44.52	7.52	16.9	19.9	5.0	21.4	4.5	12.7	12.5	6.4	152
LSD @ P = 0.05							2.284	0.738									
Probability							< .001	< .001									
CV%							3.5	6.0									

Note. Pod Shape: 1 = v. curved, 5 = straight. Pods on soil: 1 = most, 5 = none

**TABLE 4 Edamame: Quality appraisal of fresh product**

Variety	Size 5=large 1 = v.small	Eveness of size 5=even 1=v.uneven	Bean Colour 5=good 1=v.poor	Hilem Colour 5=good pale 1=v.dark	Texture 5=good 1=poor	Flavour 5=good 1=poor	Remarks
ED 30	2.5	5.0	2.5	1.0	1.0	2.0	very poor, yellow and mixed
PSVL ED 5	4.5	4.5	4.5	4.5	4.0	4.0	good
PSVL ED 6	5.0	5.0	4.3	3.0	4.0	4.0	good
PSVL ED 9	4.8	5.0	4.5	5.0	4.0	4.5	very good

**TABLE 5 Flageolet: Quality appraisal of fresh canned product**

Variety	Size compared to Asda product	Eveness of size 5=even 1=v.uneven	Breakdown and splitting 5=none 1=v.bad	Gel	Colour 5=good 1=v.poor	Texture 5=good 1=poor	Flavour 5=good 1=poor	Remarks
Target population 30 plants per m <sup>2</sup> .								
Flaforte	same	5.0	4.5	none/clear	3.0	4.0	4.0	good
Flagrano	same	5.0	3.5	present/clear	3.0	4.0	5.0	ok, good flavour
Univert	same	5.0	5.0	none/clear	3.0	3.5	4.0	really good
Flavert	same	5.0	5.0	none/clear	3.0	3.0	5.0	really good, good flavour
Target population 45 plants per m <sup>2</sup> .								
Flaforte	smaller	5.0	4.5	present/clear	3.0	4.0	4.0	good
Flagrano	smaller	5.0	4.0	present/clear	3.0	3.5	4.5	ok
Univert	same	5.0	4.0	present/clear	3.0	4.0	4.5	good
Flavert	same	5.0	3.0	present/clear	3.0	3.0	5.0	ok, good flavour
Quality references								
Sainsbury	Larger	2.0	2.0	present/clear	2.0	1.5	1.0	breaking down, very thick gell
Asda	med to large	3.0	3.0	None/cloudy	1.5	1.0	1.0	very poor, watery



## Conclusions

### Edamame

- As easy to grow as Green Beans. Some difficulty at harvest?
- Populations of 35m<sup>2</sup> probably the best.
- The 3 varieties PSVI ED 5, 6 and 9 can be grown successfully.
- Do not use a regular Soya Varieties for green harvest!
- Can expect pod yields of up to 6 to 7 tonnes/ha.
- Can expect bean yields of up to 3 to 4 tonnes/ha.
- Possibly market whole plants?
- Herbicides for Soya can be used on Edamame.
- No Insecticides approved for Edamame.
- However in a survey of Soya done by PGRO in the early 2000's, only Sclerotinia proved to be a problem.

### Flageolet

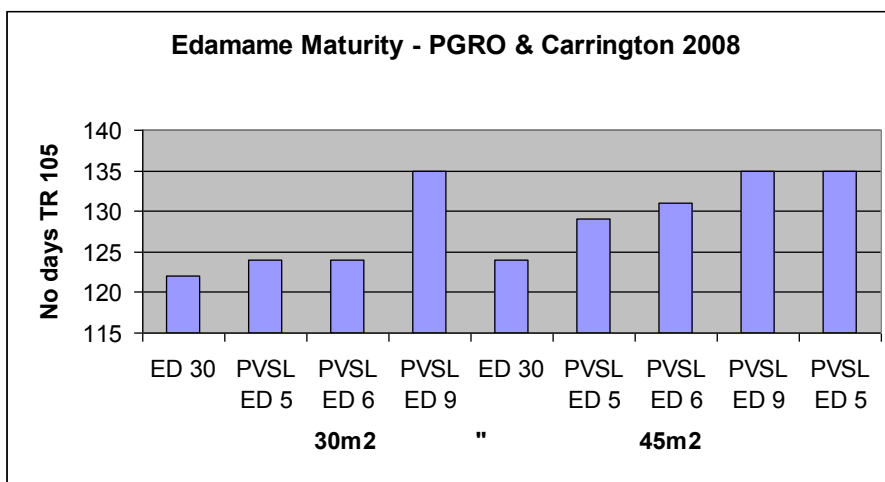
- As easy to grow as Green Beans.
- Populations of 45m<sup>2</sup> probably the best.
- We now have a range of recommended commercial varieties. Flagrano appears the earliest and the highest yielding.
- Can expect green yields of up to 8 – 9 tonnes/ha.
- Can also be harvested as a dried crop.
- Market whole plants?
- The same range of Pesticides are available for Flageolet as for Green Beans.

