Project Title:	Vining Peas: Evaluation of Precision Sowing
Project Number:	FV 297
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‘The results and conclusions in this report are based on an investigation conducted over one year. The conditions under which the experiment was carried out and the results obtained have been reported with detail and accuracy. However because of the biological nature of the work it must be borne in mind that different circumstance 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

Headline

- Trials with a range of vining pea seed rates drilled with both a Herriau precision drill and a Vaderstad drill were carried out in commercial vining pea crops
- Based on this year's data there was correlation between plant density and yield.
- The precision drill (Herriau) gave a more even plant stand than the non-precision drill (Vaderstad), but no significant yield benefit was recorded at 2 of the 3 sites
- The precision drillings resulted in an advanced (equivalent to 2 days) maturity of the peas at the freezing stage at 2 of the 3 sites.

Background

There is an increasing need to reduce costs and improve yield and quality in the production of vining peas. The use of precision type drills could do this, although little published information exists to justify their use in preference to the more conventional type of drill.

There are several factors that may be influenced by such drilling including a reduction of seed rate and an improvement in the evenness of size, maturity and colour

Challenges - To reduce production costs and provide improved quality and yields.

Opportunities –

- To improve the efficiency of seeding, provide a more even establishment and produce a more even maturity throughout the crop
- The increasing seed costs and production costs necessitates a re-evaluation of the seed rates of new commercial varieties with an aim of reducing growing costs.
- To adjust current recommendations for optimum plant populations adjusted where precision and non precision drilling is used.
- A precise even population may produce less colour variation within the produce

Summary

In the second year of the project, trials were carried out with a precision (Herriau) and a non-precision drill (Vaderstad) in 4 commercial crops of Twinkle, Waverex, Ibis and Barle vining peas. The performance of peas sown at a range of planting densities was recorded (84 - 161 plants per square metre). Plant distribution by the precision drill was as expected, markedly more even than that from the non precision drill and in some instances this effect on yield and sieve size produced a more evenly maturing crop resulting in earlier maturity than the non-precision drill.

Financial Benefits

- There are no financial benefits arising from this work at present. However the possible reduction in size grade variation may improve crop value.
- There was an indication that precision drilling reduced total pea haulm weight and this would aid and reduce harvesting costs.
- There was an indication that varying certain variety populations could increase yields or reduce seed costs.

Any benefits accrued from the results of the two year project may assist drill manufacturers in their designs and future development.

Action Points for Growers

- Use precision drilling to ensure an even plant distribution and in most cases to provide earlier maturity than a non-precision drill.
- Use precision drilling to provide less wastage from small sized peas.
- As yet there is no indication that new recommendations for seed rates are made, though there is an indication that this could be varied in some varieties. Continue to use recommended seed rates for any type of drill.
- Ensure that drills are calibrated accurately to supply the required seed rate.
- Use precision drilling to reduce pea haulm volume.

SCIENCE SECTION

Introduction

There is an increasing need to reduce costs and improve yield and quality in the production of vining peas. The use of precision type drills could do this, although little published information exists to justify their use in preference to the more conventional type of drill.

There are several factors that may be influenced by such drilling including a reduction of seed rate and an improvement in the evenness of size, maturity and colour.

The project addresses these aspects in a series of field studies to determine the benefits of precision sowings over conventional sowings in replicated trials on 4 locations using 4 varieties on field scale trials in commercial crops.

Materials and Methods

A series of field studies to determine the benefits of precision sowings over conventional sowings in replicated trials were set up at 4 locations using 4 varieties on field scale trials in commercial crops.

Varieties used were Twinkle (first early), Waverex (standard petite pois), Barle (semi leafless maincrop) and Ibis (semi leafless late maincrop).