## Technology transfer

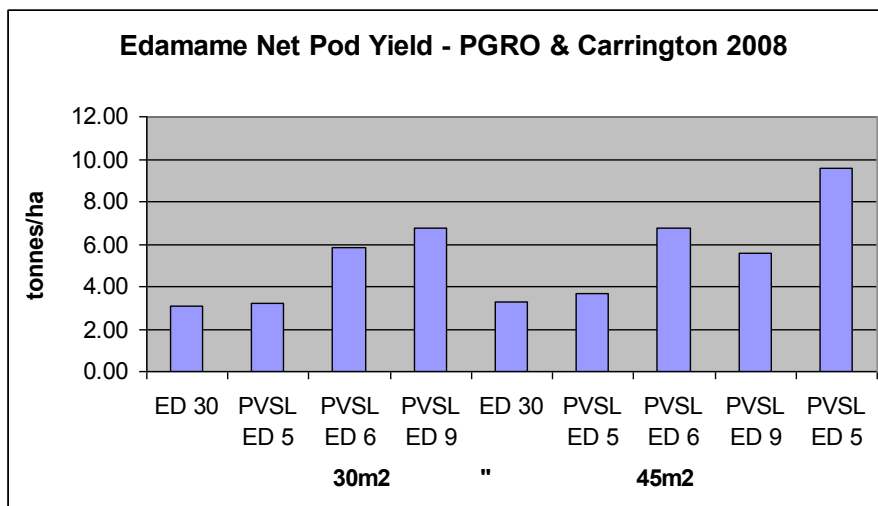
- An informal open day of the Thornhaugh trials was held at the trial site in mid August 2008, but the trial was also available for viewing at people's convenience.
- Samples were presented at the PGRO Varieties Day on 10 November 2008.
- A summary of results were given at the Vegetable Agronomists Association meeting on 11 November 2008