In trials 1 to 4 drills used; Conventional - Vaderstad Rapid A
Precision - Herriau Turbosem

The site details are as follows:

Trial 1	Swaythorpe Growers, Eastburn Farms Ltd, Eastburn, Driffield, East Yorks. OS Number: SE 984 563. Soil type: medium clay loam Variety Twinkle Sowing date 28.03.07 Harvest date 28.06.07
Trial 2	Swaythorpe Growers – JH & MW Mewbrn Ltd, Sandsfield, Brandsburton, East Yorks. OS Number: TA 146 457 Soil type: medium clay loam Variety: Waverex Sowing date: 25.04.07 Harvest date: flooded - not harvested
Trial 3	Swaythorpe Growers – Harrison Farms Ltd, West End Farm, Kilham,

	East Yorks. OS Number: SE 928 677. Soil type: medium chalk loam Variety: Ibis Sowing date: 24.05.07 Harvest date: 29.08.07
Trial 4	Swaythorpe Growers – F.H.Wastling, Thirtleby Grange, Coniston, Hull, East Yorks. OS Number: TA 147 368 Soil type: medium clay loam Variety Barle Sowing date: 29.05.07 Harvest date: 21.08.07

Trial layout: The trials in the 4 commercial crops consisted 1 ha drilled plots for each sowing rate, drill and variety.

Three sowing rates to provide 80, 110 and 140 plants per sq m were targeted using both the precision drill and the conventional drill. Within each drilled area 4 replicate plots measuring 2m x 5m were marked out immediately after drilling. Recordings were made in each of the marked sub plots. Evenness and uniformity of emergence, spacing and seedling establishment growth stage were assessed. Just prior to field harvest, 10 plants were sampled from the sub plots and measurements of yield components including numbers of pods per plant, seeds per pod, and stem numbers was recorded.

The sub-plots were then harvested by hand, vined in a plot pea viner and washed.
As a result of size grade influences in the 2006 series of trials, the number of size fractions graded out were increased from the previous 4 to 6 using a Mather & Platt size-grader. Each grade was weighed individually and overall total yield measured.
Maturity was assessed from the sampled areas using a Martin Pea Tenderometer.

Results

In 2007 March, April and the first half of May were very dry and in fact in the Yorkshire region where all the trials had been located only 7.4mm of rain fell. This was only 12% of the 20 year average of 61.72mm of rain.

The rest of May, June, July and Augusts temperatures were below average, or average with very few sunshine hours.

Rainfall was very high in June 246.4mm fell, much higher than the 20 year average of 63.8mm and also in July when 104.4mm fel when the 20year average was only 59.9mm .
Thursday 14th and Monday 25th June were defining days for the trials with 61mm of rain falling in a few hours on the 14th and 72mm of rain falling in 4 hrs both in the Yorkshire region of the trials.

This rainfall destroyed trial 2 - Waverex and compromised trial 3 - Barle

Establishment

The actual established populations were either exactly on target or above the target but the range achieved was considered to be satisfactory for the comparisons to be made between the two drills. (Appendix 1 - Tables 1, 4 and 7).

The distribution of plants over the trial area was assessed by counting in four quarters of the quadrat recorded at 6 positions within each plot.

The mean plants per sq m of each quarter were expressed in distribution histograms for each drill and population for each site (Appendix 2 - Figures 1, 2 and 3). The data presented as plants established in each quarter of the quadrat, clearly showed a more even distribution of plants from the precision drill when compared with the non precision drill in trials 1 and 4, whilst in trial 3 both drills were uneven.

Yield

The Yorkshire trial 2 - Waverex was not harvested as the field was severely affected by flooding.

In all other trials (Appendix 1 - Tables 2, 5 and 8) there was a general tendency for the yields achieved by either drill to be similar and not significantly different, in only Ibis (Table 5) was there any significant increase of yield by one sowing system over the other.

Differences in yield with increasing populations produced by both conventional sowing (Vaderstad) and precision sowing (Herriau) were statistically significant at one site (Appendix 1 - Table 5).

At the Ibis trial the yield increased with increasing plant population with both drilling systems. With the variety Twinkle there was very little yield differences with increasing populations. Whilst the variety Barle produced some of the highest yields in all trials, there was no significant increase at the higher populations over the lower ones.