## Appendices

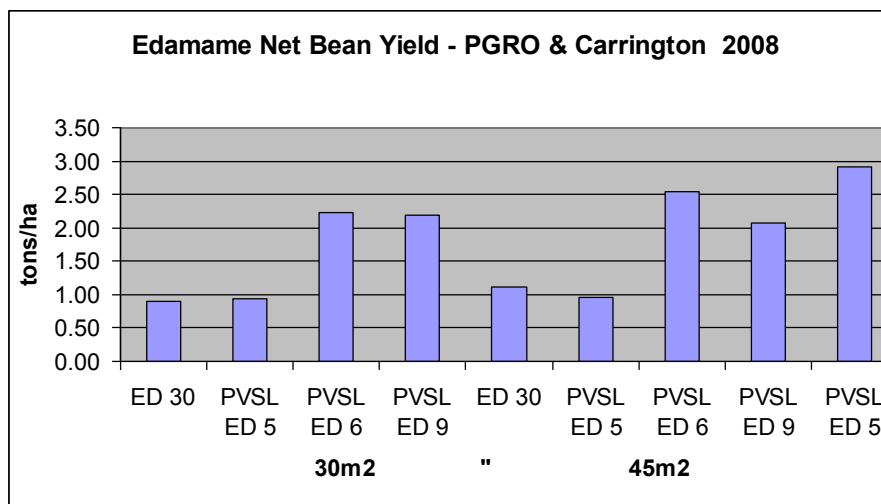
### Appendix 1



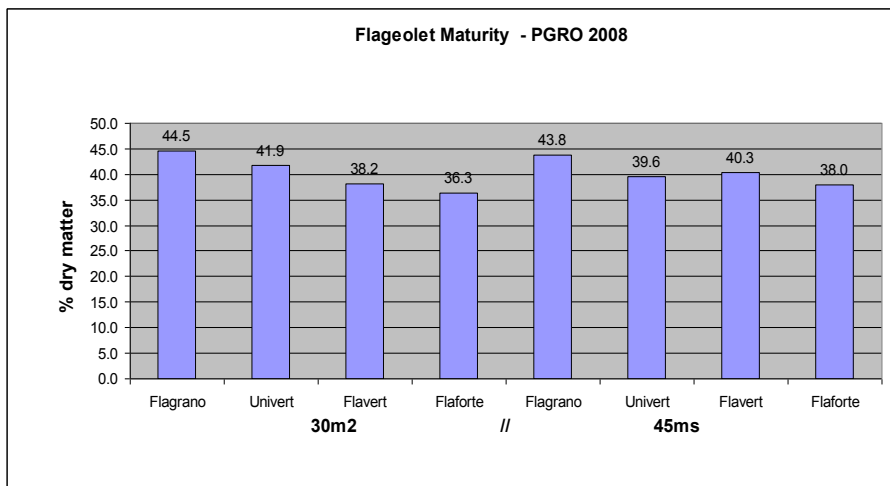
### Appendix 2



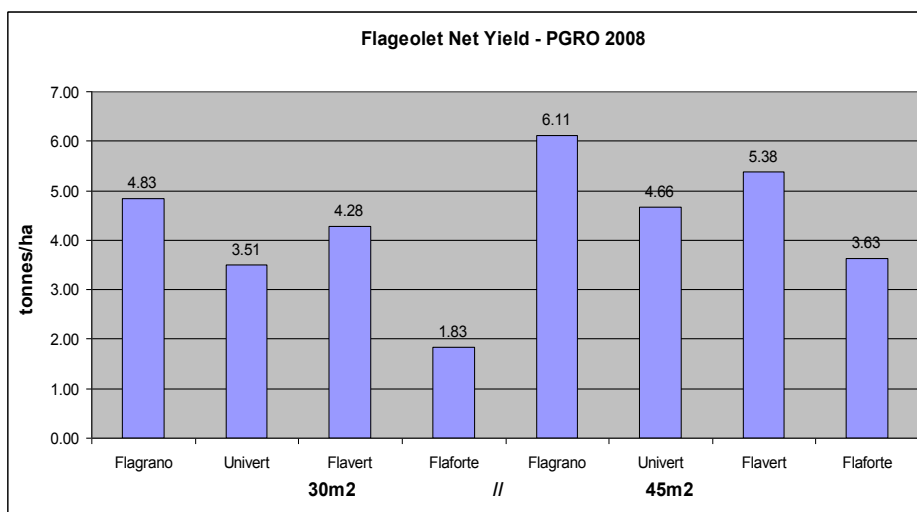
### Appendix 3



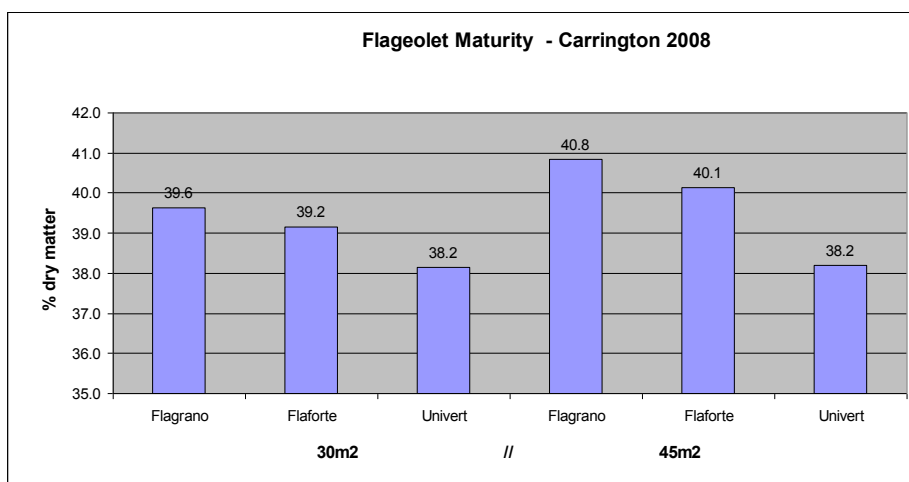
Appendix 4



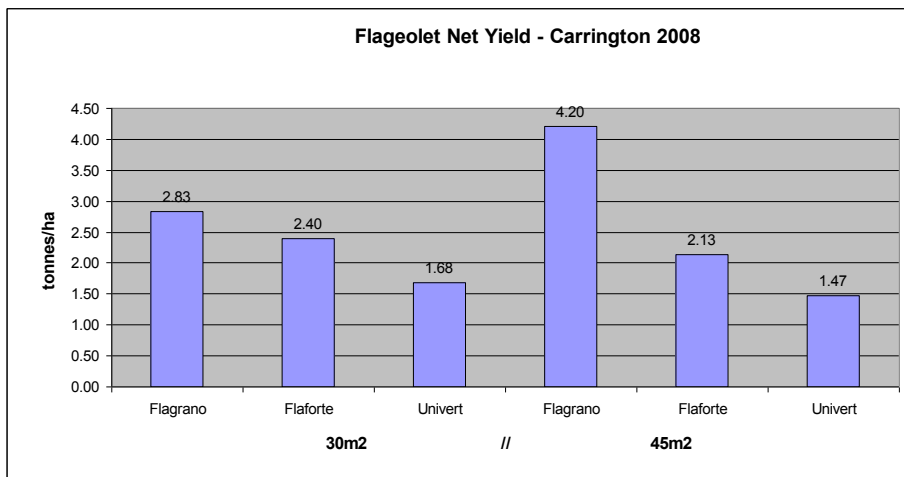
Appendix 5



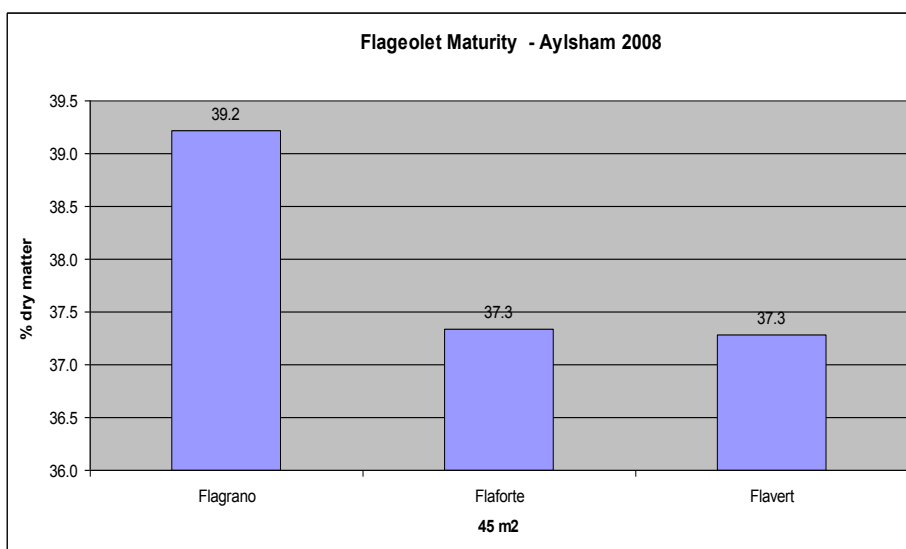
Appendix 6



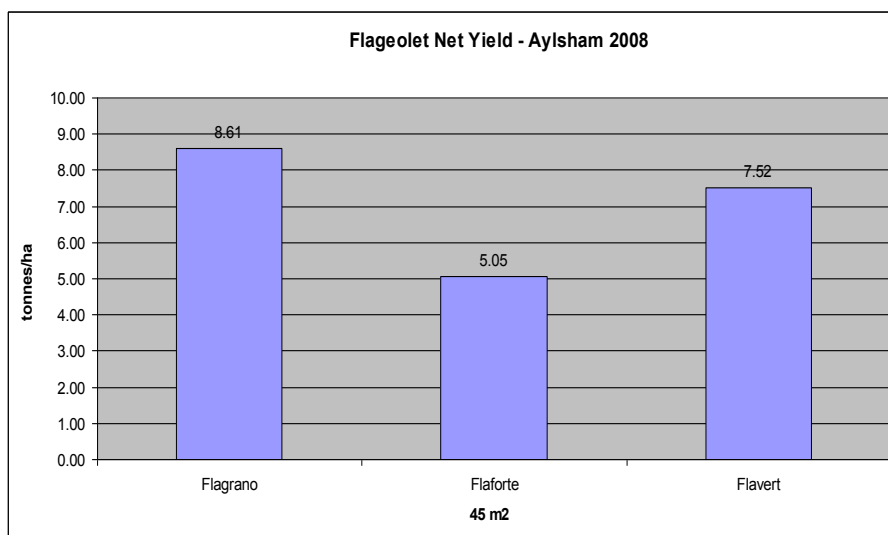
Appendix 7



Appendix 8



Appendix 9



Appendix 10 – Edamame Trial 1 - PGRO September 2008



Appendix 11 – Flageolet Trial 5 - Carrington September 2008



Appendix 12 – Flageolet Trial 6 - Aylsham September 2008.



Appendix 13 – Typical Edamame sample 10<sup>th</sup> November 2008





Appendix 14 – Varieties day demonstration 10<sup>th</sup> November 2008.



## Appendix 15

### PROCESSING DETAILS FOR FROZEN SAMPLES

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

The processing details for Edamame are given below:-

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

The processing details for Flageolet are given below:-

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

## Appendix 16 - Source of Edamame varieties

Code	Name	Address	Country
L M & P	Lyle Morrison & Partners	Manor Farm The Green North Wooton Kings Lynn Norfolk PE30 3PR	UK
ProVeg	ProVeg Seeds Ltd	6 Shingay Lane Sawston Cambridge CB2 4SS	UK

## Appendix 17 - Source of Flageolet varieties

Code	Name	Address	Country
PV	Pop Vriend Seeds B.V	Middenweg 52 P.O. Box 5 1619 ZG Andijk	The Netherlands
HS	Holland-Select B.V.	P.O..Box 27 1619 ZG Andijk	The Netherlands
Niz	Nickerson-Zwaan B.V.	Schanseind 27 P.O. Box 28 4920 AA Made	The Netherlands