Maturity

In one of the three trials the earliest maturing variety (Twinkle) (Table 3) there was a statistically significant effect of advanced maturity from the precision drill (Herriau) compared with the conventional drill (Vaderstad). This equated to 1 – 2 days advancements, but in only one of the three trials (Table 6) there was a statistically significant effect of advanced maturity between the populations.

The maturity of the Barle trial (Table 9) were compromised by severe flooding patches around the crop causing severe root death and subsequent high tenderometer readings.

Pea size grades

In 2007 the peas were graded into 6 size fractions

- S1 - very small (below7.5)
- S2 - small 1 (7.5 to 8.2mm)
- S3 - small 2 (8.2 to 8.75mm)
- S4 - medium 1 (8.75 – 9.3mm)
- S5 - medium 2 (9.3 to 10.2 mm)
- S6 - large (<10.2 mm).

See Appendix Tables 10, 11 and 12.

Seed distribution between the non-precision and precision drills

Plant counts made in each of four quadrants of a circular ⅓m² quadrant showed a greater variation of plant distribution with the non-precision drills compared with the precision drill at all of the achieved populations in both Trial 1 - Twinkle and Trial 4 - Barle.

This resulted in a markedly even plant stand as recorded in each quarter of the quadrat, compared with the population achieved by the non precision sowing. It is likely that this was an influencing factor in the advanced maturity of the Twinkle trial.

In Trial 3 – Ibis the variation was similar both in the precision and non precision sowings and there was no differences in maturity between the two methods of sowing.

Conclusions

It was very clear in two of the trials that the plant distribution from the precision drillings was much more even than for the non precision and it is likely that this resulted in all the plants reaching maturity at the same time whereas the unevenly spaced plants were at different maturities at harvest thereby resulting in a more uneven distribution of young and older peas producing an average tenderometer reading lower than the those from the precision drill.

It was interesting to note that yield was not significantly improved by the precision drilling. It was also noted that yield did not always clearly correlate with plant population. However, there was evidence to

suggest that populations of more and less than the currently recommended commercial standard of 100 plants per sq m would be of benefit, dependant on the variety grown.

There was a tendency for a more even size grading of peas following precision drilling. Sizes S1 and S2 are normally lost in the factory processing and precision sowing produces a lower percentage in these grades, than does the non precision sowing.

APPENDIX 1

Table 1: Twinkle plant establishment

	Achieved population/m²		
Target population	Vaderstad	Herriau	Mean
80	99.7	102.2	101.0
110	128.3	133.5	130.9
140	160.5	162.5	161.5

LSD for population 8.75 (sig)
LSD for drill 25.8 (ns)
LSD for population x drill 23.8 (ns)

Table 2: Twinkle net yield t/ha

Mean achieved population	Vaderstad	Herriau
101	4.60	5.21
131	5.23	5.26
162	5.70	5.88

LSD for population 0.66 (sig)
LSD for drill 0.87 (ns)
LSD for population x drill 0.64 (ns)

Table 3: Twinkle maturity

	TR	
mean achieved population	Vaderstad	Herriau
101	93.0	100.8
131	94.8	102.1
162	91.5	98.8

LSD for population 3.16 (ns)
LSD for drill 1.72 (sig)
LSD for population x drill 3.77 (ns)

Table 4: Ibis plant establishment

	Achieved population/m²		
Target population	Vaderstad	Herriau	Mean
80	92.2	77.2	84.7
110	121.2	120.0	120.6
140	152.0	130.0	140.0

LSD for population 8.8 (sig)
LSD for drill 12.2 (sig)
LSD for population x drill 13.1 (ns)

Table 5: Ibis net yield t/ha

mean achieved population	Vaderstad	Herriau
85	5.5	4.8
121	6.8	6.0
140	7.1	6.5

LSD for population 0.35 (sig)
LSD for drill 0.21 (sig)
LSD for population x drill 0.42 (ns)

Table 6: Ibis maturity

		TR
mean achieved population	Vaderstad	Herriau
85	113.9	114.5
121	107.4	107.5
140	106.0	105.2

LSD for population 1.37 (sig)
LSD for drill 2.75 (ns)
LSD for population x drill 2.62 (ns)

Table 7: Barle plant establishment

	Achieved population/m²		
Target population	Vaderstad	Herriau	Mean
80	77.5	91.5	84.5
110	113.5	111.7	112.6
140	131.5	173.0	152.3

LSD for population 7.45(sig)
LSD for drill 5.08 (sig)
LSD for population x drill 9.10 (sig)

Table 8: Barle net yield t/ha

mean achieved population	Vaderstad	Herriau
85	6.84	7.85
113	7.11	7.49
152	8.71	8.59

LSD for population 1.82 (ns)
LSD for drill 1.96 (ns)
LSD for population x drill 2.45 (ns)

Table 9: Barle maturity

	TR	
mean achieved population	Vaderstad	Herriau
85	143.8	148.6
113	160.0	152.4
152	156.4	180.4

LSD for population 16.9 (sig)
LSD for drill 17.7 (ns)
LSD for population x drill 22.5 (ns)

Table 10: Size grades of Twinkle

Vaderstad drill Plant population	wt very small size S1	wt small size S2	wt med-small size S3	Wt med size S4	Wt large size S5	Wt very large size S6
100	0.32	0.78	0.83	0.80	1.02	0.87
128	0.29	0.74	0.97	0.91	1.32	1.0
160	0.32	0.80	1.13	1.13	1.33	1.0

Herriau drill Plant population	wt very small size S1	wt small size S2	wt med-small size S3	Wt med size S4	Wt large size S5	Wt very large size S6
102	0.21	0.54	0.74	0.95	1.37	1.4
134	0.22	0.59	0.87	1.01	1.38	1.19
163	0.21	0.56	1.16	1.09	1.53	1.32

There was a significant difference in the S1 size grades between the two drills (LSD 0.04) but no effects of population.

There was a significant difference in the S2 size grades between drills (LSD 0.04) but no effects of population.

The S3 size grades were significantly increased by population (LSD 0.29) but not by the drills.
The S4 size grades were significantly increased by increasing populations with the Vaderstad drill (LSD 0.15) but no difference between drills.

The S5 size grade was increased between the 101 and 131 population by the Vaderstad and between the 131 and 161 population with the Herriau drill (LSD 0.19). But there was no significant effect caused by the drills. However, the proportion of peas in the very large size grade S6, was significantly higher from the Herriau drill than the Vaderstad (LSD 0.15)

Table 11. Size grades of Ibis

Vaderstad drill Plant population	wt very small size S1	wt small size S2	wt med-small size S3	Wt med size S4	Wt large size S5	Wt very large size S6
92	0.34	0.53	0.6	0.75	1.43	1.88
121	0.45	0.76	0.83	1.12	1.79	1.88
152	0.52	0.88	0.96	1.27	1.76	1.70

Herriau drill Plant population	wt very small size S1	wt small size S2	wt med-small size S3	Wt med size S4	Wt large size S5	Wt very large size S6
77	0.29	0.46	0.49	0.63	1.16	1.81
120	0.43	0.72	0.75	0.94	1.53	1.61
130	0.49	0.80	0.86	1.13	1.74	1.55

There was a significant difference in the S1 size grades with increases in the population (LSD 0.03) but no effects between the drills (LSD 0.06)

There was a significant difference in the S2 size grades between drills (LSD 0.04) and with increasing populations (LSD 0.07)

The S3 size grades were significantly increased by population (LSD 0.06) and between the drills (LSD 0.04) at the highest population.

The S4 size grades were significantly increased by population (LSD 0.08) and between the drills (LSD 0.05) at the high and low populations.

The S5 size grade was increased by population by both drills (LSD 0.15) and at the lower populations; there was a significant decrease of the size grade proportion with the Herriau drill. (LSD 0.17)

The Herriau drill produced a significantly lower proportion of very large size grade peas S6 at the higher populations than with the Vaderstad drill (LSD 0.12)

Table 12. Size grades of Barle

Vaderstad drill Plant population	wt very small size S1	wt small size S2	wt med-small size S3	Wt med size S4	Wt large size S5	Wt very large size S6
78	0.04	0.11	0.15	0.27	1.31	4.95
114	0.15	0.04	0.26	0.15	1.26	5.40
132	0.02	0.06	0.12	0.29	2.1	6.12

Herriau drill Plant population	wt very small size S1	wt small size S2	wt med-small size S3	Wt med size S4	Wt large size S5	Wt very large size S6
92	0.03	0.08	0.12	0.23	1.65	5.76
112	0.04	0.11	0.14	0.27	1.66	5.26
173	0.01	0.04	0.09	0.22	1.88	6.35

There were no significant differences in size grades at S1, S2, S3 or S4 with population differences or between drills.

Size grades S5 showed significant differences at the highest population with both drills (LSD 0.42) and between drills (LSD 0.13) with the Herriau drill producing the lowest proportion of S5 size grades than with the Vaderstad. However none of the differences in proportions of Size grade S6 were statistically significant

Figure 1: Plant distribution in the quadrat - Twinkle

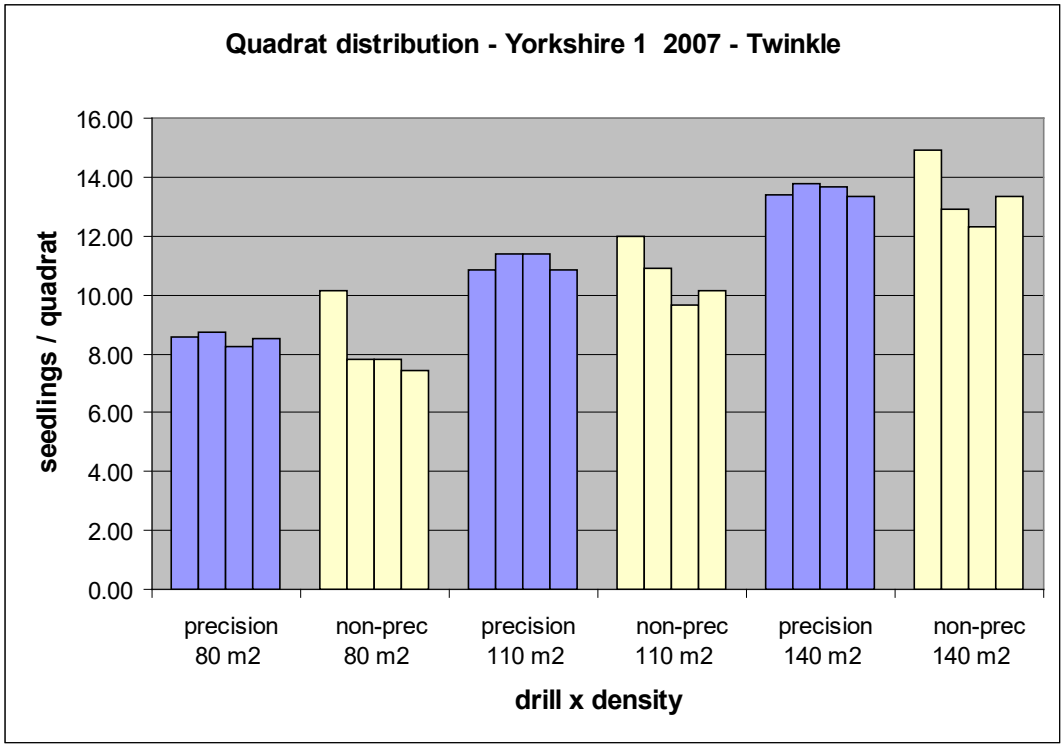


Figure 2: Plant distribution in the quadrat - Ibis

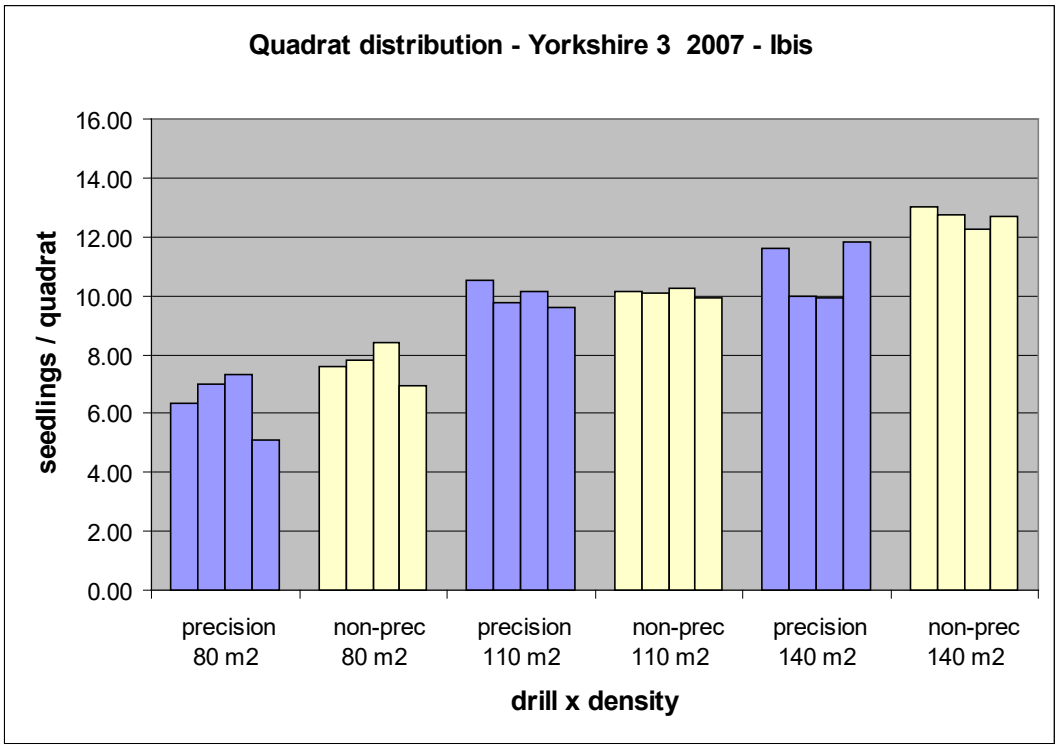
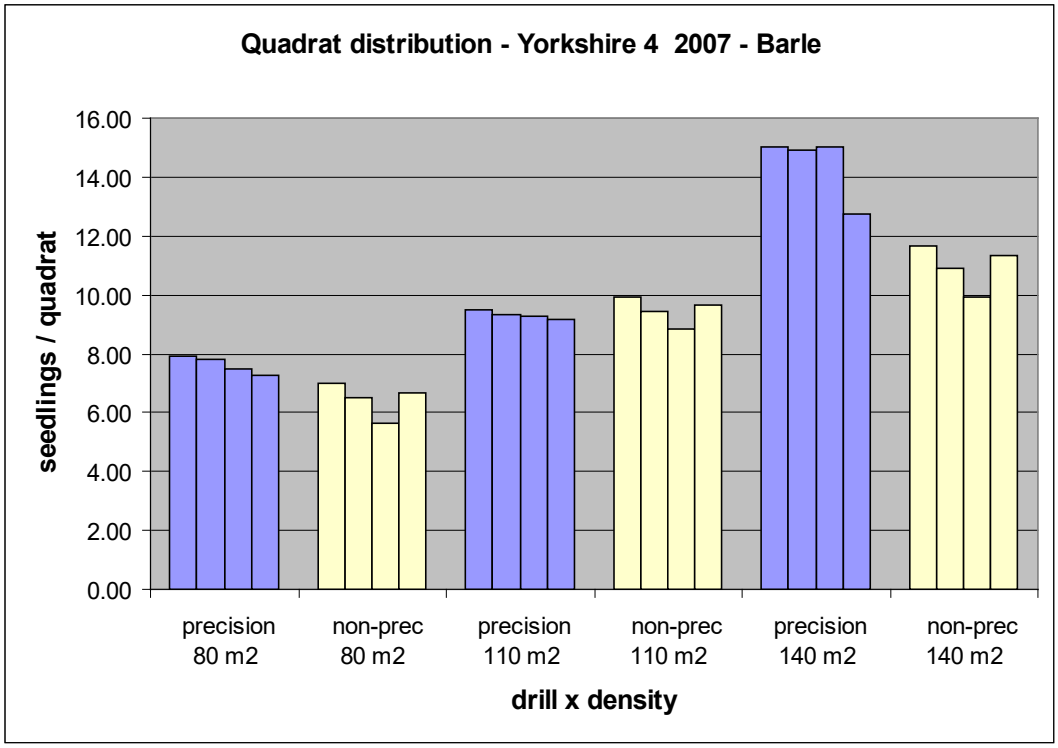


Figure 3: Plant distribution in the quadrat - Barle.



APPENDIX 2

KEY TO SOURCE OF VARIETIES

VARIETY	NAME & ADDRESS	COUNTRY
Twinkle	Sharpes, Nickerson-Advanta Ltd. Boston Road Sleaford Lincolnshire NG34 7HA	UK
Waverex	David Trethewey Seeds / Van Waveren 38 Electric Station Road Sleaford Lincolnshire NG34 7QJ	UK
Ibis	Elsom Seeds Ltd. / Danisco Pinchbeck Spalding Lincolnshire PE11 1QG	UK
Barle	PWB (Seeds) Ltd. / Crites Moscow 203 Chichester Road Cleethorpes DN35 0JN	UK

OBSERVATIONS AND CONCLUSIONS 2006 & 2007

General

There has been 2 years of trials using a range of varieties and different soil types.

Varieties in trial were:

Twinkle - 2006 and 2007 x 3 locations

Novella - 2006 x 1 locations

Ibis - 2007 x 1 locations

Barle - 2006 x 1 locations

The 2 years were quite different growing seasons:

2006 – was dry at sowing time and had below average rainfall until June.

2007 – was extremely dry until mid May with only 12% of the 20 year rainfall average.
In June and July rainfall was almost up 200% of the 20 year average.

Establishment

Over the 2 years it was very clear in the majority of the trials that the plant distribution from the precision drillings was much more even than for the non precision and it is likely that this resulted in all the plants reaching maturity at the same time. Whereas the unevenly spaced plants were at different maturities at harvest, thereby resulting in a more uneven distribution of young and older peas producing an average tenderometer reading lower than those from the precision drill.

Yields

In the majority of the trials yield was not significantly improved by the precision drilling and it is likely that the weather conditions in both years had an effect.
Yield did not clearly correlate with plant population and again the weather conditions had an effect on the crops in both years.

However, there was some evidence to suggest that populations of more or even less than the currently recommended commercial standard of 100 plants per sq m could be of benefit. This was a variety affect rather than a sowing technique.

Further variety work should be undertaken on population by yield effects.

Pea plant haulm volume

Without exception in every trial harvested the non precision sowings had far more haulm than the precision sowings.

The range was 4.2% more in one trial to 18.5% more in the highest trial.
The trial mean over the 6 trials was 11.7% more volume of haulm.

This slows down the viner output especially in a wet time and therefore production costs rise.

Sieve Size

In 2006 the majority of the trials, the precision sowing produced a much more even size distribution with the majority falling in the larger grades.
As sieve sizes below 8.2 are normally lost in the factory processing, it was decided in 2007 to more finely grade the trials.
The trials confirmed that the precision sowing produced a lower percentage in these grades, than does the non precision sowing.
This would lead to higher frozen yields, which is generally how growers are paid for their crop.

Further work is required to evaluate the value of increased factory yields from precision sowings.

